Mindfulness and Behaviour Therapy for Insomnia: An Assessment of Efficacy in a Naturalistic Australian Sample

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and ethics procedures and guidelines have been followed.

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Abstract

Insomnia is now a common major health concern that causes significant distress and disruption in a person’s life. This thesis focuses on investigating the validity of Mindfulness Based Therapy for Insomnia (MBT-I): a new treatment for insomnia, which combines Mindfulness Based Stress Reduction (MBSR) with the behavioural component of Cognitive Behaviour Therapy for Insomnia (CBT-I). A pilot study by Ong, Shapiro and Manber (2008) evaluated MBT-I in a group of subjects who met the criteria of psychophysiological insomnia, with indications of subjective treatment efficacy. This paper draws on the findings of Ong and colleagues in order to show that MBT-I may be effective in the treatment of a wide range of insomnia presentations. Thirty participants who met the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5; American Psychiatric Association, 2013) diagnosis of insomnia, participated in a six week, group intervention developed by Ong (2008). The treatment included: mindfulness meditation, sleep restriction, stimulus control and sleep hygiene. Outcome measures were a daily sleep diary and actigraphy during pre-treatment and the treatment period, along with subjective sleep outcomes collected at baseline, post-treatment and three-month follow-up. Analysis of the findings show that MBT-I was associated with a large decrease in insomnia severity, with indications of maintenance of treatment effect. There were also significant improvements in both objective and subjective sleep parameters, such as: reduced sleep onset latency; increased sleep efficiency; reduced time awake after sleep onset; and indications of cognitive arousal reduction. Overall, this study indicates that MBT-I can be successfully replicated, with evidence of treatment efficacy in a naturalistic sample. Furthermore, this study extends on previous research by identifying objective improvements in sleep following MBT-I. These results warrant further exploration of MBT-I with Phase III clinical research.
1 CHAPTER 1: Thesis Overview

Insomnia is one of the most prevalent psychological disorders, affecting an estimated 3% of the Australian population (Deloitte, 2011). Worldwide prevalence estimates of insomnia vary extensively from 3% to as high as 50% in some countries (Buysse et al., 2008a; Dohnt, Gradisar, & Short, 2012). The large variance is thought to reflect the array of uses of the term ‘insomnia’ (Ohayon & Reynolds, 2009). For the purposes of this research, ‘insomnia’ will refer to a formal diagnosis unless otherwise specified. The Diagnostic and Statistical Manual of Mental Disorders classifies insomnia as “difficulty initiating or maintaining sleep, or early morning awakenings, that occurs more often than not over a one-month period, and is severe enough impair daytime functioning” (5th ed.; DSM-5; American Psychiatric Association, 2013). A discussion of insomnia diagnosis will be presented in Chapter 3.

Insomnia can lead to several serious consequences and has been demonstrated to produce daytime impairment. Common daytime symptoms include fatigue, low energy, low mood, irritability, poor concentration and hyperarousal. These symptoms often lead to difficulties with daily activities such as work, study and household chores (Buysse et al., 2007). Insomnia has also been associated with reductions in many quality of life indicators such as physical functioning, bodily pain, mental health, emotional states, social functioning, vitality and general health (Leger, Scheuermaier, Philip, Paillard, & Guilleminault, 2001). Finally, insomnia has been shown to be associated with the risk of developing other psychiatric conditions such as anxiety and depression (Krystal, 2006) and is associated with increased risk of suicide in individuals with comorbid insomnia and depression (Cukrowicz et al., 2006).

Insomnia places a heavy burden on society. Research has identified that insomnia contributes to an increased risk of traffic and work accidents and is also responsible for
impairment in occupational and interpersonal settings (Harvey, 2002). The Sleep Health Foundation estimated the cost placed by insomnia on the Australian health care system in 2010 at $A118.7 million (Deloitte, 2011). Insomnia was identified to cause further indirect financial costs of A$1.5 billion in 2010 due to lost productivity, early retirement, absenteeism, welfare payments, motor vehicle accidents, and workplace accidents (Deloitte, 2011). Considering the cost to the quality of life of sufferers and the burden on society, it is imperative that there are adequate options to treat insomnia.

Common pharmacological treatments for insomnia include sedatives, melatonin, and some antidepressants (Smith et al., 2002). These treatments have been shown to decrease sleep onset duration and reduce the duration of wakefulness after sleep onset (Harvey, 2005). However, pharmacological treatments have limitations. For example, the use of medication to treat insomnia is associated with rebound insomnia on cessation of treatment, dependence, and withdrawal, and it can cause serious side effects in some individuals (Benca, Ancoli-Israel, & Moldofsky, 2004). Essentially, pharmacological treatments are intended to treat patients with acute insomnia rather than chronic insomnia (Harvey, 2002).

Cognitive behaviour therapy for insomnia (CBT-I) is the current gold standard, non-medical treatment option for insomnia (Harvey, 2002b; Okajima, Komada, & Inoue, 2011). Typically provided by a psychologist, CBT-I includes interventions such as cognitive therapy, stimulus control, sleep restriction, sleep hygiene (sleep-promoting behaviour instructions), and relaxation (Harvey, 2005). CBT-I addresses two models of insomnia: behavioural and cognitive. However, attention has recently been directed to the hyperarousal model of insomnia, which posits that people with insomnia commonly possess symptoms of overactivation of the sympathetic nervous system (SNS). These three models are discussed in Chapter 2.
CBT-I may not adequately address hyperarousal (Ong, Shapiro, & Manber, 2008b). It is therefore important to identify other treatment modalities that may be effective in arousal reduction. There is also scope to improve the efficacy of non-drug treatment for insomnia. In a review of CBT-I treatment of insomnia, Morin, Culbert and Schwartz (1994) report that CBT-I has moderate effect sizes (0.88 for sleep onset latency, 0.65 for wake after sleep onset, 0.53 for number of awakenings, and 0.42 for total sleep time). Although these changes are statistically significant, they are not strong enough to move the patient into the ‘good sleeper’ range (Harvey & Tang, 2003). The effect sizes for CBT-I are lower than the effect sizes reported for CBT for a range of other psychological disorders (Harvey, 2002b). While CBT-I is effective (Trauer, Qian, Doyle, Rajaratnam, & Cunnington, 2015), there is scope to enhance it, which would lead to improvement in treatment outcomes. It is therefore useful to explore other non-drug treatment options for insomnia.

One of these options is mindfulness, which can be defined as non-judgmental, present-focused awareness (Kabat-Zinn et al., 1998). Recently, there has been a growth of clinical treatment and wellness programs based on the mindfulness based stress reduction (MBSR) program of Jon Kabat-Zinn and his colleagues (Carlson & Garland, 2005). MBSR programs focus on the active development of conscious awareness via techniques such as focused breathing, sitting meditation, ‘body scanning’ and walking meditation, as well as cognitive treatment elements (Heidenreich, Strohle, & Michalak, 2006). Mindfulness is discussed further in Chapter 4.

Mindfulness has been investigated as a treatment for insomnia (Britton, Shapiro, Penn, & Bootzin, 2003; Heidenreich et al., 2006; Ong & Manber, 2011; Ong et al., 2008b; Ong, Shapiro, & Manber, 2009; Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003). Results have suggested that MBSR in combination with CBT-I may be a promising treatment for reducing symptoms of insomnia and sleep-related arousal (Cincotta, Gehrman,
Gooneratne, & Baime, 2011; Ong et al., 2008b). These results are discussed in Chapter 5. Although there is support for the use of mindfulness as a treatment for insomnia, further research is required to assess the usefulness of the approach in the general population. The research described in this thesis is designed to investigate an existing mindfulness protocol combined with behaviour therapy (MBT-I) for the treatment of insomnia in an Australian population.

Following on from this outline, the second and third chapters of the thesis present an overview of insomnia. The goal of the second chapter is to discuss theoretical models of the development and maintenance of insomnia. First, the behavioural and cognitive models of insomnia are presented. Next, important background information on sleep physiology is presented, and this is used as a platform to introduce the more recent hyperarousal model of insomnia. The third chapter provides a discussion of diagnosis, prevalence and the current treatment options for insomnia. The primary goal here is to provide a rationale for the exploration of additional non-drug treatment options for insomnia. A secondary goal is to provide a rationale for selection criteria and decisions made regarding the procedure for the research described in later chapters. This section includes a consideration of the link between theory and the treatment of insomnia, along with a discussion of aspects of insomnia that are not adequately addressed by the current treatment regimes.

Chapter 4 incorporates a comprehensive overview of mindfulness and a brief literature review of its applications in psychology. The goal of this chapter is to provide support for the use of mindfulness as a potential treatment for insomnia. The fifth chapter provides a rationale for the treatment protocol that derives from the underlying theories of mindfulness. The sixth chapter provides a rationale and framework for the current research project. This chapter includes a review of relevant research that is specific to insomnia. In addition, it presents the aims and hypotheses for the research. Finally, this chapter explores
the theoretical and practical implications of the study. The seventh chapter provides a review of the measures of mindfulness. This review provides a rationale for the decision to select a particular measure of mindfulness for the current study. The methods of the study are described in detail in Chapter 8. Included in this chapter is a description of the participants, instrumentation, data collection, and the procedure involved in this research.

The next two chapters present and discuss the results of the study. Chapter 9 presents the results of the experiment, along with an examination of qualitative feedback. First, the main outcome measure of the study, the Insomnia Severity Index (ISI), is explored. Next, the secondary subjective and objective sleep outcomes are presented. Tertiary outcome measures are also presented, such as changes in outcome measures such as anxiety and depression. This is followed by a discussion of the relationship between variables of interest. Chapter 10 provides a detailed discussion of the results of the experiment in relation to the hypotheses. The aim of this section is to: evaluate treatment outcomes; provide suggestions for future research; discuss limitations of the current research; and provide direction for clinical decision making regarding what types of people respond well to MBT-I.
CHAPTER 2: Models of Insomnia

2.1 Introduction

Insomnia is characterised by subjective complaints regarding dissatisfaction with sleep duration or quality, difficulty falling asleep, the ability to stay asleep or waking up too early in the morning (American Psychiatric Association, 2013; (Morin & Benca, 2012)). The process of transitioning from wake to sleep is intricate and easily disturbed by internal and external influences. If the body is in a state of stress or threat (either actual or perceived) the drive to survive will outweigh the drive to sleep (Bonnet & Arand, 2010). Excessive worry and anxiety can interfere in the body’s ability to shift from a wake state to a sleep state (Carney & Edinger, 2010). Similarly, external influences or life changes have the potential to interfere with the process of sleep. This interference can develop into insomnia (Troxel & Buysse, 2010). An individual with insomnia experiences nights of restless or broken sleep, difficulty initiating sleep or maintaining sleep and poor sleep quality, coupled with daytime deficits such as irritability, fatigue, and memory complaints (Sanchez-Ortuno & Edinger, 2012).

For some individuals, sleep interference is transitory. They are able to continue with their previous sleep-wake patterns after the internal or external stressor has subsided or resolved. This experience is often referred to as ‘acute insomnia’. Unfortunately, for many individuals, this resolution does not take place, and instead they move into a period of ‘chronic insomnia’. The three-P model (Spielman, Caruso, & Glovinsky, 1987a), the cognitive model of insomnia (Harvey, 2002b), and the hyperarousal model of insomnia (Bonnet & Arand, 1997a; Bonnet & Arand, 2010) all contribute to an understanding of why this occurs. Together, these complementary models have enhanced our understanding of insomnia. These three models will be discussed in this chapter.
The aim of this chapter is to provide an overview of models of insomnia, and to provide a rationale for the importance of further research on non-drug treatment. Issues to be addressed will include how insomnia is developed and maintained, how it is diagnosed, prevalence rates and the difficulties in conducting epidemiological research on insomnia, psychiatric and medical comorbidities, and current treatment options. First, an overview of three models of insomnia will be presented.

### 2.2 Models of Insomnia

#### 2.2.1 The Three-P Model of Insomnia

The three-P model of insomnia, also called the Spielman model of insomnia, was first introduced in 1986 (Spielman, 1986). The model explains the onset and maintenance of insomnia as a combination of 1) predisposing, 2) precipitating and 3) perpetuating factors (Spielman et al., 1987a). Predisposing factors precede the onset of insomnia and leave an individual more or less vulnerable to the development of insomnia. These include psychological or biological components such as female gender or trait anxiety. Precipitating factors are psychological, environmental or medical circumstances that trigger the onset of acute insomnia. They may include life changes such as divorce, becoming a parent, work changes, illness or international travel. Perpetuating factors are the behavioural changes that individuals implement to cope with the symptoms that arise from insomnia. These factors generally make an individual feel better in the short-term but perpetuate the sleep problem in the long-term. Some common perpetuating behaviours are napping, increasing caffeine intake, spending longer portions of time in bed, focusing on sleep, and trying harder to sleep (Spielman et al., 1987a).

From this perspective, acute insomnia occurs when precipitating factors (e.g., work stress) add to an individual’s predisposing factors (e.g., the tendency to worry) and create a
disturbance to sleep. When individuals respond to a short-term sleep problem by continuing their normal behaviours, they usually return to their normal sleep pattern once the precipitating event is resolved. However, individuals who respond by altering their sleep-related behaviours, and who begin to worry and think differently about sleep, move into a period of chronic insomnia (Morin et al., 1999; Spielman et al., 1987a). The three-P model of insomnia has greatly influenced treatment for insomnia over the years. Many components of cognitive behaviour therapy for insomnia (CBT-I), such as sleep restriction and stimulus control, were designed to resolve the perpetuating behaviours explained in this model. CBT-I will be discussed in more detail in the section below titled ‘Current non-drug treatment for insomnia’.

2.2.2 Cognitive Models of Insomnia

Although the behavioural model of insomnia has led to an understanding of many aspects of sleep disturbance, the model does not fully explain the development and maintenance of insomnia. A number of cognitive processes have been linked to the disruption of sleep. This section will discuss cognitive aspects known to influence insomnia.

Worry about sleep, daytime consequence of sleep disturbance and general worrying are known to trigger arousal leading to both sleep disturbance (Harvey, 2002c; Harvey & Greenall, 2003) and shorter total sleep time (Kelly, 2002). The greater the negative valence, the greater the sleep onset latency (Wicklow & Espie, 2000). It has been proposed that worry is maintained via dysfunctional beliefs about sleep and selective attention (Harvey, 2005). For example, people with insomnias often hold the belief they must have eight hours sleep each night, increasing the likelihood that they will worry about falling asleep (Harvey, 2003). It is common for patients to report experiencing an increased number of affect-inducing thoughts and images as bedtime approaches. Thought content, along with response to thoughts, have been the focus of recent investigations. For example, attempts to stop
unwanted thoughts at night have been linked to an increase in cognitive arousal and frustration. Harvey and colleagues provide a review of advances in the cognitive model of insomnia (Harvey, Tang, & Browning, 2005b).

Safety behaviours are protective behaviours employed by the poor sleeper to reduce the likelihood of the feared outcome happening (Harvey, 2002a). Most safety behaviours have a short-term benefit (e.g., a decrease in anxiety or worry) but contribute to a longer-term problem and often these behaviours perpetuate the sleep problem. Safety behaviours are usually reactions to worry and are commonly employed without a conscious decision making process. For example, a person who holds the maladaptive belief that adults must have eight hours of non-interrupted sleep to function well at work may react to a shorter sleep duration by working longer hours, taking fewer breaks and applying a high level of internal pressure in an attempt to reduce the chance of poor performance in this area. In the short-term, the person may feel more in control of the situation; however, in the longer term, the added stress and the lack of ‘down time’ in their day may contribute to the maintenance of poor sleep.

Selective attention or monitoring for threats involves a process of attention towards internal (e.g., muscle tension) and external (e.g., sounds) stimuli that may be perceived as a threat to sleep (Harvey, 2002a). Selective attention interrupts the natural, effortless transition from wake to sleep by the addition of a task that increases mental alertness. Although the poor sleeper may assume that this process is protective of good sleep, it actually works against the natural sleep process of ‘letting go’. Adding to the concept of selective attention, Espie and colleagues propose a disruptive sleep process they call the ‘attention-intention-effort’ pathway (Espie, Broomfield, MacMahon, Macphee, & Taylor, 2006). The authors suggest that in addition to having increased attention, those with insomnia ‘try’ to fall asleep. This process disturbs sleep further, rather than improving it.
The way individuals perceive their sleep also has the potential to influence sleep disorders. People with insomnia tend to overestimate the time they are awake in bed and underestimate the time they spend asleep (Harvey et al., 2005b). This is known as sleep state misperception. An interesting adjunct to the concept of sleep state misperception is the concept of ‘reversed sleep state misperception’. In a study investigating treatment for insomnia, benzodiazepines were administered prior to sleep (Mendelson, 1990). Objectively, sleep quality was worse with reductions in stages 3 and 4 sleep, however, participants perceived that their sleep was better. This was explained by the fact that benzodiazepines have been known to have amnesiac qualities (Schneiderhelmert, 1988). Therefore, perception of sleep is likely to be influenced by memory. Harvey and colleague provide a concise review of the research on sleep misperception (Harvey & Tang, 2012).

Research on the variety of cognitive aspects that contribute to sleep has accumulated to a point where there is now a rich understanding of the factors that lead to and maintain insomnia. A recent prospective study explored the contribution of a combination of cognitive processes (including worry, selective attention, safety behaviours, dysfunctional beliefs and somatic arousal) on sleep (Jansson-Fröjmark, Harvey, Lundh, Norell-Clarke, & Linton, 2011). The combination of cognitive processes was shown to differentiate people with insomnia from normal sleepers, providing support for the contribution of these processes to insomnia. Results following treatment revealed that people who demonstrated reductions in selective attention, monitoring and safety behaviours increased the likelihood of reporting remission from insomnia (Jansson-Fröjmark et al., 2011). This is further evidence that successful treatment needs to be able to reduce or eliminate these cognitive process.

The cognitive model of insomnia has contributed to a greater understanding of insomnia and has led to important advances in treatment (Edinger, Wohlgemuth, Radtke, Marsh, & Quillian, 2001). Indeed, treatment involving a combination of cognitive and
behavioural techniques to treat insomnia has been found to be superior over cognitive only or behavioural only treatments (Harvey et al., 2014). This suggests that cognitive and behavioural models are complementary, and provide unique avenues to influence sleep improvement.

In the past decade, experimental research has indicated that variance in the central nervous system response to stress may explain why some people develop insomnia. Bonnet and Arand (2003) found that people who slept poorly when exposed to a stressful environment were found to have higher sympathetic nervous system activity and lower parasympathetic nervous system activity than good sleepers (Bonnet & Arand, 2003). As a result, a different model of insomnia was developed. This hyperarousal model of insomnia has provided a new way to understand insomnia from a physiological and neurological perspective. To effectively discuss the hyperarousal model, it is important to first consider how sleep and wake are regulated in good sleepers. The next section will focus on the regulation of sleep, after which the hyperarousal model will be presented.

### 2.3 Sleep and Wake Regulatory Processes

The brain plays a central role in maintaining arousal and sleep, and in switching between the two states. Three major systems are involved in the process of regulating sleep and wake. These systems rely on several key areas of the brain to suppress wakefulness and promote sleep. This section will present an overview of these three systems, along with a review of several neurological structures in the brain that are involved in regulation of sleep and wake.

#### 2.3.1 Homeostatic Drive

The longer a person is awake, the more ‘drive’ to sleep their body will develop. This process has been referred to as Homeostatic Drive, or Process S, and is the first component of
the two-process model of sleep (Borbely, 1982). Drive to sleep builds while we are awake. This is thought to be related to a gradual build-up of adenosine in the basal forebrain during wakefulness (Huang, Urade, & Hayaishi, 2011; Porkka-Heiskanen, 1999; Porkka-Heiskanen & Kalin, 2011). Sleepiness motivates us to seek a safe and comfortable place for sleep in order to replenish our energy. Sleep drive can accrue if a person does not provide adequate opportunity for their body to sleep. This is often referred to as ‘sleep debt’.

2.3.2 Circadian Rhythm

The circadian system also influences when sleep and wake occur. In humans, circadian processes are driven by a master clock, located in the suprachiasmatic nucleus, also referred to as the SCN (Grandin, Alloy, & Abramson, 2006). The SCN projects signals to the dorsomedial hypothalamus, which acts as the signal distributor for the SCN. The dorsomedial hypothalamus in turn sends signals to three major populations of target neurons. These are 1) the ventrolateral pre-optic nucleus (VLPO), which is involved in sleep-wake regulation, 2) a group of hypothalamic endocrine cells that secrete neurotransmitters and hormones such as orexin (involved in sleep-wake transitions) and corticotrophin-releasing hormone (involved in the stress response), and 3) autonomic cells that project to the brainstem.

The SCN is thought to promote arousal by generating a signal that increases during the day and decreases at night. In situations where input from the SCN is lost, there have been noted reductions in sleep consolidation. The SCN also influences melatonin and body temperature cycles directly. Melatonin is synthesised in the pineal gland in response to photic information received through the retina. Melatonin levels in the body fluctuate throughout the day, depending on the level of light to which an individual has been exposed (Norman & Hayward, 2005). For example, exposure to light inhibits melatonin release. Melatonin has a role in regulation of sleep and wake by causing drowsiness and lowering body temperature, as well as in other processes required to initiate and maintain sleep (Arendt & Skene, 2005).
However, it is the SCN that performs the primary role in regulating the timing of body functions.

The SCN is capable of directing processes in the body to occur approximately every 24 hours without external cues, however, it can also be influenced or ‘entrained’ by external cues known as ‘zeitgeber’ (German for ‘synchroniser’). Zeitgeber are environmental cues that assist our body to synchronise with the Earth’s 24 hour day/night cycle. These cues include the presence or absence of white or blue light, physical movement, social interaction, temperature, and patterns of eating and drinking (Grandin et al., 2006). It is this process that allows us to adapt to changes in the environment and travel across time zones.

The circadian rhythm is the second element that makes up the two-phase model of sleep and has been referred to as Process C (Borbely & Achermann, 1999). Process C actively promotes both wake and sleep at different phases of the circadian cycle (Borbely & Achermann, 1999; Mistlberger, 2005). When Process S is high and Process C determines it is night time and releases melatonin, the body is highly likely to transition into a sleep state. However, the autonomic nervous system is also an important system that can override the process of falling asleep.

2.3.3 Autonomic System Balance

The autonomic nervous system (ANS) is the component of the nervous system that regulates involuntary actions of the body, such as that of the smooth muscle, heart and glands (Chrousos, 2009). The ANS is primarily concerned with survival. It has two branches: the sympathetic nervous system (SNS), which activates the stress response (often referred to as the ‘fight, flight or freeze’ response); and the parasympathetic nervous system (PNS), which deactivates the stress response and functions to return the body to homeostasis. Sleep is associated with a change in balance within the ANS towards a PNS dominance (Hirshkowitz, Moore, & Minhoto, 1997).
In situations of perceived threat, the SNS continues to dominate the nervous system, sustaining alertness regardless of the level of homeostatic or circadian pressure to sleep. This is an adaptive function, known as allostasis, which means maintaining stability through change (McEwen, 1998). The term allostasis was introduced to describe the way the cardiovascular system responds to resting and active states of the body (McEwen, 1998; McEwen & Stellar, 1993) and this process increases the chance of survival in situations of threat. We cannot, however, stay in this mode of coping for long without paying a price. Repeated cycles of allostasis, or inefficiency in turning off the stress response, leads to wear and tear on the body.

The damage of prolonged allostasis has been referred to as allostatic load (McEwen, 1998). In extreme cases, allostatic load has also been shown to cause atrophy of neurons in the hippocampus and prefrontal cortex (areas that are involved in memory, selective attention and executive functioning), and hypertrophy of neurons in the amygdala (areas that are known to be associated with fear, anxiety and aggression; McEwen, 1998). Thus, the ability to regulate emotions, learn, remember, make decisions and regulate sleep and wake may be negatively influenced by chronic stress (McEwen, 1998).

Research indicates that poor sleepers have higher levels of sympathetic nervous system activity than good sleepers. There is an array of studies investigating the difference between self-reported ‘good sleepers’ and ‘poor sleepers’ on a wide variety of markers of sympathetic activity. For example, people with insomnia have been shown to have higher SNS activation in the following measures: cardiovascular activation (Bonnet & Arand, 1997a, 2003; Monroe, 1967); spectral and evoked EEG measures such as increased beta activity, increased amplitude to N1 and decreased amplitude for N350 (Bastien, St-Jean, Morin, Turcotte, & Carrier, 2008); secretion of corticosteroids and adrenaline (Vgontzas & Chrousos, 2002); frontalis and mentalis EMG, and body temperature (Adam, Tomeny, &
Oswald, 1986); and metabolic measures such as VO2. A review of these studies was conducted by Bonnet and Arand (2010). Chronic activation of the SNS has been referred to as hyperarousal. This will be discussed after a brief description of the neurological structures involved in transitioning between wake and sleep.

2.3.4 The Brain and Sleep

2.3.4.1 Ventrolateral Preoptic Nucleus

The ventrolateral pre-optic nucleus (VLPO) is a small cluster of neurons situated in the anterior hypothalamus. The VLPO is heavily involved in the initiation of sleep and is an essential element of the sleep-wake central circuitry. A diffuse population of cells, referred to as the extended VLPO, extend medially and dorsally from the VLPO. The VLPO is associated with NREM sleep, while the extended VLPO is more closely related to REM sleep (Lu, Greco, Shiromani, & Saper, 2000). Knowledge of the importance of the VLPO comes from studies where lesions to this area have led to sleeping problems. For example, the presence of such lesions can lead to reductions in sleeping times (Saper, Cano, Scammell, Cano, & Scammell, 2005). Research has also suggested that aging leads to a decline in the number of neurons of the VLPO, which is perhaps the reason why aging leads to a reduction in sleep quality (Schwartz & Roth, 2008).

Interactions between the sleep-promoting VLPO, and the branches of the ascending arousal pathway (which will be discussed in the following section) are mutually inhibiting. The sleep-inducing neurotransmitters serotonin and adenosine activate the VLPO. Once activated, the VLPO secretes the neurotransmitters GABA and galanin, which induce sleepiness. These neurotransmitters inhibit excitatory neurotransmitters, such as orexin, therefore opposing the arousing effect of the posterior hypothalamic and brainstem centres (Saper, Chou, & Scammell, 2001; Yamanaka, Muraki, Tsujino, Goto, & Sakurai, 2003).
During wakefulness, the VLPO is inhibited by the arousal-inducing neurotransmitters norepinephrine and acetylcholine (Saper et al., 2005).

2.3.4.2 **Ascending Arousal System**

Wakefulness is maintained by a system called the ascending reticular activating system (ARAS). The ARAS originates in the upper brainstem, alongside the pons and midbrain. It then extends to the diencephalon, where it divides into two branches. During sleep, these two systems are blocked by the action of the VLPO, as discussed above. The first division of the ARAS innervates the thalamus by extending to two cholinergic structures in the brainstem and basal forebrain. These are called the pedunculopontine and laterodorsal tegmental nucleus (PPT and LDT) (Schwartz & Roth, 2008) and they play a critical role in bridging information in between the thalamus and the cerebral cortex. The PPT and LDT are most active during wakefulness and REM sleep. Transmission to the reticular nucleus of the thalamus is of particular importance to wakefulness, as it acts as a gate that is able to block thalamocortical rhythms and promote wakefulness. Saper et al. (2005) have reviewed this area.

The second branch of the ascending arousal system extends to the lateral hypothalamus, the basal forebrain and the cerebral cortex (Saper, Fuller, Pedersen, Lu, & Scammell, 2010). This aspect of the arousal system comprises monoaminergic cell populations within a number of structures, such as the locus coeruleus, the dorsal and median raphe nuclei, the ventral periaqueductal grey matter, and the tuberomammillary nucleus (Schwartz & Roth, 2008). Each group of cells produces a different neurotransmitter. The neurons in the locus coeruleus produce norepinephrine, neurons in the dorsal and median raphe nuclei produce serotonin, neurons in the ventral periaqueductal grey matter produce dopamine, and neurons of the tuberomammillary nucleus produce histamine.
These neurons then extend onto the hypothalamic peptidergic neurons, which contain melanin-concentrated hormones or orexin (also called hypocretin), and basal forebrain neurons that contain GABA and acetylcholine. Reductions in orexin are associated with difficulty in maintaining wakefulness and the loss of muscle tone in attacks of cataplexy (Mileykovskiy, Kiyashchenko, & Siegel, 2005). The neurons finally project onto the cerebral cortex. Lesions to this branch of the arousal system are associated with longer sleep duration and may cause coma (Saper et al., 2005).

Both the wake- and sleep-promoting neurons are mutually inhibitory. This mutually antagonistic relationship gives rise to behaviour similar to that seen with a ‘flip-flop switch’ in an electrical circuit (Saper et al., 2001). In the brain, neurons on each side of the circuit (wake-promoting or sleep-promoting) inhibit those on the other side. If either side obtains an advantage over the other, it turns the neurons off on the other side, thus causing a rapid collapse in activity and dramatic change in state. This is why relatively little time is spent transitioning between the two states (Schwartz & Roth, 2008). This concept is reviewed by Saper and colleagues (Saper et al., 2010). If one of the sides of the circuit is damaged or weak, the system operates closer to the transition point and changes between the two states occur with less pressure or input from the other side, leading to oscillations between wake and sleep. In cases of extreme dysfunction, the outcome can be sleep disorders, such as parasomnias or sleep-wake disorders including hyperarousal or narcolepsy (Saper et al., 2010).

2.3.5 Summary

This section has provided an overview of how sleep occurs in a neurological sense. Drive to sleep (Process S) is accumulated during the day and the circadian system provides a 24 hour framework for sleep and other bodily functions to occur regularly. However, the sympathetic branch of the autonomic nervous system can override the drive to sleep by
increasing arousal. This can be adaptive in the short-term, but leads to wear and tear on the body. It is well documented that poor sleepers have higher indications of sympathetic activity than good sleepers, indicating that dysfunction of the autonomic nervous system may be important in insomnia. Finally, the neurological structures that are involved in the transition between wake and sleep – the VLPO and the ascending arousal system – were briefly discussed. In light of this background information, the next section will present the third model of insomnia: the hyperarousal model.

### 2.4 The Hyperarousal Model of Insomnia

Hyperarousal can be defined as a state of excessive cognitive, neurological and physiological activation, where the SNS maintains activation of the nervous system in the absence of a stressor. Hyperarousal leads to sympathetic activation at night. This in turn results in chronic difficulties with the initiation and maintenance of sleep (Riemann et al., 2010). The aim of this section is to explore how hyperarousal occurs and how it impacts sleep and the body. For many individuals, the onset of hyperarousal occurs around a time of life stress. The presence of a psychosocial stressor (e.g., divorce, job loss, life transition) combined with coping mechanisms (e.g., problem-solving or emotion regulation) results in a physiological response, which can be adaptive or maladaptive. The ability to maintain wakefulness at night is essential in times of physiological threat (allostasis). However, a shift from adaptive to maladaptive can occur when the physical response continues in the absence of the stressor, or if sleep itself becomes the cause of stress (Okajima et al., 2011).

Maladaptive cognitions around sleep, selective attention and catastrophising, along with maladaptive behaviours such as spending increased time in bed, napping and increased caffeine intake, can lead to a conditioned response of arousal towards bedtime. This may be specific to one’s own bed or may extrapolate to include all sleep environments.
Metaphorically speaking, this is like trying to sleep while at war, with the brain attempting to perform two oppositional functions at once. This dissonance can be seen in studies investigating the brain chemistry and cortical arousal in good sleepers compared to those with insomnia.

In situations of high stress or when ineffective coping mechanisms are utilised, a change in brain chemistry will reflect a stress response (e.g., an increase in monoamines, cortisol and orexin, and a decrease in serotonin and adenosine). The release of these substances changes the physiological state of the body. For example, an increase in cortisol is known to increase heart rate and, as discussed earlier, orexin is related to sleep-wake transitions with increased amounts signifying a pressure towards wakefulness (Riemann et al., 2010). A global reduction of gamma-aminobutyric acid (GABA) in the brains of insomniac patients compared with good sleepers has been found (Winkelman et al., 2008). GABA is the most prevalent inhibitory neurotransmitter in the central nervous system (CNS), and therefore data support the assumption that in the case of hyperarousal, the balance between inhibition and excitation might be compromised, leading to insomnia.

The initiation of the stress response has the potential to change the functioning of the ARAS and the VLPO, resulting in impairment of the ‘sleep switch’. This concept was introduced by Cano and colleagues, who examined the brains of rats in a stress-induced situation designed to induce insomnia (Cano, Mochizuki, & Saper, 2008). Results indicated simultaneous activation of sleep-promoting and arousal-related brain regions. Fos activation is a known marker of neuronal activity (Dragunow & Faull, 1989) and was shown in the sleep circuitry of rats in a stressful situation to be similar to that a typical sleeping rat. At the same time, activation of the cortex and the arousal system was similar to a typical, fully awake rat (Cano et al., 2008). This may be because the VLPO is fully activated as a result of
homeostatic and circadian pressure for sleep, and yet the arousal system cannot be ‘switched off’ as it is excited by the limbic system.

The impact of stress on sleep is likely to be similar in humans. Cortical activation is often experienced and described a state in which the mind races. Polysomnography (PSG) studies focusing on the electroencephalogram (EEG) correlates of hyperarousal have found there to be increased beta activity during sleep (Baglioni et al., 2014). More recently, the cyclic alternating pattern (CAP) has been used to provide a measure of hyperarousal. CAP measures the periodicity of arousals during sleep and is thought to be reflective of stable or unstable sleep. In instances of higher CAP rate (unstable sleep) the ‘flip-flop switch’ is not functioning effectively. People with insomnia have been found to have higher CAP rate, which suggests that hyperarousal impacts the stability of sleep (Terzano et al., 2003). This wake-like cortical activation at night is a possible explanation of why people with insomnia tend to underestimate their total sleep time and overestimate their sleep onset latency. Hyperarousal is likely to aggravate sleep misperception through altering or increasing mentation during the pre-sleep period, blurring the distinction between sleep and wakefulness, and rending the point of sleep onset more difficult to detect (Harvey & Tang, 2012).

2.4.1 **What Factors Lead to Hyperarousal?**

There are several factors that influence the stress response and the tendency for chronic activation. The intensity and duration of the stress can be a factor, as can the individuals’ coping mechanisms, personality and cognitive functioning (e.g., how they think about problems). Genetic features, early development, learned behaviours, diet, exercise and other behaviours, such as smoking or alcohol intake, can also impact the likelihood of developing hyperarousal (Bonnet & Arand, 1997a). These factors influence the sensitivity and reactivity of stress mediators, such as secretion of cortisol (McEwen & Seeman, 1999).
Research suggests that there may be individual sensitivity to stress. Bonnet and Arand (2003) investigated the sleep of 50 ‘normal’ sleepers under various stressors and found that individuals who had lower sleep efficiency in the first sleep study night (stressor) had higher heart rates compared with those who had higher sleep efficiency. These participants (referred to as ‘situational insomniacs’) had non-significant increases in low-frequency electrocardiographic spectral power (a measure of sympathetic nervous system activity) on all nights as compared with ‘good sleepers’. The situational insomniacs also had significantly decreased high-frequency power (parasympathetic nervous system activity) on baseline and after the three hour advance night (where sleep onset was delayed) as compared with good sleepers. In the same study, under the condition of caffeine (400mg given 30 minutes prior to going to bed) situational insomniacs had a dramatic decrease in sleep efficiency from 93% to 61%, compared with the good sleepers who only dropped from 96% to 82%. This indicates that some people are more sensitive to stressful situations, and as a result are more likely to become hyperaroused.

Ong and colleagues proposed a two-level model of arousal that contributes to an understanding of cognitive arousal (Ong, Ulmer, & Manber, 2012). The model deconstructs the concept of cognitive hyperarousal to include primary arousal (cognitive activity directly related to sleep difficulties) and secondary arousal (how an individual relates to thoughts about sleep). The secondary arousal component has the potential to dramatically impact upon the emotional valence of the primary component. The specificity of this model leads to the potential to direct therapeutic techniques at improving both metacognitive processing and cognitive deactivation (Lundh, 2005).

Research on vulnerability to the development of hyperarousal is still in its infancy. However, that which has been undertaken to date indicates that there are varying degrees to which people respond to stress, with those who are more sensitive to stress being associated
with an increased change of sleep disruption. Current research has also focused on exploring
the nature and direction of the relationship between hyperarousal and insomnia. The next two
sections will briefly explore the supporting evidence for two different lines of thought
regarding the role of hyperarousal in people with insomnia.

2.4.1.1 Hyperarousal Contributes to Insomnia Development

Studies exploring the direct impact of hyperarousal on insomnia have utilised
caffeine, a well-known stimulant, to elicit a sympathetic response in participants with the
goal of examining the impact on sleep. One study (Bonnet & Arand, 1992) revealed that
caffeine increased the metabolic rate in participants and reduced sleep efficiency and sleep
latency on multiple sleep latency tests (MSLTs). Several studies have also reported
significant negative correlations between total sleep at night and MSLT values the next day
(Bonnet & Arand, 1992, 2000; Seidel, Ball, & Cohen, 1984; Stepanski, Zorick, Roehrs,
Young, & Roth, 1988). Given that a stimulant can cause a similar impact on sleep as seen in
patients with hyperarousal, these results suggest that those with hyperarousal may have
difficulty sleeping as a consequence of hyperarousal (Bonnet & Arand, 1992).

Another study (Thomas et al., 2000), found that those with insomnia exhibited a
pattern of whole brain hypermetabolism across waking and sleep states, failure of wake-
promoting structures to decline in metabolism from waking to sleep states, and reduced
relative waking metabolism in the prefrontal cortex in patients with insomnia. The study
proposes that higher cerebral metabolism in non-REM sleep in patients with insomnia may be
the result of a lack of a reduction in activity in these subcortical structures in the transition
from waking to sleep. The reduced waking metabolism in the prefrontal cortex may indicate
that these patients are chronically sleep deprived. This is consistent with findings in the
literature that suggest that sleep deprivation results in decreases in regional brain function in
the thalamus and in the prefrontal and posterior parietal cortices (Thomas et al., 2000). The
authors of this study propose that this may be due to inefficient sleep, perhaps caused by hyperarousal (Nofzinger et al., 2004).

The release of stress hormones such as cortisol may provide another avenue by which hyperarousal causes insomnia. Catabolism (breaking down of larger cells to use as energy) and anabolism (building up larger cells such as muscle tissue, from smaller cells) fluctuates across the 24 hour period. The catabolic hormones (cortisol, adrenaline and nor-adrenaline) have their lowest output values during the early hours of sleep. A study examining matched (height and weight) good and poor sleepers found that poor sleepers excreted about 10% more cortisol and 17% more adrenaline than good sleepers (Adam et al., 1986). The authors concluded that people who sleep poorly have less than optimal conditions for anabolic restoration during sleep and that they actually require better quality sleep as a consequence (Adam et al., 1986). This is a vicious cycle, as tiredness often leads people to focus more on sleep and increases nocturnal arousal as a result.

Studies have also investigated neurobehavioural functioning to examine the cause of daytime deficits in people with insomnia. People who experience insomnia generally report feeling tired and believe that their performance is worse at work and when completing tasks requiring attention (Carney & Edinger, 2006; Carney, Edinger, Manber, Garson, & Segal, 2007; Harvey et al., 2005b). When asked, most people with insomnia attribute their performance difficulties to their sleep problems. Even so, a surprising feature of insomnia research is that many studies have failed to find a difference in daytime performance between people with insomnia and normal sleepers on tests that are sensitive to sleep loss (Riedel & Lichstein, 2000). However, deficits in higher level neurobehavioural functioning have been found (Shekleton et al., 2014). This indicates that neurobehavioural deficits in insomnia may be due to hyperarousal rather than sleepiness resulting from chronic sleep loss.
Although this finding does not provide direct information regarding the relationship between hyperarousal and sleep, it does pose a different, and relevant, question to the current body of research. Although chronic insomniacs tend to complain of daytime functional deficits, such deficits are related more closely to tension and hyperarousal than to sleep debt (Rosa & Bonnet, 2000). Thus, treatment focused on lowering arousal may have more value with respect to an individual’s functioning and quality of life. This point will be discussed further later in this section in the review of current insomnia treatment.

2.4.1.2 **Hyperarousal as a Reaction to Insomnia**

Interestingly, there is some evidence to suggest that hyperarousal may be a response to poor sleep. Given that insomnia patients have shorter total sleep time and increased wake after sleep onset (WASO), it would make sense that people with insomnia have reduced sleep latencies in nap evaluations (MSLT). However, results of a meta-analysis have indicated there is no change in daytime sleep latency in people with insomnia (Bonnet & Arand, 2010). In fact, some studies have found that sleep onset during the day is significantly longer in people who report poor sleep as compared with good sleepers (Rosa & Bonnet, 2000). The continual stress and anxiety induced by chronic insomnia may lead to hyperarousal as a way of adapting to the situation.

2.5 **Summary and Conclusion**

Hyperarousal is a term used to describe the chronic difficulties some people have with ‘switching off’. This state of overactivation leads to a range of difficulties for the sleep process. There is evidence to suggest that a number of different brain structures and systems are heavily involved in the processes required to stay awake, as well as to allow a person to fall asleep. Increased sympathetic nervous system activity is common in individuals with insomnia, and is apparent across a range of different measures of sympathetic arousal, such as
heart rate and core temperature. Hyperarousal could also be conceptualised as an independent problem, and has the potential to leave an individual vulnerable to developing insomnia. Further, there is also evidence to suggest that hyperarousal may be a response to sleep loss, and that it perpetuates the sleep problem.

In reviewing the information provided by an exploration of the three prominent models of insomnia, there is a clear framework to conceptualise how insomnia is developed and maintained. Insomnia appears to involve three constellations of causes, symptoms and sequelae. The first is behavioural. A person with sleep problems tends to respond to short-term sleep difficulties with maladaptive behaviours such as spending increased time in bed. The second aspect is cognitive. Individuals with insomnia are prone to worry, attempt to control the sleep process and have maladaptive beliefs about sleep (to name but a few of the elements that may be involved). In the third aspect, insomnia also involves overactivation of the sympathetic nervous system. People with insomnia have been shown to have a range of markers of increased sympathetic activity, such as cardiac output, and also display neurological indications of having difficulty ‘switching off’.

The processes involved in the development and maintenance of insomnia should guide treatment, such that it addresses the behavioural, cognitive and hyperarousal models of insomnia. When taken together, the evidence reviewed above presents a compelling case for the argument that treatment for insomnia should target a reduction in hyperarousal. Later in this chapter, an exploration of the evidence focused on current treatments for insomnia and its ability to reduce hyperarousal will be presented. This will include discussion of cognitive behaviour therapy for insomnia (CBT-I). In Chapter Three, the current diagnostic methods and treatments for insomnia will be presented, along with an examination of how these treatment modalities match, or fail to match, the theories of the aetiology of insomnia.
3 CHAPTER 3: Diagnosis and Treatment of Insomnia

3.1 Importance of Diagnosis

Given the review of the predominant models of insomnia presented in the previous chapter, it is important to identify how a person with insomnia presents in a clinical setting. In most areas of psychology and medicine, diagnosis is a difficult and complicated task (Elstein & Schwarz, 2002). Essentially, diagnosing involves a process whereby symptoms are isolated and problems are grouped into categories. There are inherent problems with the process of diagnosing; people are often incorrectly categorised, and some disorders are very difficult to break down into symptoms (Wainstein, 2009). As such, diagnostic models have been under criticism. Insel and colleagues provide an overview of problems with diagnostic models (Insel et al., 2010). On the other hand, it is important that we are able to be specific and clear about symptoms and symptom clusters. This provides us with the ability to communicate about particular aspects of individuals, in order to fully understand and to make inferences to the broader population (Achenbach, 2001). The selection of a robust, unambiguous, widely accepted and easily administrable diagnostic measure was required for the research described in this thesis. This section provides a review of the conceptualisation of insomnia, the existing classification systems used to diagnose insomnia, and the issues surrounding the choice of the most suitable diagnostic tool for the current study.

3.2 History of the Conceptualisation of Insomnia

The conceptualisation of the relationship between sleep and psychiatric disorders has changed markedly over time. Historically, insomnia was conceptualised as a symptom of a psychiatric disorder. This is logical, given that the DSM-5 reveals that sleep disturbance is a symptom of the majority of mood and psychotic disorders (Harvey, 2008). However, it is
now accepted that insomnia can be an independent problem. This shift was reflected in the inclusion of primary insomnia in the *DSM-III-R* in 1987 (American Psychiatric Association, 1987) which has remained in place, with minor adjustments, up to the current *DSM-5*. The most recent DSM has introduced a new paradigm to the diagnosis of sleep disorders.

Insomnia is commonly seen in conjunction with other medical and psychological conditions, and can occur as a primary, secondary or comorbid condition (Carney & Edinger, 2010). Primary insomnia (PI) occurs without the presence of any other psychiatric or medical conditions, secondary insomnia (SI) is precipitated by a psychiatric or medical condition or a substance, and comorbid insomnia (CI) occurs when two conditions occur at the same time but do not have a causal relationship. The relationship between sleep and other disorders is useful to consider for accuracy of diagnosis, and is particularly important for treatment. Later in this chapter, a detailed discussion of the nature of the relationships between insomnia and other medical and psychological conditions is presented.

### 3.3 Classification Systems

Diagnosis of insomnia is largely based on subjective complaints (Troxel & Buysse, 2010). There are three notable classification systems used to diagnose insomnia: the *DSM-5*, the International Classification of Sleep Disorders (ICSD-II; American Academy of Sleep Medicine, 2000) and the World Health Organisation’s International Classification of Diseases (ICD-10; The ICD-10 Classification of Mental and Behavioural Disorders, 1992). There are differences in the criteria each of the classification systems deem as being indicative of insomnia. Table 1 presents an overview of the diagnostic criteria for insomnia as defined by the *DSM-5*, the ICSD-II and the ICD-10.
Table 1

Summary of the three main insomnia classification systems

<table>
<thead>
<tr>
<th>Insomnia categories</th>
<th>DSM-5</th>
<th>ICSD-II</th>
<th>ICD-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insomnia Disorder</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Psychophysiological insomnia</td>
<td>○</td>
<td>• Adjustment insomnia (acute insomnia)</td>
<td></td>
</tr>
<tr>
<td>Paradoxical insomnia</td>
<td>○</td>
<td>• Psychophysiological insomnia</td>
<td></td>
</tr>
<tr>
<td>Idiopathic insomnia</td>
<td>○</td>
<td>• Paradoxical insomnia</td>
<td></td>
</tr>
<tr>
<td>Insomnia caused by mental disorder</td>
<td>○</td>
<td>• Idiopathic insomnia</td>
<td></td>
</tr>
<tr>
<td>Inadequate sleep hygiene</td>
<td>○</td>
<td>• Insomnia caused by mental disorder</td>
<td></td>
</tr>
<tr>
<td>Behavioural insomnia of childhood</td>
<td>○</td>
<td>• Inadequate sleep hygiene</td>
<td></td>
</tr>
<tr>
<td>Insomnia caused by drug or substance</td>
<td>○</td>
<td>• Behavioural insomnia of childhood</td>
<td></td>
</tr>
<tr>
<td>Insomnia caused by medical condition</td>
<td>○</td>
<td>• Insomnia caused by drug or substance</td>
<td></td>
</tr>
<tr>
<td>Insomnia not caused by substance or known physiological conditions, unspecified (nonorganic insomnia)</td>
<td>○</td>
<td>• Insomnia caused by medical condition</td>
<td></td>
</tr>
<tr>
<td>Physiologic (organic) insomnia, unspecified</td>
<td>○</td>
<td>• Insomnia not caused by substance or known physiological conditions, unspecified (nonorganic insomnia)</td>
<td></td>
</tr>
<tr>
<td>*Note: The following information in categories below will be based on a diagnosis of Psychophysiological insomnia.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific sleep difficulties</th>
<th>DSM-5</th>
<th>ICSD-II</th>
<th>ICD-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep Onset Insomnia</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sleep Maintenance Insomnia</td>
<td>○</td>
<td>• A complaint of insomnia combined with decreased functioning during wakefulness</td>
<td></td>
</tr>
<tr>
<td>Late insomnia</td>
<td>○</td>
<td>• Trying too hard to sleep suggested by inability to fall asleep when desired, or ease of falling asleep during relatively monotonous pursuits</td>
<td></td>
</tr>
<tr>
<td>Nonrestorative sleep</td>
<td>○</td>
<td>• Conditioned arousal to bedroom or sleep related activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PSG displays increased sleep latency, reduced sleep efficiency and increased number and duration of awakenings</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency and description of occurrence</th>
<th>DSM-5</th>
<th>ICSD-II</th>
<th>ICD-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three nights per week</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Difficulty occurs despite adequate opportunity to sleep</td>
<td>○</td>
<td>• Mild: almost nightly complaint of insufficient sleep</td>
<td></td>
</tr>
<tr>
<td>Moderate and severe: nightly complaint of insufficient amount of sleep</td>
<td>○</td>
<td>• Moderate and severe: nightly complaint of insufficient amount of sleep</td>
<td></td>
</tr>
<tr>
<td>At least three nights per week</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1

*Summary of the three main insomnia classification systems (cont.)*

<table>
<thead>
<tr>
<th>Description of daytime difficulties</th>
<th>DSM-5</th>
<th>ICSD-II</th>
<th>ICD-10</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>o</em> Difficulty in social, occupational, educational, academic, behavioural or other important areas of functioning</td>
<td><em>o</em> Mild insomnia: often restlessness, irritability, anxiety, fatigue and tiredness</td>
<td><em>o</em> Moderate insomnia: mild to moderate social occupational functioning as well as above symptoms</td>
<td><em>o</em> Sleep quality interferes with ordinary activities in daily living</td>
</tr>
<tr>
<td><em>Note: these are seen as part of insomnia, not an outcome of insomnia.</em></td>
<td><em>o</em> Severe insomnia: Severe social/occupational functioning as well as above symptoms</td>
<td><em>o</em> Preoccupation with sleeplessness and excessive concern over consequences</td>
<td></td>
</tr>
<tr>
<td><strong>Length of time difficulties present</strong></td>
<td><em>o</em> Three months at least three nights per week</td>
<td><em>o</em> Acute: four weeks or less</td>
<td><em>o</em> One month</td>
</tr>
<tr>
<td></td>
<td><em>o</em> Subacute: more than four weeks but less than six months</td>
<td><em>o</em> Chronic: six months or longer</td>
<td></td>
</tr>
<tr>
<td><strong>Exclusion and inclusion</strong></td>
<td><em>o</em> Difficulties not explained by another sleep disorder, substance abuse, coexisting mental disorder or medical conditions</td>
<td><em>o</em> No other medical or mental disorders account for sleep disturbance</td>
<td><em>o</em> Not specified</td>
</tr>
<tr>
<td></td>
<td><em>o</em> Other sleep disorders can exist with insomnia</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td><em>o</em> With mental, medical or other sleep disorder comorbidity</td>
<td><em>o</em> Severity: mild, moderate or severe</td>
<td><em>o</em> Nil</td>
</tr>
</tbody>
</table>
Episodic, persistent or recurrent

Note: The DSM-5, the ICSD-II and the ICD-10 are the three most prevalent methods of diagnosing insomnia. As the ICSD-II displays several subtypes of insomnia, the specific considerations for psychophysiological insomnia have been chosen for analysis of key features.
Table 1 contains a summary of the three main classification symptoms to diagnose insomnia. Emerging from this overview, it is clear that each tool has a different way of directing the health care professional to diagnose or rule out insomnia. The DSM-5, the ICSD-II and the ICD-10 use different diagnostic descriptors for the sleep problem (displayed in the first row of Table 1). The ICSD-II differentiates a range of insomnia subsets, while the DSM-5 and the ICD-10 draw distinctions between diagnoses based on circumstances external to the sleep problem. The DSM-5 recognises primary insomnia and insomnia related to Axis I (all psychological diagnostic categories except mental retardation) and Axis II (personality disorder) conditions, and the ICD-10 specifies nonorganic insomnia and nonorganic disorder of the sleep-wake schedule. It was not possible to present a comprehensive table incorporating all ICSD-II diagnoses. Comparisons that follow have been based on the selection of the ICSD-II subset of psychophysiological insomnia, as it is most similar to the DSM-5 and ICD-10 diagnoses of insomnia.

The ICSD-II displays a high degree of specificity across a range of aspects of the diagnostic criteria. The ICSD-II also describes severity (mild, moderate and severe insomnia), and length of time (acute, subacute and chronic). The ICSD-II provides further criteria regarding sleep difficulties (e.g., “Trying too hard to sleep suggested by inability to fall asleep when desired, but ease of falling asleep during relatively monotonous pursuits”) and daytime symptoms, which are separated into categories of mild, moderate and severe. This classification system has been criticised for lacking of empirical substantiation for the range of subtypes of insomnia and for its convoluted diagnostic process, which is time consuming for practitioners (Ohayon & Reynolds, 2009). It has been argued that the subsets should be subsumed within broader categories (Buysse et al., 1994; Reynolds, Kupfer, Buysse, Coble, & Yeager, 1991; Soldatos & Lugaresi, 1987). The DSM-5, on the other hand,
allows for considerable heterogeneity within diagnostic categories (Edinger et al., 2011). The diagnostic process according to these criteria is less cumbersome and is commonly favoured by clinicians and researchers for this reason.

Symptoms of insomnia are often difficult to separate from symptoms of psychological and medical conditions. The assessment of the type of insomnia (PI, SI or CI) is essential to determine treatment direction and expectations. The notion of primary, secondary or comorbid insomnia is expressed differently in the three diagnostic tools. The DSM-5 considers the presence of a medical or psychological disorder as a specifier, wherein the clinician would make the diagnosis of insomnia and specify if there is a substance, medical or psychological issue present. It does not differentiate between SI, partial SI and comorbid insomnia (CI). The ICSD-II, on the other hand, uses different diagnoses (e.g., “Insomnia caused by a mental disorder”) for SI. As with the DSM-5, SI, partial SI and CI are not well addressed in this system. Therefore, classification tools alone may be inadequate to thoroughly diagnose complicated cases of insomnia. It is desirable to have an experienced clinician to make a thorough diagnosis, particularly in the setting of co-occurring sleep, medical or psychological symptoms. McCrae and Lichstein (2001) provide a heuristic model of assessment, treatment and prevention of insomnia, which can be applied by clinicians.

3.4 Diagnosis of Insomnia in the Current Study

For the purpose of recruitment for this study, the DSM-5 was selected as the most suitable assessment tool. This was because it provides a clear, concise framework, is able to be administered within a short period of time and is a widely accepted measure in both psychology and medicine. Furthermore, the DSM 5 approach acknowledges bidirectional or interactive effects between sleep disorders and coexisting psychiatric conditions such as depression. To supplement the DSM-5, an assessment was conducted by a respiratory
physician with considerable experience in diagnosing sleep disorders. Decisions regarding the inclusion and exclusion criteria in insomnia research must fit within the context of prior research, as well as enable the exploration of relevant research questions. As such, preliminary research on the treatment protocol used in this study was conducted, prior to the commencement of this thesis, on a sample of people with the diagnosis of physiological insomnia without major mental conditions or sleep disorders (Ong et al., 2008b). The decision for the current study was therefore to include a naturalistic sample. This refers to a group of people who self-select for treatment. The selection of a naturalistic population made it possible to assess the efficacy of treatment in a ‘real world’ sample. The inclusion and exclusion criteria for the current study are discussed in Chapter 6. The next sections will explore first the prevalence of insomnia and then the relationships between insomnia and other medical and mental health conditions. These sections aim to provide further evidence in support of studying a naturalistic sample when exploring the efficacy of treatments for insomnia.

3.5 Prevalence

This section present prevalence rates of insomnia, followed by information about the financial and individual burden it causes.

3.5.1 General Prevalence Rates

Prevalence rates of insomnia vary in the literature. Dissatisfaction with sleep quality and quantity are very common complaints reported in clinical practice. There are, however, several difficulties in estimating prevalence rates of insomnia, which vary extensively, from as low as 3% to as high as 50% (Buysse et al., 2008a; Dohnt et al., 2012). As discussed above, main difficulty in this estimation is the different uses of the term ‘insomnia’. It can be used to describe a subjective complaint relating to sleep quantity or quality. It can be a
symptom of a sleep disorder or an organic or mental disorder. Insomnia is also a sleep disorder diagnosis and can occur as a primary or secondary problem, or an acute or chronic problem. This variability leads to a variety of methods used in epidemiological studies to assess insomnia, contributing to the range in prevalence rates (Ohayon & Reynolds, 2009). Ohayon (2002) published a clinical review on the epidemiology of insomnia, in which prominent epidemiological research was grouped into the following categories: 1) studies examining insomnia symptoms (i.e., estimation of prevalence of difficulty initiating or maintaining sleep, difficulty with non-restorative sleep regardless of duration, daytime consequences without criteria, frequency criteria or severity criteria); 2) studies that include insomnia symptoms along with daytime consequences; 3) studies investigating the prevalence of dissatisfaction with sleep quality or quantity, based on subjective reporting; and 4) studies investigating the prevalence of insomnia based on a diagnosis using the DSM-III-R, DSM-IV or the ICSD-II. Prevalence rates of the studies were then averaged, and the ranges of these averages are displayed in Figure 1.

A follow-up, cross-sectional study of 25,579 participants across seven European countries displayed in Figure 1, presents a similar picture (Ohayon & Reynolds, 2009). Many participants who do not meet the diagnosis of insomnia are dissatisfied with their sleep. In fact, 37% of subjects were dissatisfied with their sleep, 20.2% of people aged over 15 described their sleep as ‘too short’, and 16.6% described their sleep as ‘too light’. Over 35% of the sample experienced symptoms of insomnia, yet only 6.6% satisfied the DSM-IV criteria for insomnia disorder (Ohayon & Reynolds, 2009). Rather than perceiving these prevalence rates as complicated and inconsistent, the work of Ohanyon (2002) provides a unique opportunity to understand why there are such diverse estimates of insomnia in the literature. It is important to consider this variety of approaches to prevalence rates when considering the impact of insomnia on the population.
Figure 1. Ranges of prevalence based on the work by Ohayon (2002).

Note. Data displayed are based on a review of epidemiological papers reviewed by Ohayon (2002). The bars in Figure 1 display range of prevalence rates.
3.5.2 Prevalence of Insomnia in Australia

In Australia, the prevalence of primary insomnia was estimated to be 3% (at 2% of males and 3.9% of females) in 2010 based on an independent report written by Deloitte Access Economics for the Sleep Health Foundation (Deloitte, 2011). However, a large proportion of Australians reported dissatisfaction with their sleep, even though they may not meet the criteria for insomnia. This is consistent with the epidemiological analysis by Ohayon (2002), while a strong focus on point prevalence, rather than lifetime prevalence, may also contribute to underreporting of insomnia prevalence, as lifetime estimates tend to be higher. One epidemiological study, for example, found lifetime prevalence to be 16.6% (Breslau, Roth, Rosenthal, & Andreski, 1996).

The use of strict criteria in epidemiological studies may also lead to an underestimation of the number of those with sleep difficulties. A large proportion of individuals do not meet the criteria for insomnia, even though they experience distressing symptoms of insomnia and request treatment (Buysse, 2005). This problem is transferable to treatment development studies. If inclusion and exclusion criteria are extremely strict, then treatment outcomes may not be extrapolated to the population, who are likely to self-refer for insomnia treatment. Although there is difficulty in ascertaining accuracy in the prevalence of insomnia, there is no question that insomnia is a very common problem that places a significant burden on society and negatively impacts the life of people with insomnia (Buysse, 2005; Leger et al., 2001).

3.6 The Burden of Insomnia in Australia

In addition to negatively affecting the quality of life of individuals who suffer from insomnia (Leger et al., 2001), the condition places a significant financial burden on society as
well (Deloitte, 2011). The aim of this section is to briefly outline the financial cost of insomnia to individuals and society.

Insomnia negatively impacts the health of individual sufferers, and thereby places a significant burden on health care systems. The Sleep Health Foundation estimated the cost placed on the Australian health care system by insomnia in 2010 was A$118.7 million (Deloitte, 2011). Insomnia was also estimated to cost society further indirect financial costs of AUD $1.5 billion due to lost productivity, early retirement, absenteeism, social security payments, motor vehicle accidents and workplace accidents in 2010 (Deloitte, 2011).

Individuals with both mild and severe insomnia have been found to have significantly lower mean scores across a range of quality of life indicators, such as physical functioning, bodily pain, mental health, emotional states, social functioning, vitality and general health (Leger et al., 2001). It is clear that the enormous individual, societal and financial impact of insomnia warrants a thorough investigation to determine if current treatment could be improved.

3.7 The Relationship between Insomnia and Other Medical and Psychological Conditions

The relationship between insomnia and other medical and psychological conditions is complex, as significant correlations between insomnia and other diagnoses have been found. Individuals who have severe insomnia found to be 5.04 times more likely to have at least one psychiatric diagnosis and 2.83 times more likely to have at least one chronic medical illness than those with no insomnia (Sarsour, Morin, Foley, Kalsekar, & Walsh, 2010). The aim of this section is to present an overview of the multifaceted relationship between insomnia and some commonly co-occurring psychiatric and medical conditions.
3.7.1 Insomnia and Medical Diagnoses

Individuals with chronic insomnia report a higher frequency of medical conditions over a wide range of problems. Figures 2 and 3 display information from an extensive review paper with a focus on insomnia and comorbid medical conditions (Taylor et al., 2007). The study examined self-reported measures of sleep, health, depression and anxiety from 772 men and women aged between 20 and 98. As shown in the two figures, there is a significant overlap between insomnia and many medical problems. Overall, the relationship appears to be bidirectional, as insomnia is related with greater incidences of a range of medical problems and a range of medical problems are associated with a greater proportion of insomnia complaints. The relationship between insomnia and chronic pain is an example of a strong bidirectional relationship (Morin & Benca, 2012). People who experience chronic pain are more likely to report insomnia, and those with insomnia are more likely to report chronic pain (Taylor et al., 2007).

Figure 2. Insomnia rates for specific medical problems based on the work of (Taylor et al., 2007).
Figure 3. Rates for medical problems in participants with or without insomnia based on the work of (Taylor et al., 2007).

3.7.2 Insomnia and Sleep Disorders

Insomnia frequently occurs as a comorbid or secondary condition alongside other sleep disorders such as sleep-disordered breathing (Glidewell, 2013). A high prevalence rate (39% to 58%) of insomnia symptoms has been reported in patients with obstructive sleep apnoea, and between 29% and 67% of insomnia patients have an apnoea-hypopnea index (AHI) of >5 (Luyster, Buysse, & Strollo, 2010). This increases the complexity of insomnia research. The symptoms of insomnia and other sleep disorders often overlap, such as daytime fatigue. Therefore, it can be difficult to determine the cause of each symptom.

3.8 Insomnia and Mental Illness

There is a strong relationship between insomnia and mental illnesses. Between 40% and 60% of people with insomnia suffer from a concomitant mental disorder, most commonly
depression and anxiety (Ohayon & Roth, 2003). Individuals with insomnia are more than five times more likely (odds ratio 5.64 99% CI 5.07–6.29) to present with anxiety or depression (Pearson, Johnson, & Nahin, 2006). There have also been relationships observed between insomnia and impulsivity (Schmidt, Gay, Ghisletta, & Van der Linden, 2010; Schmidt, Gay, & Van der Linden, 2008), substance misuse disorders (Boulanger, Doan, & Pashos, 2008; Morin & Benca, 2012; Roane & Taylor, 2008), bipolar disorder (Harvey, Schmidt, Scarna, Semler, & Goodwin, 2005a), obsessive compulsive disorder (Paterson, Reynolds, Ferguson, & Dawson, 2013), paranoia (Freeman, Pugh, Vorontsova, & Southgate, 2009) and schizophrenia (Bersani, Iannitelli, Pacitti, & Bersani, 2012). The nature of these relationships is complex. The aim of the next section is to explore some of the ways that insomnia and mental illness relate to one another.

3.8.1 Insomnia May Predict Psychiatric Illness

Insomnia can negatively impact on psychiatric conditions, with the presence, severity and chronicity of insomnia (whether primary insomnia or insomnia related to a medical condition) found to be predictors of psychiatric illness (Breslau et al., 1996; Ohayon & Roth, 2003). This relationship has been shown to be non-linear, as severe insomnia is more likely to lead to the development of a secondary or comorbid medical or psychiatric condition. Having a diagnosis of insomnia increases the likelihood of a person suffering with anxiety (Nowell & Buysse, 2001). A study found that subjects with insomnia were 17.35 times more likely to have clinically significant anxiety (Taylor, Lichstein, Durrence, Reidel, & Bush, 2005), which was higher than the rate of co-occurring depression. Insomnia has also been found to be a significant predictor of anxiety disorders, such as panic disorder (Alvaro, Roberts, & Harris, 2014).

It is accepted that insomnia influences the onset and trajectory of depression. Insomnia is a significant risk factor for the development of a first episode of depression (Nutt,
Wilson, & Paterson, 2008). One study found participants with a history of insomnia had a four times greater chance of developing a new onset of depression than those who did not have insomnia at baseline (Breslau et al., 1996). Insomnia has also been found to be a significant risk factor for recurrent depression (Perlis et al., 2006; Riemann & Voderholzer, 2003). Even after controlling for a history of depressive symptoms, insomnia is still a significant predictor for subsequent depressive episodes (Ohayon, Cautel, & Lemoine, 1998). Symptoms of insomnia have also predicted the reoccurrence of depression after birth in women with a history of depression prior to pregnancy (Dørheim, Bjorvatn, & Eberhard-Gran, 2014).

3.8.2 Mental Illness May Influence the Development of Insomnia

A diagnosis of a mental illness may increase the likelihood of developing insomnia (Buysse, 2005). Major depression and depressive disorders have been shown to be the largest risk factors in the development of insomnia (Katz & McHorney, 1998; Ohayon et al., 1998). In a population study of over 3,000 participants, people with depression were found to be more likely to suffer with severe insomnia than non-depressed individuals (Katz & McHorney, 1998). Those with anxiety have also been shown to have a greater likelihood of developing insomnia. Anxiety disorders such as generalised anxiety disorder (GAD; Alvaro et al., 2014) and social anxiety (Raffray, Bond, & Pelissolo, 2011), have been shown to predict the likelihood of developing insomnia.

3.8.3 Medical or Psychological Conditions Can Disrupt Sleep

Some psychological conditions, including anxiety (Carney, Edinger, Carney, & Edinger, 2010a) and depression (Riemann, 2007) have been shown to interfere with sleep. Chronic anxiety frequently delays the onset of sleep (Belanger, Morin, Langlois, & Ladouceur, 2004). Depressed individuals have also been noted to display increased sleep onset latency, as well as increased nocturnal arousals, early morning awakenings and reduced
delta sleep (stages 3 and 4) in the first sleep cycle (Riemann, 2007). It has been hypothesised that depression and anxiety may impact upon the processes that assist individuals to initiate and maintain sleep, as well as to maintain wakefulness. These processes include the homeostatic process (S), the circadian process (C) and SNS (Nutt et al., 2008), which are discussed in Chapter 2.

Depressed individuals have been shown to have disruptions in REM sleep patterns, such as a prolonged first REM sleep period and shorter REM latency. It has been hypothesised that this, along with other key changes such as increased nocturnal arousals and early morning awakening, is reflective of an issue with the circadian system (Nutt et al., 2008). It is not yet known if this is a cause, a symptom or a comorbid condition with depression, and this is the current focus of much research. Palagini, Baglioni, Ciapparelli, Gemignani and Riemann (2013) provide a review of this topic.

While depression itself appears to influence sleep, so do common treatments for depression. Many antidepressants have adverse effects on sleep architecture. Tricyclic antidepressants (TCAs), monoamine oxidase inhibitors (MAOIs) and selective serotonin reuptake inhibitors (SSRIs) disrupt REM sleep and have varied effects on slow-wave sleep and sleep continuity. Antidepressants with sedative properties, such as some of the tricyclic antidepressant medication may improve sleep continuity, however, they often cause daytime sedation (Kupfer, 1999).

3.8.4 Comorbid Insomnia and Secondary Insomnia

The majority of cases of insomnia are secondary to a medical or psychiatric condition. Epidemiological studies have shown that SI accounts for up to 73% cases of insomnia (McCrae & Lichstein, 2001). Insomnia is commonly seen as a secondary or comorbid condition with an anxiety disorder (Carney & Edinger, 2010; Carney et al., 2010a; Carney, Edinger, Carney, & Edinger, 2010b). Sleep disturbances are seen in approximately 70% of
individuals with anxiety disorders (Belleville, Cousineau, Levrier, St-Pierre-Delorme, & Marchand, 2010). It is most common for anxiety disorders to occur simultaneously with or precede the onset of insomnia, but insomnia can also occur prior to the onset of anxiety (Ohayon & Roth, 2003). The combination of anxiety and insomnia is a particularly difficult combination for sufferers. People with CI and anxiety have poorer reported quality of life than those with anxiety only (Carney & Edinger, 2010). As such, it is imperative to consider treatment for insomnia when dealing with populations of people with anxiety (Belleville, 2014).

Epidemiological studies have found that approximately 20% of all people with insomnia suffer from comorbid depression (Drake, Schwartz, & Roth, 2008; Kupfer, 1999). An especially concerning outcome from the research on CI and depression are the findings exploring risks of suicidal ideation and suicidal behaviour. Sleep problems in depressed individuals (poor sleep quality, low sleep efficiency and increased REM activity and time) have been noted as significant predictors of suicidal ideation and suicidal behaviour (Cukrowicz et al., 2006). Nightmares have been reported as significant predictors of suicidal ideation (Cukrowicz et al., 2006). It is, therefore, paramount that sleep is considered as a critical focus of treatment in individuals with depression.

### 3.8.5 Symptoms of Insomnia and Psychiatric Conditions

Symptoms of insomnia are extremely common in most psychiatric conditions. For example, insomnia is one of the diagnostic criteria of an generalised anxiety disorder (GAD) (American Psychiatric Association, 2013). Insomnia or hypersomnia are also diagnostic criteria used in the diagnosis of depression (American Psychiatric Association, 2013). Over 75% of psychiatric patients have sleep difficulties during the acute phase of their illness (Sweetwood, Grant, Kripke, Gerst, & Yager, 1980). In some cases, sleep disruption can be a helpful indicator to bring attention to a change in mood or psychotic symptoms. For example,
reduced sleep duration is one of the first indicators of a manic episode (Plante & Winkelman, 2008). Kloss and Szuba (2003) provide a review of insomnia in psychiatric populations and Harvey (2001) discusses the difficulties differentiating insomnia symptoms from an insomnia diagnosis.

3.8.6 Treatment of Insomnia Can Improve Psychiatric Conditions

Treatment of insomnia can lead to changes in comorbid or secondary psychiatric illness such as depression (Drake et al., 2008), generalised anxiety disorder and alcoholism (Haynes, Parthasarathy, Kersh, & Bootzin, 2011; Krystal, 2006). In light of the presented research on comorbid insomnia and psychiatric conditions, this information provides further support for a focus on insomnia treatment. Krystal (2006) reviews the support for treatment of insomnia in psychiatric settings.

3.8.7 Diagnosis and Treatment

Given the complex relationship between insomnia and medical and psychiatric disorders, it is essential to consider insomnia in research into the development of new treatments. A large proportion of patients with insomnia also have psychiatric or medical conditions. For insomnia treatment to be successful, it must be able to address sleep concerns in the diverse population of insomnia sufferers. Many studies exploring treatment outcomes exclude psychiatric conditions so as to ensure that a ‘pure’ sample of people with insomnia is studied. Although this allows for a clearer conclusion to be made regarding the success of the treatment and is important for the early stages of study into treatment development, such people are not representative of the population. To ensure the generalisability of results, it is important to include those with psychiatric and medical conditions in the samples studied.
3.8.8 Summary of Insomnia and Mental Illness

Although there are many questions yet to be answered, research is beginning to shed light on the complex relationship between sleep disorders and psychiatric or medical disorders. These findings suggest that it may be advantageous to examine the effectiveness of insomnia treatment in a naturalistic sample, which is reflective of the wide range of comorbid conditions commonly found in the population. Such findings have informed the selection criteria used in the current treatment evaluation study, as further discussed in Chapter 7.

3.9 Measurement of Insomnia

Measurement of insomnia is complex. As discussed earlier, diagnosis of insomnia is largely dependent on self-reporting. However, those with insomnia often misperceive their sleep (Harvey & Tang, 2012; Tang & Harvey, 2005). This generates questions surrounding the reliability and validity of self-reported measurements of sleep. As such, there has been a push to combine objective measurements and subjective measurements of insomnia in research and clinical settings. The aim of this section is to present a discussion of measurements for insomnia, along with a rationale for the methods of measurement used in the current study.

One of the difficulties in the diagnosis of insomnia is that there are no known physiological markers of insomnia. While the majority of other sleep disorders, such as obstructive sleep apnoea, are diagnosed by overnight polysomnography (PSG), these diagnostic measures are rarely used to diagnose insomnia. More recently, however, PSG studies and the use of cyclic alternating pattern (CAP) have been used to explore sleep stability, which is a marker for hyperarousal (Terzano et al., 2003). It is also common to see increased beta activity in sleep in patients with insomnia. This provides evidence for the ‘flip-flop’ switch (discussed in Chapter 2) regarding hyperarousal (Saper et al., 2005). Although
there is an indication that PSG may be able to detect disturbance in the sleep of people with insomnia, not all people who have indications of hyperarousal as measured by PSG report dissatisfaction with their sleep. Some self-reported good sleepers have been shown to have poor sleep (long sleep onset latencies, reduced total sleep time or wake after sleep onset) in a study focusing on hyperarousal and EEG (Rosa & Bonnet, 2000). PSG is not accepted as best practice, partly due to questions surrounding its usefulness (Morin & Benca, 2012) and partly due to the cost associated with overnight sleep studies. It is a useful tool, however, to screen for other sleep disorders that may be contributing to symptoms of sleep disturbance.

The use of actigraphy has been explored as a less costly and less invasive way to collect information regarding sleep. Actigraphy has been used for over 25 years to assess sleep-wake behaviour (Blackwell et al., 2008). It utilises a single channel that collects data on movement and a sensor to record the amount and duration of ambient white light illuminance. This information is then used to infer time spent asleep and awake.

There are several advantages of using actigraphy over PSG in insomnia research. PSG involves approximately 20 different leads that are attached to the participant and can disrupt sleep (Blackwell et al., 2008). Actigraphy, on the other hand, is not cumbersome, and is therefore of less burden to the participant than a PSG. Furthermore, actigraphy can be used over extended periods of time, and therefore may be more reliable than PSG which usually only measures sleep on one or two nights. PSG is costly and time consuming, particularly for chronic conditions such as insomnia. It is therefore suggested that actigraphy may be the more desirable option (Blackwell et al., 2008) and was for this reason chosen to measure objective sleep in the research presented in this thesis.

The particular actigraph selected for the study, as well as the methods of measurement, will be discussed further in Chapter 8. Although actigraphy is a useful way of measuring sleep across time, it is not often utilised to diagnose insomnia, as there are no
established cut-offs for how quantitatively disrupted sleep must be to receive this diagnosis (Carney et al., 2010a). Occasionally, however, actigraphy is used to rule out sleep state misperception. For the purposes of the research presented here, actigraphy was utilised as an objective outcome measure. The advantage of this was that it was possible to record week-to-week variation in sleep, and provide information about both the differences between objective and subjective measurements of sleep, and the changes in particular sleep measures across time.

Other common measures of insomnia focus on subjective measures. Typically, a sleep diary, completed daily, provides a measure of important outcome variables such as sleep onset latency (SOL), total sleep time (TST) and wake after sleep onset (WASO) (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006). Sleep diaries can be designed to collect other information relevant to the intended outcomes, such as sleep quality and number of awakenings. Sleep diaries are also used as a treatment method to address the perception issues that may be present for individuals. The intended purpose of the sleep diary in this case is to assist individuals to take a more objective view of their sleep. It allows them to look at their sleep averages across time to reduce the focus on night to night variation, and also to help understand patterns and improve consistency with wake time. This will be discussed in the following section on cognitive behaviour therapy for insomnia. Sleep diaries were utilised in the current study.

3.10 Current Non-Drug Treatment

3.10.1 CBT-I

Cognitive behaviour therapy for insomnia (CBT-I) has been considered the ‘gold-standard’, non-drug treatment for insomnia. CBT-I involves a combination of cognitive and behavioural interventions that together are intended to target and eliminate behavioural and
cognitive contributions to an individual’s sleep problem. There is compelling evidence that CBT-I is a lasting, effective treatment for chronic insomnia when it occurs as an independent condition (Trauer et al., 2015). For example, the American Academy of Sleep Medicine (AASM) concluded that CBT-I is associated with improvement in 70% of patients and its effects are sustained for at least six months post-treatment (Morin et al., 2006b). This section aims to describe CBT-I and review available data to investigate if it is able to address all aspects present in the three theories of insomnia (behavioural, cognitive and hyperarousal).

3.10.1.1 Sleep Hygiene

The first component of CBT-I is sleep hygiene. These are instructions to establish behaviours and situations that are known to create a platform for good sleep (Stepanski & Wyatt, 2003). Usually these are delivered in the form of a handout and are discussed with a patient. Instructions include: to exercise, but not to be involved in strenuous exercise for 3-4 hours before intended sleep time; to limit caffeine and alcohol; and to ensure the bedroom environment is comfortable, at a regular temperature and is relatively free from light and noise. Sleep hygiene forms an element of CBT-I that is targeted towards reducing unwanted associations connected to the bedroom environment. On its own, sleep hygiene has been shown unlikely to improve insomnia as a sole intervention (Englefriedman, Hazlewood, Bootzin, & Tsao, 1992).

3.10.1.2 Relaxation

Relaxation is often delivered as the second component of CBT-I treatment. Lichstein provides a detailed review of commonly used relaxation strategies (Lichstein, 1988). Relaxation focuses on teaching an individual techniques to reduce physiological and/or cognitive arousal. Examples of common relaxation techniques are listed below.
1. **Progressive muscle relaxation** was developed by an American physician Edmund Jacobson in the early 1920s. It is a relaxation technique where individuals learn to tense and relax parts of their body sequentially. Progressive relaxation has been found to have positive impacts on sleep (Alexandru, Róbert, Viorel, & Vasile, 2009; Nicassio & Bootzin, 1974).

2. **Relaxation breathing control** involves training individuals in diaphragmatic breathing, and encourages them to regularly practice breathing in, holding the breath and then letting it out. The 4-7-8 breathing method is commonly used where patients are asked to breathe in for the count of four, hold for the count of seven seconds and breathe out over the count of eight seconds. Breathing techniques have been known to have a calming effect on the central nervous system by increasing carbon dioxide (Choliz, 1995).

3. **Autogenic training** was developed by the German psychiatrist Johannes Heinrich Schultz, who first published work on this in 1932. Individuals learn to repeat phrases in their mind that are in line with a physical state shift in their body, such as ‘my hand is warm and heavy’. Autogenic training has been found to have a positive influence on sleep disorders (Stetter & Kupper, 2002).

4. **Hypnosis** is where individuals are put into a trance-like state and in which they are suggestible to cognitive restructuring. Unfortunately, not all people are susceptible to hypnosis and the evidence for this approach is lacking. One early study found there to be improvements in total sleep time and sleep onset in an autohypnosis group compared with controls, however, the sample size was modest (N = 18), randomly allocated in to four groups (Anderson, Dalton, & Basker, 1979). Hypnosis is thought to stimulate relaxation and reduce tension (Serban, Padurariu, Ciobica, Cojocaru, & Lefter, 2013).
5. **Biofeedback** is where individuals are measured for a physiological indication of arousal such as heart rate, theta waves (4–7 Hz), sensory motor rhythm wave (SMR; 13–15 Hz), or muscle tone (EMG) and instructed to relax while watching the measurement output. Biofeedback has been found useful for certain types of insomniacs, primarily those who are tense or anxious (Hauri, 1981).

Although evidence suggests that relaxation contributes to improved outcomes in insomnia treatment, there is no clear understanding of the method by which these techniques work. To date, there is no research exploring relaxation training (without the other components of CBT-I) on hyperarousal in those with insomnia.

3.10.1.3 **Stimulus Control**

The next component of CBT-I is stimulus control. The development of stimulus control is based on the concept of classical conditioning. From this perspective, insomnia is conceptualised as a conditioned response of wakefulness to the bedroom environment. As such, individuals are given the instructions that they are to do nothing in bed apart from sleep and sexual activity, with the aim of improving their associations between sleep and the bedroom environment (Bootzin & Epstein, 1991). Individuals are instructed to leave the bedroom environment if they are not asleep, thereby reducing the amount of time spent in bed. They are also instructed not to engage in activities such as watching TV, reading or using portable electronic devices in bed. The aim is to decrease the amount of wake time in bed and therefore reduce the conditioned response of wakefulness, worry, frustration, stress or even entertainment in the bedroom environment. A meta-analytic study found convincing evidence for the use of stimulus control (independently and in conjunction with other treatment), along with support for its benefit for problems of sleep onset and sleep maintenance (Morin et al., 1999).
### 3.10.1.4 Sleep Consolidation

Sleep restriction, or as it is has more recently been referred to, ‘sleep consolidation’ is the next component of CBT-I (Spielman, Saskin, & Thorpy, 1987b). The three-P model of insomnia (comprising predisposing, precipitating and perpetuating factors) posits that the distinction between people who develop a chronic sleep condition following an acute sleep problem and people who don’t is how they react to the problem. People with insomnia typically react with safety behaviours such as spending longer in bed. This leads to more time awake in bed, which unintentionally perpetuates the sleep problem. Sleep consolidation aims to reduce the time awake in bed by limiting the total amount of time in bed (Spielman et al., 1987b).

The way this is implemented is by averaging total sleep time over a one-week period to provide a guide for the individual as to how much time to spend in bed each night. This information is used to tailor a ‘sleep window’, with a consistent rise time seven days per week. To find out their total sleep time, patients are instructed to keep a sleep diary. The process of keeping this diary is also part of the treatment, as collecting data about their sleep provides an avenue for individuals to understand their sleep patterns and improve their perception of sleep. After collating this information, participants average their total sleep time and add 30 minutes to the average. The resulting amount of time is used as the ‘sleep window’. The sleep window is then ‘set’ at a particular time each day. This is useful in strengthening circadian rhythms and in reducing the large fluctuations in total sleep time often experienced by people with insomnia. Over time, this window is widened as individuals hit a target ‘sleep efficacy’ (which is determined by the proportion of time spent in bed asleep as compared with awake). Sleep consolidation has been found to reduce sleep onset and improve sleep efficiency (Morin et al., 1999; Spielman et al., 1987b).
Sleep consolidation aims to counter the known safety behaviour of spending more time in bed. However, removal of a safety behaviour has the potential to generate anxiety and therefore exacerbate a sleep problem. It is important that this intervention is delivered after appropriate assessment for potential features of generalised anxiety disorder (GAD) and after the patient has acquired anxiety management skills.

3.10.1.5 Cognitive Therapy

The final component of CBT-I aims to address the cognitive processes that have contributed to insomnia. Cognitive treatments for insomnia include:

1. **Paradoxical intention** which involves participants being instructed to focus their attention on staying awake rather than falling asleep. The rationale behind this is to assist in the reduction of ‘striving’ for sleep, which has the potential to disrupt the natural process of letting go and falling asleep (Espie et al., 2006; Espie & Lindsay, 1985). One recent study found that trying to sleep led to sleep fragmentation and increased sleep onset latency in normal sleepers (Rasskazova, Zavalko, Tkhostov, & Dorohov, 2014). A review of non-drug treatments for insomnia found paradoxical intention to contribute significantly to the improvement of sleep outcomes (Morin et al., 2006b).

2. **Thought stopping** aims to interrupt unwanted worry and pre-sleep cognitive activity by instructing the patient to engage in a repetitive cognitive activity, such as repeating the word “the” every three seconds (Levey, Aldaz, Watts, & Coyle, 1991) or to yell “stop” sub-vocally when rumination occurs (Wolpe, 1973). The contribution of thought stopping to the treatment of insomnia has been questioned due to its similarity to thought suppression, which is known to fuel further anxious cognitions (Harvey & Tang, 2003)
3. **Imagery training** involves the patients being trained to rehearse an image of a relaxing place such as a beach or an object such as a candle. There is emphasis on visualising and imagining the sensory components of the experience. For instance, patients visualising a beach can imagine the visual experience of the water glistening and the auditory experience of the waves. The rationale for this is to invoke cognitive and emotional relaxation and to focus the attention, which provides an alternative to attending to worrying thoughts, sleep-related threats and striving for sleep (Harvey & Payne, 2002).

4. **Cognitive restructuring** aims to address the aspect of the cognitive model of insomnia in which people with insomnia often hold an array of maladaptive beliefs about sleep (Morin, Kowatch, Barry, & Walton, 1993a; Morin, Stone, Trinkle, Mercer, & Remsberg, 1993b). These beliefs influence thinking, feelings and behaviours. Cognitive restructuring aims to identify and alter irrational or dysfunctional beliefs about sleep and provide accurate alternative information instead (Belanger, Savard, & Morin, 2006). Treatment targets the following categories of maladaptive sleep-related beliefs: unrealistic sleep expectations, misconceptions about the cause of insomnia, distorted perceptions of the consequences of poor sleep, faulty beliefs about sleep-promoting practices, and any other disturbing thoughts that may potentially impact sleep (Belanger et al., 2006). The patient is instructed to identify and rehearse alternative belief statements. Because patients often perceive themselves as victims of insomnia, an important goal of treatment is to strengthen their sense of control in coping with the sleep problem (Morin et al., 1999).

3.10.1.6 **Evidence for CBT-I**

Many controlled studies report that CBT-I has been found effective in reducing the severity of insomnia (Trauer et al., 2015). Meta-analytic studies have reported significant
effect sizes for improvements in sleep onset latency, duration of awakenings and for sleep quality (Trauer et al., 2015). CBT-I has been shown to be more effective than pharmacotherapy for insomnia with respect to effect sizes and the continuation of treatment benefit. However, when investigating remission using criteria, only 26% to 43% of patients using CBT-I achieve full remission (Buysse et al., 2011; Epstein, Sidani, Bootzin, & Belyea, 2012; Morin et al., 2009).

While the benefits of CBT-I persist after treatment finishes, pharmacotherapy commonly results in a return to baseline sleep after the cessation of treatment (Jacobs, Pace-Schott, Stickgold, & Otto, 2004). Other research indicates that CBT-I may have the potential to concomitantly reduce the severity of comorbid conditions (Sanchez-Ortuno & Edinger, 2012; Smith, Huang, & Manber, 2005). CBT-I has also been found to be useful for secondary insomnia, wherein the primary condition is depression, post-traumatic stress disorder, and alcohol dependence (Sanchez-Ortuno & Edinger, 2012). As previously discussed, comorbid insomnia accounts for a substantial proportion of insomniacs (Ohayon et al., 1998).

The three-P model of insomnia proposes that insomnia is maintained via a collection of perpetuating behaviours, such as napping, spending more time in bed, and poor sleep-related behaviours such as increased caffeine intake and reduced exercise. The CBT-I components of sleep consolidation, sleep hygiene and stimulus control are effective methods to reduce daytime napping, reduce time in bed and improve the consistency of morning waking (Schwartz & Carney, 2012).

The cognitive models of insomnia propose that there are several cognitive elements that influence the maintenance of insomnia. Dysfunctional beliefs are known to perpetuate worry and safety behaviours, and have been linked to frustration and cognitive arousal (Harvey, 2005). Many studies that have reviewed the efficacy of CBT-I have found significant reductions in the Dysfunctional Beliefs About Sleep Scale (DBAS), indicating that
CBT-I is effective in changing beliefs about sleep (Schwartz & Carney, 2012). However, a recent study found that dysfunctional beliefs about sleep did not mediate improvements in insomnia (Okajima, Nakajima, Ochi, & Inoue, 2014). Another cognitive process known to interfere with the process of sleep is sleep related effort, or trying to sleep (Espie et al., 2006). Although CBT-I may be successful in reducing sleep effort, there is no research to date to confirm this (Schwartz & Carney, 2012).

As previously discussed, a large component of recent research investigating the development and maintenance of insomnia has focused on hyperarousal, as both a predisposing and perpetuating factor. Hyperarousal has been conceptualised to include cognitive, somatic and cortical overactivation, and has the potential to profoundly impact both the quality and quantity of sleep (Bonnet & Arand, 2010). It is essential that treatment for insomnia can reduce overall hyperarousal, and particularly pre-sleep arousal. It is therefore interesting to note that there is not sufficient evidence that CBT-I can reduce arousal (Ong et al., 2009). Two randomised controlled trials investigating CBT-I as a treatment for late-life insomnia did find decreases in arousal based on pulse rates (Lichstein, Riedel, Wilson, Lester, & Aguillard, 2001; Lichstein, Wilson, & Johnson, 2000). This indicates that older adults experienced a positive reduction in physiologic arousal. However, the pulse rates were recorded before and after relaxation practice rather than before and after treatment. Therefore, the results do not explain if these changes were sustained nor if they contributed to improvements in sleep parameters (Lichstein et al., 2000).

Subjective measurements of pre-sleep arousal have been collected by three randomised controlled trials investigating CBT-I (Rosen, Lewin, Goldberg, & Woolfolk, 2000; Vincent & Lewycky, 2009; Wu, Bao, Zhang, Deng, & Long, 2006) and one treatment outcome study without the use of a control group (Galuszko-Wegielnik, Jakuszkowiak-Wojten, Wiglusz, Cubala, & Landowski, 2012). Rosen and colleagues (2000) found a
significant reduction in pre-sleep arousal between baseline and post-treatment through the use of both muscle relaxation training and guided imagery. However, there was also a significant reduction in pre-sleep arousal in the control group (Rosen et al., 2000). This suggests that CBT-I relaxation techniques (progressive muscle relaxation and guided imagery) may reduce self-reported arousal, however, their contribution was not significantly greater than the impact of a sleep education control.

Results of a study using three treatment conditions (CBT, pharmacotherapy, combined CBT and pharmacotherapy) and a placebo group revealed that CBT-I resulted in reduced self-reported pre-sleep arousal as measured by the Pre-Sleep Arousal Scale (PSAS) to a greater degree than for the pharmacotherapy group (Wu et al., 2006). However it should be noted that the baseline scores on the PSAS in this study (Somatic Arousal $M = 5.2$, $SD = 2.3$, Cognitive Arousal $M = 7.1$, $SD = 1.6$) were below the average for both somatic and cognitive arousal for an insomnia population (Somatic Arousal, $M = 17.67$, $SD = 6.45$, Cognitive Arousal, $M = 25.5$, $SD = 6.57$) as reported by the authors of the PSAS (Nicassio, Mendlowitz, Fussell, & Petras, 1985).

In a further study investigating CBT-I delivered as an online treatment, a significant decrease in cognitive arousal as scored by the PSAS subscale was found, although somatic arousal was not assessed. The authors also reported a medium effect size for the PSAS (Vincent & Lewycky, 2009). A more recent study (Galuszko-Wegielnik et al., 2012) investigated self-reported hyperarousal based on the Hyperarousal Scale, which was designed to measure hyperarousal as a trait (Regestein, Dambrosia, Hallett, Murawski, & Paine, 1993). Although the reduction in hyperarousal did not reach significance following treatment, hyperarousal reduced significantly (52.3 vs. 42.4; $p < .001$) between baseline and follow-up assessments (Galuszko-Wegielnik et al., 2012).
While it seems relaxation training delivered within the context of CBT-I has the potential to reduce symptoms of physiological and cognitive arousal, the supporting research is scant. Two directions of future research may assist insomnia treatment. These are, firstly, further investigation into CBT-I and arousal, and secondly, exploration of alternative treatments to CBT-I that may have potential to reduce arousal.

3.10.1.7 Criticisms and weaknesses of CBT-I

In an important review article, Harvey and Tang (2003) proposed that CBT-I requires further refining to improve efficacy. The authors pointed out that the magnitude of change in terms of effect size pales in comparison with many other CBT interventions. For example, effect sizes for CBT for depression have been reported to be as high as 2.15, whereas CBT-I effect sizes range between 0.63 to 0.96 (Harvey & Tang, 2003). One possible explanation for this is that CBT requires good insight into internal processing, as well as a high motivation to change (Edinger & Means, 2005). Not all individuals with insomnia have good insight into their thinking and beliefs. Within the CBT framework, maladaptive thoughts and beliefs are approached directly. The first step is to increase awareness to cognitions and the second goal is to restructure maladaptive thoughts into adaptive ones. Unfortunately this technique is not possible for all individuals, especially those with rigid thinking styles, for example, people with borderline personality disorder (Blenkiron, 1999). An alternative approach to cognitive restructuring may be able to address maladaptive thinking in individuals who are not suited to CBT-I.

3.11 Summary

This chapter has provided an overview of the diagnosis, prevalence and impact of insomnia. This information clarified the reason for the wide range of prevalence rates of insomnia and identified the differences between the three primary classification systems.
Next, this chapter included a discussion of the complex relationship insomnia has with medical and psychological illness, and the importance of examining the effectiveness of insomnia treatment in naturalistic samples. The information included here forms the basis of the research design presented in Chapter 7. This chapter has also evaluated CBT-I. Although CBT-I is well established and effective in treating insomnia, it may not be as efficient in reducing hyperarousal.

Mindfulness has been raised as a potential strategy that may be able to reduce the arousal level of people with insomnia and provide an indirect way of reducing worry and rumination about sleep (Ong et al., 2012). As will be discussed in greater depth in the following chapters, mindfulness aims to improve sleep by reducing the overall arousal level of insomnia sufferers. Chapter 4 provides an exploration of what mindfulness is and an examination of why it might provide a suitable approach to the problems posed by insomnia. A review of research investigating mindfulness as a treatment option for insomnia will be critically reviewed in Chapter 5.
CHAPTER 4: Mindfulness

4.1 Introduction

Mindfulness is an increasingly popular intervention and practice. The concept itself originates in Eastern philosophy and Buddhist teachings, and has been practiced for centuries (Gethin, 2011). In the West, however, mindfulness has only appeared in the literature in the last few decades. The potential application of mindfulness is vast, with support for its use as a treatment for a variety of psychological and physiological conditions (Grossman, Niemann, Schmidt, & Walach, 2004a). The aim of this chapter is to present an overview of mindfulness. The topics covered include: what mindfulness is and how it is increased; the mechanisms of mindfulness and how it influences neurological change; and how mindfulness relates to personality and mood. The chapter will close with a discussion of mindfulness as a potential treatment for insomnia.

4.2 Definition of Mindfulness

The definition of mindfulness has been a focus of attention in the past two decades. The number of definitions of mindfulness that exists is reflective of the expansion of mindfulness from its original roots in Eastern philosophies to its position today in secular treatment techniques such as Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 1990).

4.2.1 History of the Definition of Mindfulness

In Buddhist tradition, mindfulness is considered to be an essential part of the framework that guides a Buddhist approach to life. This framework, or system, is thought to lead a person away from suffering and towards a balanced mind (Hanh, 1978). The word
‘mindfulness’ was translated from the term sati (in its Pali form) or smṛti (in its Sanskrit form) by Rhys Davids in the late 1800s (Gethin, 2011). At the time, there were also several other Pali and Sanskrit words that held similar meanings, such as upatthita sati (presence of mind) and satipatthana (fixing the attention, earnest meditation). Davids (1843–1922) was a British scholar of the Pali language and founder of the Pali Text Society. His translations formed the basis of the term ‘mindfulness’ in English. Davids became clearer in his definition of mindfulness in 1881, when he defined sati as “literally ‘memory,’ but [the term] is used with reference to the constantly repeated phrase ‘mindful and thoughtful’ (Sampajañña); and means that activity of mind and constant presence of mind” (Davids, 1881, in Gethin, 2011, p. 264).

Davids emphasised that mindfulness also incorporates a duality of awareness: connection with the present moment, at the same time as connection with ethical foundations. Gethin (2011) rephrased this sentiment eloquently in saying that “if you consistently remember what it is you are doing in any given moment, you will truly see what it is you are doing; and in truly seeing what it is you are doing, those of your deeds, words and thoughts that are motivated by greed, hatred and delusion will become impossible for you” (Gethin, 2011, p. 265). This contrasts with the Western model of mindfulness, which tends to emphasise ‘non-judgement’ as a foundation of practice.

4.2.2 Modern Definition of Mindfulness

The Oxford Dictionary Online (n.d.; def. 1) defines mindfulness as “the quality or state of being conscious or aware of something”. Jon Kabat-Zinn communicates the importance of the way in which attention is applied in his definition that “mindfulness is paying attention in a particular way: on purpose, in the present moment, and non-judgmentally” (Kabat-Zinn, 1990). This definition is frequently cited, although other experts in mindfulness do not believe it truly captures all aspects of mindfulness, prompting a
workforce to be formed to facilitate discussion on the definition of mindfulness. This arrived at the definition of mindfulness as the “self-regulation of attention, which involves sustained attention, attention switching, and the inhibition of elaborative processing” (Bishop et al., 2004, p. 233). This definition is used for the purposes of this study, based on the rigor with which it was derived. A number of reviews of the definitions of mindfulness attest to the difficulty of defining it. The term has been used for a long period of time across many countries, cultures and beliefs. As a result, the definition varies depending on the contexts in which it is used. For instance, mindfulness delivered in the therapeutic approach known as Mindfulness Based Stress Reduction has some differences with mindfulness as practiced in non-secular traditions. (Chiesa, 2013; Gethin, 2011). In Chapter 5, the differing ways of conceptualising mindfulness will be explored in greater detail, as current mindfulness measures are evaluated.

4.3 The Presence of Mindfulness in Research

When the concept of mindfulness first appeared in the Western world, it was met with scepticism (Kabat-Zinn, 2003). This could be interpreted as beneficial, because scepticism is often followed by empirical research. This section aims to provide a historical review of mindfulness in Western literature, starting with Jon Kabat-Zinn who is an instrumental figure in the introduction of mindfulness to the West. He developed the Mindfulness Based Stress Reduction (MBSR) program in 1979 at the University of Massachusetts Medical Centre, and published his seminal book *Full Catastrophe Living* in 1990 (Kabat-Zinn, 1990), which communicated the essence of mindfulness to a general audience. The work of Kabat-Zinn captured the attention of the media, particularly in the United States of America. Around this time, stories about mindfulness appeared on the cover the *Time* and *Newsweek*. 
Mindfulness has since been embraced by large corporations such as Google. The company’s in-house mindfulness teacher, Chade-Meng Tan, has announced that mindfulness is “the new fitness” (Confino, 2014). Google has a large audience and therefore has strong marketing capacity. The interest in mindfulness shown by the Google Corporation has undoubtedly increased public awareness of mindfulness. As such, mindfulness is now regularly discussed in newspaper articles and blogs, and is a term that most educated individuals are familiar with. Unfortunately, in an aim to increase the marketability of mindfulness, Google have not communicated some important elements of the practice, such as non-striving. This can be seen in many articles that depict mindfulness as a way to ‘get ahead’. The title of Chade-Meng Tan’s 2012 book is *Search Inside Yourself: The Unexpected Path to Achieving Success, Happiness (and World Peace)* (Kabat-Zinn, 1990, 2003) (Kabat-Zinn, 1990, 2003) (Kabat-Zinn, 1990, 2003) (Kabat-Zinn, 1990, 2003).

Since mindfulness was introduced to Western psychology, there has been a steep increase in its presence in psychological research, with a dramatic increase in this century. A recent search (conducted on 28 February, 2016) of ‘mindfulness’ in the ‘topics’ search category of Web of Science located 13, 526 papers. The majority of these papers (10,763) were published after 2010. Treatment outcome studies are regularly providing more support for the use of mindfulness interventions across a wide range of problem areas (Baer, 2003; Grossman et al., 2004a). The efficacy of mindfulness-based interventions is discussed in greater detail later in this section.

Mindfulness is becoming increasingly popular, both in clinical research and in popular psychology. Although the term the word ‘mindfulness’ is used in these different fields, the meaning may vary between contexts. In non-secular traditions, mindfulness is fused with many ethical and spiritual ideas and practices, whereas in popular psychology, it is often viewed as a tool to achieve more, and is therefore quite removed from its origins, as is
the case with Google. MBSR focuses on mindfulness that is closely connected to its original principles, without attachment to religious or spiritual teachings. It is, therefore, suitable for a wider variety of people, and remains consistent with its original content.

As the current study is based in a Western context, the decision has been made to present an overview of mindfulness from a Western perspective. Specifically, the discussion in the next section will provide an overview of what mindfulness is, including a discussion of the principles of mindfulness, such as acceptance and non-judgement, based on MBSR. It will consider the results from studies utilising Mindfulness Based Stress Reduction (MBSR) or Mindfulness Based Cognitive Therapy (MBCT). Both of these treatment packages aim to deliver a consistent experience to each individual with respect to mindfulness education, and the length and timing of a meditation practice. Therefore, these approaches are suitable for empirical research as the interventions possess consistency, allowing their outcomes to be interpreted with greater clarity and specificity.

4.4 What is Mindfulness?

4.4.1 The Process of Being Mindful

The process of mindfulness involves intentionally directing attention to the present moment. It involves a continual process of self-regulation of attention. Maintaining attention towards the present moment requires awareness. When attention is focused on one specific aspect of the present moment (i.e., through selective attention), a vast array of human experiences are potential distractions. Humans can be easily distracted by experiences such as thoughts, sensations, judgements, worries, emotions and memories. The practice of mindfulness requires an awareness of such distractions, in conjunction with a continual refocusing of attention.
4.4.2 Third Wave Therapies

Mindfulness interventions have been referred to as the ‘third wave’ of cognitive behaviour therapy (Hayes, 2004), which utilises metacognition. Metacognitive processing is required in order to be mindful, as it enables an individual to self-regulate attention, maintain and shift attention, and inhibit elaborative processing. There are several different treatment orientations that utilise mindfulness as an avenue to improve metacognition. These include: acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 1999), dialectical behaviour therapy (Linehan, 2013), and mindfulness based stress reduction (Kabat-Zinn, 1990).

Hayes (2004) explains that the third wave of cognitive behaviour therapy is built on existing behaviour therapy by broadening the focus of change instead of committing to first-order change. Mindfulness-based interventions teach change strategies such as observing thoughts, which is classified as an indirect (second order) change strategy. Such second order change strategies target metacognitive processes, rather than the content of cognitions itself (Ong et al., 2012). In this way, mindfulness strategies are aimed at “creating a shift in the lens through which first order cognitions are viewed” (Ong et al., 2012, p. 654).

4.4.3 The Principles of Mindfulness

Mindfulness involves developing a specific attitude towards the present moment. This attitudinal shift allows meditators to develop a different relationship with their present moment experience. The next section outlines the seven principles or attitudes of mindfulness as explained by Jon Kabat-Zinn (1990). These are non-judgement, patience, beginner’s mind, trust, non-striving, acceptance and letting go.
4. 4. 3. 1 Non-Judgement

Thought content often contains assessments of our observations and these assessments are often referred to as judgements. For example, a judgement might contain thoughts surrounding one’s like or dislike of an experience. From a mindful perspective, the process of judging can obstruct awareness of the present moment and can increase emotional reactions. The principal of non-judgement encourages individuals to observe their ‘judging mind’ and to ‘let go’ (discussed later) of judgements (Kabat-Zinn, 1990). This process involves metacognition, or awareness of thought. Meditation practice enhances ability to observe and distance ourselves from thought content, which facilitates a greater awareness of the actual experience.

4. 4. 3. 2 Patience.

The Oxford Dictionary Online (n.d.; def. 1) defines patience as “the capacity to accept or tolerate delay, problems, or suffering without becoming annoyed or anxious”. From a mindfulness perspective, applying the principle of patience involves a willingness to allow experiences and events to unfold in their own time. Patience can be increased through mindfulness practice. This is facilitated by increasing awareness of thought content, in particular by increasing awareness of impatience, striving, fantasy or judgement. Awareness of these aspects of cognitive functioning enables a person to make a conscious decision to return the attention to the present moment. This reduces the amount of time a person is negatively impacted by impatience, which in turn reduces suffering (Kabat-Zinn, 1990).

4. 4. 3. 3 Beginner's Mind

Beginner’s mind describes a foundational attitude by which the present moment is attended to, without connection to prior experiences (Kabat-Zinn, 1990). It involves directing attention to the present moment as if this were the first experience of such a moment. It is
based on the theory that much of our experience is not attended to, simply because it is not novel. Attention decreases when we are re-exposed to stimuli, which demonstrates our capacity to learn and to convert a newly acquired skill into automatic processing (Schneider & Chein, 2003). However, our capacity to perform functions with little attention also enables us to switch into ‘autopilot’, rendering us more likely to miss important details around us. This state has been described as ‘mindlessness’ and it is discussed in more detail following this consideration of the principles of mindfulness.

4. 4. 3. 4 Trust

Although trust is commonly used word in the Western world, there are some differences in the way it is explained from a mindfulness perspective. The Oxford Dictionary Online (n.d.; def. 1) defines trust as the “firm belief in the reliability, truth, or ability of someone or something”. From a mindfulness perspective, however, trust is a process where respect for feelings, instincts, our potential and the capability of our body is held. This can also be extended to include trust in the basic good of people and society as a whole (Kabat-Zinn, 1990).

4. 4. 3. 5 Non-striving

Striving involves making efforts to achieve or obtain something. Non-striving, on the other hand, involves attending to the present moment without impatiently pursuing another experience, goal or situation. Jon Kabat-Zinn states that “we only have moments to live” (Kabat-Zinn, 1990). By this, he means that when we are striving for our moment to be different, we are not fully attending to the present moment. Unfortunately, non-striving is a concept that is quite jarring to many commonly held values in Western society. Even so, this principal highlights the importance of the application of non-judgement in order to cultivate awareness of our true present moment.
4. 4. 3. 6 **Acceptance**

In psychology, acceptance is often referred to as a person’s assent to the reality of a situation, including recognising a process or condition (often a negative or uncomfortable situation) without attempting to change it. This principal can be extremely challenging to those people who experience high levels of pain, anxiety, depression or any other difficult experience (cognitively, emotionally or physically). However, acceptance of difficult experiences can improve chronic conditions. For example, acceptance of chronic pain can lead to reductions in pain levels, depression, anxiety and disability, and improve work status (McCracken & Eccleston, 2003). Acceptance is an important component in learning how to cope with the challenges and difficulties in life. In support of this notion, there is some evidence to suggest that increased mindfulness, without acceptance, can lead to increases in negative emotions such as worry and anxiety. However, when acceptance is applied, greater outcomes are observed (Lundh, 2005).

4. 4. 3. 7 **Letting go**

Letting go involves both the identification of moments where our attention is not with the current moment, and the choice to drop whatever was on our mind in favour of refocusing on the present moment. Letting go is required in order for the other six principles of mindfulness to be fluidly applied in an ongoing manner. For example, letting go of judgements is required in order to apply a non-judgemental stance. We cannot be mindful without letting go. Jon Kabat-Zinn’s book *Full Catastrophe Living* provides a fuller exploration of all of these concepts (Kabat-Zinn, 1990). Together, these seven principles provide a guideline for improving awareness and connection with each and every moment of life. Later in this chapter, these principles will be explored in the context of insomnia.
4.5 Mindlessness

An alternative way of gaining an understanding of mindfulness is to examine its opposite, which can be referred to as ‘autopilot’ or ‘mindlessness’ (Langer, 1992). Mindlessness is “a state of mind characterized by an overreliance on categories and distinctions drawn in the past and in which the individual is context-dependent and, as such, is oblivious to novel (or simply alternative) aspects of the situation” (Langer, 1992, p. 289). In a state of mindlessness, we are not cognizant of the focus of attention.

As discussed in the context of beginner’s mind (4.4.3.3), the human brain has the capacity to acquire knowledge and commit it to procedural memory so that full attention is not always required to perform tasks. For example, we are able to concentrate on a memory while also driving a car. However, divided attention such as this requires the brain to delegate our total capacity for attention across more than one task, reducing its overall effectiveness (Duncan, 1980). The degree of distraction from one point of focus varies depending on the nature of the other. Although it is impressive that we are able to perform a complex task such as driving without full attention, this is not optimal and can lead to increased errors and reduced responses to environmental danger (Chen et al., 1996). On the other hand, sustained attention is associated with improved performance and decreased levels of arousal (Coull, 1998).

4.6 How is Mindfulness Increased?

Mindfulness is thought to be increased by both formal and informal practices. The aim of meditation, for instance, is to continually reinforce the present focus of attention in concert with the seven mindful attitudes discussed above. Formal mindfulness meditation practice can be passive or active. Meditation itself can also be informal, whereby the principles of mindfulness are applied to elements of everyday life. Passive and active
approaches to both formal and informal mindfulness practices will each be discussed in this section.

Formal mindfulness practices include exercises designed to increase present-focused awareness, decrease mindlessness, and increase acceptance and non-striving. Some examples of formal mindfulness meditations include breathing meditation or mindfulness of the breath, (which is aims to develop sustained attention), and body scanning (which involves moving attention and awareness through each part of the body.) The body scan is a technique that facilitates a greater flexibility of present-focused attention. Mindfulness can also be practiced formally by paying attention to present sensory experiences such as sounds or visual experiences. Mindfulness of emotions is a passive formal meditation technique whereby the meditator focuses on the physiological manifestations of emotions in order to ‘let go’ of the ‘story’ of the emotion (i.e., the collection of thoughts that are centred around the reason for the emotion). Formal meditations can also be active, such as mindful yoga and mindful walking. Typically, these are slow versions of these actions, designed to enhance the mind-body connection (Salmon, Lush, Jablonski, & Sephton, 2009). For example, mindful walking aims to slow down the walk to a rate of one step per 30 to 60 seconds (Kabat-Zinn, 1990).

Formal practices like these provide an opportunity to apply the principles of mindfulness. Meditations generally include instructions that assist the meditator in becoming aware of the tendency of the mind to drift to a thought, judgement, feeling or other distraction. When the mind does drift, the individual is instructed to bring attention back to the part of the body that is being focused on. Other principles are applied continuously, such as letting go of judgements and striving through developing trust and patience, practicing acceptance and developing self-awareness.

Informal mindfulness practice involves applying the principles of mindfulness to everyday life. Jon Kabat-Zinn explains that “informal practices are aimed at cultivating a
continuity of awareness in all activities of daily living” (Kabat-Zinn, 2003, p. 289) and Mindfulness Based Stress Reduction (MBSR) includes a component of informal mindfulness meditation as part of the intervention (Kabat-Zinn, 1990). This approach means that any present moment can be viewed as an opportunity to practice mindfulness. In his book You Are Here, Vietnamese Zen teacher Thich Naht Hanh explains that informal practice energises us. He argues this “is why you should practice walking, washing the dishes, watering the vegetables, and any other activity with mindfulness. When you practice, the seed of mindfulness is quite small, but if you cultivate it every day, it becomes bigger and stronger” (Hanh, 2010, p. 21). Essentially, informal practice involves reminding ourselves to pay attention throughout the day to what is happening in the present moment (Didonna, 2009).

This section has provided an explanation of what mindfulness is, along with how it is increased. It is now important to consider how it may be relevant to treating sleep disorders. The first avenue that provides a theoretical link between increasing mindfulness and reducing insomnia is the construct of stress.

4.7 Stress, Insomnia and Hyperarousal

Stress is a pervasive issue in modern society. In the short-term, the stress response has the potential to improve an individual’s reaction to the stressor by increasing alertness and the time available to act. However, as discussed in Chapter 2, continuous activation of the stress response can cause wear and tear on the body, referred to as allostatic load (McEwen, 1998; McEwen & Seeman, 1999). As such, stress can negatively impact psychological and physical health (Sharma & Rush, 2014). For example, stress has been linked to autoimmune disease, migraines, obesity, muscle pain, coronary heart disease and hypertension (Sharma & Rush, 2014).
Stress is an important consideration when reviewing the underpinnings of insomnia, as it has the potential to precipitate and perpetuate the condition, while insomnia itself can exacerbate stress (Kim, 2010). For example, exposure to stressful life events and cognitive intrusions have been found to be significant predictors of insomnia (Drake, Pillai, & Roth, 2014), with chronicity a moderator of the relationship (Pillai, Roth, Mullins, & Drake, 2014). Stress exposure has been shown to increase the odds of developing insomnia by 19% for every additional stressor (Pillai et al., 2014). The higher the level of stress during the day, the harder the parasympathetic nervous system must work in order to reach a state where sleep is likely to occur (Cano et al., 2008). This may be one of the reasons why it takes longer for a hyperaroused person to fall asleep.

Both physiological and cortical arousal interfere with sleep. Elevated functioning of the stress systems (HPA axis and the sympathetic nervous system) are positively correlated with sleep disturbance in chronic insomniacs, and are also active in the stress response (Vgontzas et al., 1998). In Chapter 1, the hyperarousal model of insomnia was introduced. This holds that people with insomnia often experience chronically elevated sympathetic arousal (hyperarousal), which interferes with the natural process of falling asleep (Bonnet & Arand, 1997a). Similarly, cortical arousal has been linked to sleep impairment. People with insomnia have been shown to have higher cortical arousal both throughout the day and during the transition to sleep. For example, Lamarche and colleagues (1997) found that people with insomnia had less alpha waves during the first part of the sleep onset period and did not show the dramatic decrease in alpha waves that typically characterises sleep. Furthermore, those with psychophysiological insomnia had reduced overall delta waves. This provides support for the notion that stress is a central component of insomnia.

Increased cognitive arousal is also seen in patients with insomnia. The two-level model of arousal devised by Ong and colleagues (2012) distinguishes primary arousal (the
cognitive activity directly related to sleep difficulty) from secondary arousal (how one relates to thoughts about sleep). Essentially, this model differentiates cognitive from metacognitive processes. In a theoretical paper, Lundh (2005) described ‘sleep interfering processes’ that affect the normal cognitive deactivation that is required to fall asleep. He proposed that mindfulness may be able to train individuals in skills that counter these sleep interfering processes, such as self-observation and acceptance of spontaneously occurring cognitive processes (Lundh, 2005).

Combining these two ideas, mindfulness training may be able to improve metacognitive processing in order to improve cognitive deactivation of primary cognitive processing. The target of treatment is the relationship with cognition, rather than the thoughts themselves (Ong et al., 2012), which is in turn likely to reduce overall (cognitive, cortical and physical) arousal. As indicated in Chapter 3, there is insufficient evidence that the most widely used non-pharmacological treatment for insomnia, CBT-I, can convincingly reduce the arousal component of insomnia; whereas there is substantial evidence to suggest that mindfulness-based therapies reduce arousal. If mindfulness is able to reduce arousal in the context of insomnia, it may provide a valuable treatment option. Another way of reducing hyperarousal is by addressing unhelpful automatic reactions by increasing insight via metacognition. This may provide an individual with awareness of problematic behaviours that may be perpetuating hyperarousal. Dillard-Wright and Spear (2011) presented a unique way of using mindfulness to understand chronic problems with stress, anxiety and panic through their theory of problematic loops.

### 4.8 Problematic Loops

Dillard-Wright and Spear (2011) propose that a series of problematic loops can occur as a result of mindlessness. Three are of particular interest to the development and
maintenance of insomnia. These are the stress-lethargy loop, the anxiety-fear loop, and the panic-control loop.

4.8.1 The Stress-lethargy Loop

The stress-lethargy loop describes a process by which energy is continuously depleted (Dillard-Wright & Spear, 2011). The loop occurs when, in a mindless state, a person strives to meet demands, resolve crises and abolish anxiety. Stress is then followed by periods of depleted energy or lethargy. Forced recuperation then occurs (i.e., it is not a conscious choice, but an autonomic reaction). Then, when energy returns, focus is immediately returned to eliminating stress. This process results in chronic oscillations between stress and lethargy.

The stress-lethargy loop has the potential to contribute to sleep problems by increasing sympathetic activity. When a person spends the majority of their time focusing on the source of stress (either engaged in activity or in ruminations about stress), their body produces increased levels of stress hormones. Ruminations about the source of the stress can even occur when the person is attempting to recover from the stress. For example, a stressed individual may be having a massage. However, while lying on the massage table, the person may cognitively rehearse details of a tense situation at work. This may reduce the effectiveness of the relaxation and even lead to increased stress.

Furthermore, people with insomnia are known to misattribute tiredness to sleep deficiency, even when it is caused by other factors (Ross & Olson, 1981). Therefore, in a state of mindlessness, a person may worry more about sleep (assuming that poor sleep is causing the lethargy) and react by focusing more on and trying harder to sleep. As discussed in Chapter 2, this is likely to exacerbate sleep problems via the ‘attention-intention-effort’ pathway (Espie et al., 2006). This is a simple error of attribution with major consequences, as it perpetuates hyperarousal and leads to the chronicity of the problem. Mindfulness-based
meditation may be able to improve awareness and break the loop, thereby providing a way to reduce stress, improve energy and increase sleep quality.

4.8.2 The Anxiety-fear Loop

The anxiety-fear loop describes a process by which we mindlessly react to negative experiences by focusing on preventing the situation from re-occurring due to fear of not coping (Dillard-Wright & Spear, 2011). This leads to oscillations between hesitation and restlessness. When in this cycle, an individual’s focus is divided between excessive attention towards information that may indicate the feared situation is possible and ruminations about the feared situation. In a sleep context, this might translate to excessive attention towards tiredness and ruminations about not falling asleep again and the catastrophe that may unfold as a result. Just as in the stress-lethargy loop, the anxiety-fear loop has the potential to lead to chronic overactivation of the sympathetic nervous system which may negatively influence sleep. Furthermore, the excessive attention and monitoring of sleep-related threats has been shown to exacerbate sleep problems (Semler & Harvey, 2004).

4.8.3 The Panic-control Loop

The panic-control loop describes another automatic reaction to situations that are incongruent with a desired experience. In a state of panic, a person in this loop is likely to react by attempting to control situations, people, their body (in the case of insomnia), or the environment (Dillard-Wright & Spear, 2011). This leads to fluctuations between feeling overwhelmed and frustrated, which is particularly likely if the problem is actually outside of control. Sleep is not within our control. Although we are able to influence some of the behaviours and situations that will allow us to be in a relaxed state when the body is ready for sleep, the process of falling asleep is autonomic.

The panic-control loop leads to increased effort, which is likely to increase arousal (Espie et al., 2006; Fogle & Dyal, 1983). It may also lead to increases in anxiety and
frustration, to which the person might react with further efforts towards control. Attempting to control something that is not within our control is often frustrating. This emotion is on the anger continuum and, like many emotions, increases the sympathetic nervous system response and is therefore likely to interfere with sleep. Control attempts thus have the potential to disrupt sleep further and result in a vicious cycle.

These three loops are examples of how mindlessness can lead to chronic stress and distress. They also highlight the importance of awareness and conscious decision making in the management of health, with respect to both the mind and the body. However, these loops also provide important avenues by which mindfulness interventions may interject and rectify the chronicity of many medical and psychological issues. This section has also presented an alternative way to conceptualise some elements of cognitive and behavioural issues that lead to insomnia.

4.9 Mindfulness and the Stress Response

It is accepted that mindfulness interventions are often associated with decreases in stress (Cahn & Polich, 2006; Grossman et al., 2004a). In fact, this relationship forms the name for the popular treatment of Mindfulness Based Stress Reduction (MBSR) (Kabat-Zinn, 1990). It has been noted that mindfulness training may lead to decreases in both experienced stress and measures of the stress response. One meta-analytic study found that MBSR was associated with a reduction in symptoms of stress in healthy subjects (Chiesa & Serretti, 2009), while another recent review found that 15 out of 17 studies showed a significant reduction in the stress of participants after training with MBSR (Sharma & Rush, 2014). Mindfulness has also been found to be associated with decreases in stress in individuals who were experiencing extremely stressful circumstances, such as cancer patients (Carlson, Speca, Patel, & Goodey, 2003).
Meditation has been found to positively influence the stress response via a number of pathways, which are discussed next, although not all studies have focused specifically on mindfulness meditation. For this review, the focus is on studies using mindfulness meditation. Some exceptions have been made, however, in cases where there was little or no evidence of research on mindfulness-based meditations, but where the finding is of particular interest to this research.

4.9.1 The Potential of Mindfulness to Reduce Stress

Brain areas that show changes as a result of meditation have been identified as playing a role in improving the stress-response. One group of researchers investigated the brains of long-term meditators using magnetic resonance imaging (MRI). Participants had learned and practiced concentrative meditation practices and open awareness meditations in the same Dzogchen tradition of Tibetan Buddhism for an average of 16.5 years. Compared with non-meditating controls, these long-term meditators were found to have increased grey matter density in brainstem regions such as the medulla oblongata (involved in relaying sensory inputs from the body, and in respiratory and cardiac control), locus coeruleus (which synthesises and releases norepinephrine), nucleus raphe pontis (releases serotonin) and the pontine tegmentum (involved in the initiation of REM sleep; (Vestergaard-Poulsen et al., 2009).

The norepinephrine (noradrenaline) system of the locus coeruleus is thought to modulate arousal by regulating the interplay between focused and flexible responses to environmental demands (Aston-Jones & Cohen, 2005), as well as mediating the stress response (Hoelzel et al., 2011a). Increased activity in other areas of the brain thought to be involved in arousal and autonomic control during mindfulness meditation have also been found. These areas include the pregenual anterior cingulate, the amygdala, the midbrain and the hypothalamus (Lazar et al., 2000). Together these results indicate that, over time,
meditation may lead to increased density of neural fibres in areas of the brain involved in the stress response. This may explain the parasympathetic effect of meditation.

There is substantial evidence to support the notion that meditation is associated with a decrease in sympathetic, and an increase in parasympathetic tone. This decrease has been detected across a range of measures of stress, such as cortisol reductions, decreased heart rate, decreased blood pressure, lowered breathing rate and decreased muscle tension (Krygier et al., 2013; Lazar et al., 2000; Takahashi et al., 2005; Tang et al., 2009). By increasing parasympathetic tone, the body can more effectively attenuate the stress response.

Meditation may also assist in the management of stress. Measurements of physiological response after stress exposure indicate that a group of meditators returned to baseline more quickly than non-meditators. Harinath and colleagues (2004) found that three months of yogic meditation was associated with significant decreases in systolic, diastolic and mean arterial pressure, indicating a shift towards parasympathetic dominance (Harinath et al., 2004). Earlier studies also found that meditators more rapidly returned to baseline heart rate and skin conductance after exposure to stressful film clips (Goleman & Schwartz, 1976). More recently, a study found that meditators did not exhibit frontal gamma induction in response to stressful film clips (Aftanas & Golosheynik, 2005).

As has previously been discussed, stress is a central component in the onset and maintenance of insomnia. The potential for meditation to aid in the reduction of stress and sympathetic activation, along with the improvements it affords in the management of stress, suggests that mindfulness meditation may provide an extremely valuable addition to non-drug treatment for insomnia.

### 4.9.2 Meditation and EEG

The brain contains billions of neurons that generate electrical impulses when they communicate with one another. Sensitive neurological recording equipment, such as an
electroencephalogram (EEG), has the ability to detect and record these electrical impulses, or ‘brainwaves’. Figure 4 displays an example of the four common bands of adult brain waves: beta (14–30 Hz), which is associated with focused mental activity; alpha (8–13 Hz), associated with relaxed alertness; theta (4–7 Hz), associated with light sleep or deep relaxation; and delta (< 3.5 Hz), which is associated with deep sleep (Norman & Hayward, 2005).

Figure 4. Examples of EEG for the four frequency bands beta, alpha, theta and delta. © Can Stock Photo Inc. Alila

Meditation (not specific to mindfulness meditation) is known to lead to a state of relaxation. As noted above, this may be due to the increase in parasympathetic activity and decrease in sympathetic activity. However, another physiological aspect that might provide further understanding of how meditation improves relaxation is the observation of differences in brainwaves during and after meditation. Research suggests that the training in meditation may provide the brain with a unique opportunity to change. Given that insomnia and
hyperarousal are associated with increased cortical arousal, meditation may provide a unique opportunity to positively impact on sleep in those with insomnia. Specific changes to brainwaves associated with meditation will now be discussed.

4.9.2.1 **Theta**

Theta power has been found to be more pronounced in advanced meditators (Cahn & Polich, 2006; Simpkins & Simpkins, 2012). In a study comparing concentrative meditation and mindfulness meditation, it was found that mindfulness meditation was associated with greater frontal theta activity than concentrative meditation (Lutz, Slagter, Dunne, & Davidson, 2008). Theta activity in the frontal area has been associated with relaxed attention (Inanaga, 1998), concentration and learning, (Laukka, Jarvilehto, Alexandrov, & Lindqvist, 1995), error detection and top-down processing (van Driel, Ridderinkhof, & Cohen, 2012), and maintenance of memory (Jensen & Tesche, 2002). Increases in theta power have also been associated with decreases of self-reported anxiety (Cahn & Polich, 2006).

4.9.2.2 **Alpha**

Meditation has also been shown to increase alpha power, which is known to be associated with passive awareness and relaxed attention, as well as being associated with subjective reports of wellbeing and comfort (Simpkins & Simpkins, 2012). Increased alpha power has been related to decreased blood flow in areas of the brain such as the frontal cortex (Cahn & Polich, 2006). Studies investigating the neurological benefits of meditation found increased alpha (8–13 Hz) waves during meditation (Lagopoulos et al., 2009) and at rest in meditators compared with a non-meditator control (Cahn & Polich, 2006). These findings support the notion that meditation has the potential to increase relaxed attention during meditation (state) and to increase our ability to attend calmly between meditations (trait).
4.9.2.3 *Sleep, Meditation and EEG*

Both sleep and meditation states have been known to influence an increase in theta power. However, it is interesting to note the increase in theta power has a contrasting impact on alpha power in a sleep state versus a meditative-state. In sleep, increases in theta power are associated with decreases in alpha power of up to 50%, whereas in meditative states, increased or stable alpha power has been observed. Furthermore, increases in overall cerebral blood flow during meditation have been reported. Conversely, during sleep, decreases in blood flow are typical (Cahn & Polich, 2006). This difference may be linked to consciousness. The neurological processes and theoretical models of consciousness are beyond the scope of this thesis. However, in very simplistic terms, sleep is experienced as increased relaxation with a lack of consciousness. Meditation is also experienced as increased relaxation. However, it is also associated with increased awareness and attention. Meditation may have the potential to be restorative to energy and therefore be important to the treatment of insomnia, given that improvement in energy may reduce symptoms of insomnia.

4.9.3 *Additional Benefits of Mindfulness*

4.9.3.1 *Mindfulness Meditation and Sustained Attention*

The improvement of sustained attention to the present moment is a central goal of mindfulness. Neurological findings support the notion that meditation may have the potential to improve attention. For example, meditation has been associated with activation of neural structures involved in attention, such as the frontal and parietal cortex (Lazar et al., 2000). Increased activity in the anterior cingulate cortex (ACC) during meditation practice has also been found (Cahn & Polich, 2006). The ACC facilitates executive attention by detecting streams of information that are incompatible with the focus of attention. The ACC then responds by implementing top-down regulation to resolve the conflict (Hoelzel et al., 2011b). As discussed earlier, frontal theta activity has been observed to increase during meditation.
This may be a reflection of ACC activity (Hoelzel et al., 2011b). Improvements in attention regulation are indicative of improvements in mindfulness and this may serve as a pathway to reducing arousal and improving awareness of autopilot reactions or safety behaviours.

4.9.3.2 Mindfulness Meditation and Emotion Regulation

Mindfulness meditation has been associated with changes in cortical function in areas involved in awareness of the mind and body and emotional regulation. One key area of the brain associated with meditation is the insula. The insula is associated with introspective awareness and empathy. Studies have found increased grey matter density (Hoelzel et al., 2008) and greater cortical thickness of the insula in meditators compared with non-meditators (Lazar et al., 2005). The insula may also play a role in body awareness. It has been postulated that increases in activity of the insula are associated with increased bottom-up processing, meaning that meditation may increase awareness of the actual sensation of the stimulus or experience. With respect to sleep, meditation may assist a person to become more aware of physiological indications of sleepiness or tiredness, without the overlaying emotional reaction to these physical sensation. This leads to the opportunity to be more responsive to the body, rather than reactive or controlling, which is common in the aforementioned problematic loops (Dillard-Wright & Spear, 2011)

Emotional regulation can be distinguished as either cognitive or behavioural regulation (Ochsner & Gross, 2005). Attention regulation has the potential to influence emotional regulation. Selective inattention, reappraisal or cognitive change require attention (Ochsner & Gross, 2005). Mindfulness meditation has been linked with greater emotional regulation, and specifically with improved prefrontal control over amygdala responses (Hoelzel et al., 2011b; Lazar et al., 2005). Similarly, increased grey matter density in meditators has been found in both the right (Hoelzel et al., 2008) and left hippocampus (Hoelzel et al., 2011a), which is involved in emotion regulation. In contrast, individuals with
major depression (Sheline, 2000) and PTSD (Kasai et al., 2008) have been shown to have decreased hippocampal density. This information indicates that meditation may improve the brain’s ability to regulate the fear response.

Studies investigating brain structure in experienced meditators compared with non-meditators have found significant differences in other areas involved in emotion regulation such as the cerebellum. Hoelzel and colleagues (2011) reported increases in density of the cerebellum in meditators compared with non-meditators (Hoelzel et al., 2011a). The cerebellum is responsible for sensory perception, coordination and motor control, as well as cognitive and affective regulation.

4.9.3.3 **Mindfulness Meditation and Emotional Desensitisation**

There are some similarities in the way both exposure therapy and mindfulness meditation reprogram the brain in the face of stressful or anxiety-producing situations, leading to desensitisation. Exposure therapy aims to gradually increase exposure to the feared situation while simultaneously applying relaxation. Over a period of exposure, the stress response is deactivated because the association of situation with anxiety is gradually replaced with a new association where situation is experienced in a state of relaxation.

Mindfulness likewise increases internal exposure to difficult emotions (e.g. fear), and provides the meditator with opportunities to observe the non-threatening impact of strong emotions. This affords an opportunity to acquire a new sense of safety in the presence of the feared situation or stimuli (Hoelzel et al., 2011b). In the context of insomnia, mindfulness meditation may be able to provide an opportunity for the individual to desensitise to sleep-related anxiety. The increased awareness and acceptance of the emotional experiences associated with sleeplessness can also provide insight into the urges towards safety behaviours and maladaptive behaviours.
4.9.3.4 Mindfulness Meditation and the Mind-Body Connection

Meditation has been suggested to improve the mind-body connection. The temporoparietal junction (TPJ) has been found to be connected with awareness of the body, and there is some research to suggest it may also have greater levels of grey matter density in meditators compared with non-meditators (Hoelzel et al., 2011a). The TPJ has been identified as an essential component of a conscious experience of the self, mediating the spatial unity of self and body. Conversely, impairment in functioning of the TPJ is associated with a pathological experience of the self, such as in out-of-body experiences (Hoelzel et al., 2011a).

Awareness of the body is required in order to respond to physical sensations and cues in an adaptive way. For example, it is important to differentiate sleepiness and tiredness. These two physical experiences are indications of different physical needs. Sleepiness is linked with circadian and homeostatic drive to sleep (Borbely, 1982). Tiredness, on the other hand, has a range of possible causes, including medical, psychological or behavioural ones (Lamassiaude-Peyramaure, 2009). A lack of awareness can lead to reactions (e.g. maladaptive behaviours such as increasing caffeine intake when tired), missing cues of sleepiness and continuing a task or responding to tiredness as if it was sleepiness. As discussed in the cognitive model of insomnia, reactions, or safety behaviours, have the potential to perpetuate sleep disturbance.

4.9.3.5 Mindfulness Meditation May Increase Melatonin Production

Meditation has also been shown to have a positive effect on the circadian and homeostatic drive by increasing melatonin production. Melatonin, a hormone produced by the pineal gland, has the action of reducing core temperature, which often leads to lowered physiological arousal. It also contributes to circadian rhythms (Dawson & Encel, 1993; Dollins, Zhdanova, Wurtman, Lynch, & Deng, 1994). Harinath and colleagues found that
three months of yogic meditation was associated with increases in plasma melatonin levels
(Harinath et al., 2004). This change was also positively correlated with wellbeing. Melatonin
levels in participants were also found to be significantly higher on nights after meditation
practice (Harinath et al., 2004).

4.9.4 Summary

In summary, stress is closely related to insomnia. It has the potential to initiate the
onset of insomnia, as well as to perpetuate the problem. Sleep disturbance can also be a
stressful experience in itself. So far, this chapter has discussed the ways in which mindfulness
may potentially reduce hyperarousal, via improvements in the stress response. This section
has provided theoretical links, along with supporting evidence, for the use of mindfulness in
the treatment for insomnia. The question of mindfulness and personality will be addressed in
the next section.

4.10 Mindfulness and Personality

Examining the relationship between mindfulness and personality traits may provide
an avenue to predict which type of person may or may not respond well to mindfulness
treatment. The aim of this section is to explore the current literature on the relationship
between mindfulness and personality, which is commonly assessed using the big five traits of
neuroticism, extraversion, conscientiousness, agreeableness and openness to experience
(Costa & McCrae, 1992). These five factors, and their relationship with mindfulness, will
now be discussed.

Neurotic individuals tend to be moody, insecure, anxious and self-conscious,
commonly describing low levels of wellbeing (Costa Jr, 1991). Mindful individuals, on the
other hand, tend to be effective in the process of experiencing negative emotional states
without attempting to push them away, and score highly on psychological wellbeing.
measures (Barrick, Mount, & Judge, 2001; Brown & Ryan, 2003). Results of meta-analytic studies have confirmed a strong negative relationship between mindfulness and neuroticism (Giluk, 2009). A strong positive correlation has also been found between negative affect and neuroticism. Higher levels of neurotic symptoms are related to higher experiences of negative affect. A neurotic individual is thereby highly susceptible to psychological distress, which is likely to impact sleep. They are, therefore, of particular interest in the current study. It is not known if the practice of mindfulness may reduce symptoms of neuroticism, nor if neurotic traits interfere with the process of being mindful (Brown & Ryan, 2003; Giluk, 2009). This research will investigate treatment response based on personality and will attempt to shed light on this important topic.

Extraverts tend to be social, outgoing, talkative and assertive (Barrick et al., 2001). Although both extraversion and mindfulness relate positively to subjective wellbeing (Giluk, 2009), extraversion is also related to a desire for activity, excitement and stimulation (McCrae & Costa, 2003) which opposes some of the principals of mindfulness (such as non-striving). The nature of slowing down, and paying attention to the present moment is likely to provide a challenge to the extravert. Mindfulness and extraversion have been found to have a weak positive correlation (Giluk, 2009).

Being open to experience describes individuals with traits of curiosity, imagination, broad-mindedness and unconventionality (Barrick et al., 2001). People who score highly on openness to experience tend to be receptive to experience, including their own inner experience and emotions, and are curious about both their inner and outer worlds (Costa & McCrae, 1992). These traits may lead to mindfulness. Furthermore, the broad-minded individual may be receptive to the idea of mindfulness and its congruence with their personality may mean that they find it easier to develop the practice. As such, many of the studies investigating personality and mindfulness have included openness to experience in
their analysis. Interestingly, however, meta-analytic studies have concluded that there is only a weak positive correlation between mindfulness and openness to experience (Giluk, 2009).

People who score highly on agreeableness tend to be good-natured, cooperative, caring, supportive and concerned for others (Costa & McCrae, 1992). Kabat-Zinn (1990) explains that a central feature of mindfulness is the development of empathy and compassion towards oneself, as well as to others. The concept of trust is also central to both agreeableness and mindfulness. Agreeable individuals trust and believe that others are honest and well intentioned (McCrae & Costa, 2003). Trust in the self and others is core principal of mindfulness (Kabat-Zinn, 1990). Agreeableness and mindfulness have been found to have a positive relationship of moderate strength (Giluk, 2009).

Conscientious individuals are responsible and dependable. They abide by rules and are focused on achievement (Barrick et al., 2001). Costa and McCrae (1992) describe one of the overarching components of conscientiousness as self-discipline, which is essential in the development and maintenance of mindfulness. Furthermore, mindfulness and conscientiousness both include a focus on responding to situations deliberately, not impulsively (Giluk, 2009). Despite these similarities, there is little research that has explored the relationship between these two constructs. One recent study, however, found conscientiousness to have a strong positive relationship with mindfulness (Giluk, 2009). Furthermore, it is expected that the traits of conscientiousness may make it more likely that a person will benefit from a mindfulness and behaviour therapy intervention, as they are more likely to commit to doing homework and overcome challenges that might arise in implementing difficult parts of the program, such as sleep consolidation. To date, there has been no exploration of how these factors may influence response to MBT-I.

The research discussed here shows that relationships between aspects of personality and mindfulness have been found. The strongest relationships are between mindfulness and
conscientiousness, and mindfulness and neuroticism. These results have influenced the development of some of the secondary analysis of the current study, which aims to explore the overarching question of who is likely to benefit from mindfulness and behaviour therapy for insomnia. These research questions and attendant hypotheses will be discussed in detail in Chapter 5.

4.11 Mindfulness and Mood

Regular mindfulness meditation may be able to improve mood symptoms by reducing the tendency to react negatively to mental and physical states with ruminative thought or maladaptive behaviours (Broderick, 2005). By nature, mindfulness training involves repeated return of conscious awareness to the breath or the immediate present which interrupts the thought patterns that initiate and maintain disturbed mood states (Broderick, 2005; Raes, Dewulf, Van Heeringen, & Williams, 2009). Research has indicated that the ability to regulate mood explains part of the negative correlation between mindfulness and depression (Jimenez, Niles, & Park, 2010).

Interestingly, there is relatively little research investigating the relationship between mindfulness and mood or the ability for mindfulness interventions to improve mood. The majority of these studies have focused on changes in mood disturbance and have used assessments that aim to identify mood disorders or symptoms of psychopathology, such as the Positive and Negative Affect Scale (PANAS), the Symptom Checklist (SCL-90), the State-Trait Anxiety Inventory (STAI), and the Beck Depression Inventory (BDI). A review of the literature concluded that the benefits of mindfulness on mood and anxiety disorders are equivocal (Toneatto & Nguyen, 2007).

The Profile of Mood States (POMS) assesses mood in a range of areas (anger, confusion, depression, fatigue, tension, vigour) and is useful in assessing mood in clinical
disorders, as well as in individuals without mood disorders. Two studies relevant to the current body of research explored the impact of mindfulness on mood using the POMS. The findings of both studies suggest that mindfulness may be able to improve mood. Results of the first study indicated a MBSR intervention was responsible for a 65% reduction in overall mood disturbance in a group of cancer patients (Speca, Carlson, Goodey, & Angen, 2000). This change was also related to the amount of time spent meditating, with minutes spent meditating per day explaining 15.5% of the variance in mood improvement (Speca et al., 2000). These results were maintained at a six month, follow-up assessment (Carlson, Ursuliak, Goodey, Angen, & Speca, 2001). However, a subsequent study by the same research team did not find any significant reductions in mood in different group of cancer patients (Carlson et al., 2003). The lack of change in mood may be explained by a floor effect, as this patient group was assessed to have quite low levels of pre-treatment mood disturbance. A more recent study detected a reduction in overall mood disturbance, as well as significant decreases in four subscales (tension, depression, fatigue and confusion), in a group of undergraduate students (Zeidan, Johnson, Gordon, & Goolkasian, 2010).

To date, no studies have investigated mindfulness and mood in a group of people with insomnia, even though mood disorders commonly co-occur with insomnia (Becker, 2006; Carney, Harris, Falco, & Edinger, 2013; Kloss & Szuba, 2003; Peterson, Rumble, & Benca, 2008). People with insomnia have been found to have decreased mood, particularly in the morning (Levitt et al., 2004). Furthermore, it has been proposed that subsyndromal levels of mood disturbance, associated with dysfunctional beliefs about sleep, may negatively influence sleep perception, resulting in exaggerated sleep complaints (Edinger et al., 2000).

In summary, there is some evidence to indicate that mindfulness may have a positive impact on subjective mood, which warrants further research. Given the relationship between mood and insomnia it would be interesting to find out if MBSR has a positive impact on
mood in a group of people with chronic insomnia. This would be beneficial, considering the impact of insomnia on mood and the impact of mood on sleep perception.

4.12 Measurement of Mindfulness

Mindfulness is a concept has proven difficult to measure. At this stage, there are no objective measures of mindfulness. To date, the majority of studies examining mindfulness have evaluated mindfulness based on self-report questionnaires. However, there are inherent problems with this mode of measuring mindfulness. Specifically, if someone is not mindful, do they know they are not mindful? It is possible that people who are low on mindfulness may actually report high levels of mindfulness.

Another problem with self-report measurements in pre-post studies in general occurs when there is a false negative outcome. For example, once someone is trained in mindfulness, they become more aware of mindlessness. Therefore, they may actually report lower levels of mindfulness following a mindfulness treatment, simply because they understand the concept to a greater degree and are able to identify more moments in life when they are not paying attention to their present moment.

Despite these issues, there are a range of measurement tools available to assess mindfulness. During the development stage of the current study, there was some difficulty in selecting the best tool to assist in the measurement of mindfulness. Chapter 6 includes a review of the current measures of mindfulness.

4.13 Efficacy of Mindfulness Interventions

When considering if mindfulness is an appropriate treatment strategy for insomnia, it is important to consider the effect sizes that have been produced after applying mindfulness to other, similar problem areas. Two areas that are useful to consider are anxiety and chronic
pain. Anxiety, by its nature, has many similarities to insomnia. Most important of these is the concept of arousal, as anxiety is often (if not always) associated with chronic hyperarousal. Chronic pain also overlaps with insomnia. The chronicity of the conditions is one commonality. There are also similarities in the resistance patients have in accepting the condition, which often leads to attempts to control or manage with maladaptive strategies such as dependence on medication. Results of studies applying mindfulness to treat anxiety and pain are therefore useful to evaluate in order to generate potential expectations of what mindfulness may be able to achieve when applied to insomnia. Meta-analytic studies evaluating mindfulness as a treatment have provided evidence for the efficacy of mindfulness interventions across a range of problem areas. One meta-analysis revealed that mindfulness interventions produced effect sizes ranging from moderate to large. Outcomes from this study can be found in Table 2 (Baer, 2003).
Table 2

*Effect sizes of mindfulness interventions across a range of disorders from Baer (2003)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean Effect Size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>By research design</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre–post</td>
<td>8</td>
<td>0.71</td>
</tr>
<tr>
<td>Between group</td>
<td>10</td>
<td>0.69</td>
</tr>
<tr>
<td><strong>By population</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic pain</td>
<td>4</td>
<td>0.37</td>
</tr>
<tr>
<td>Psychiatric Axis 1 (anxiety, depression)</td>
<td>4</td>
<td>0.96</td>
</tr>
<tr>
<td>Medical (fibromyalgia, cancer, psoriasis)</td>
<td>4</td>
<td>0.55</td>
</tr>
<tr>
<td>Nonclinical (medical students, healthy volunteers)</td>
<td>4</td>
<td>0.92</td>
</tr>
<tr>
<td><strong>By outcome measure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>17</td>
<td>0.31</td>
</tr>
<tr>
<td>Anxiety</td>
<td>8</td>
<td>0.70</td>
</tr>
<tr>
<td>Depression</td>
<td>5</td>
<td>0.86</td>
</tr>
<tr>
<td>Medical symptoms (self-report)</td>
<td>11</td>
<td>0.44</td>
</tr>
<tr>
<td>Global psychological</td>
<td>18</td>
<td>0.64</td>
</tr>
<tr>
<td>Medical symptoms (objective)</td>
<td>2</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Other meta-analytic studies have found similar results. For example, a more recent analysis of mindfulness in the treatment of anxiety and depression found that interventions yielded moderate effect sizes in the general population (Hedges’ $g = 0.58$ for mood symptoms and Hedges’ $g = 0.63$ for anxiety). Large effect sizes were found in anxious and depressed populations (Hedges’ $g = 0.95$ for mood symptoms and Hedges’ $g = 0.63$ for anxiety; (Hofmann, Sawyer, Witt, & Oh, 2010). Mindfulness has also been determined to be effective in reducing relapse in major depression (Piet & Hougaard, 2011). Mindfulness-based therapy was found to be effective in reducing anxiety, depression and stress in a review of 209 studies ($n = 12,145$) with moderate effect sizes, that did not differ from those obtained using traditional CBT or behavioural therapies, or pharmacological treatments (Khoury et al., 2013). There was one review that investigated the literature on mindfulness-based therapy and insomnia, however, this study investigated early research in the field, and is therefore
Chapter 5 presents a detailed review of the literature using mindfulness-based therapy for insomnia.

This research shows MBSR can be associated with clinically significant improvements across a wide range of psychological and physiological conditions. Specifically relevant to the current study are the consistent moderate to large effect sizes found with MBSR in anxiety and chronic pain. These results provide further evidence that MBSR may be an effective treatment option for insomnia.

4.14 Conclusion

This chapter has provided a definition of mindfulness as the “self-regulation of attention, which involves sustained attention, attention switching, and the inhibition of elaborative processing” (Bishop et al., 2004). It has presented summary of the research surrounding what mindfulness is and the ways in which mindfulness may be important with respect to insomnia, and has included a discussion of the mechanisms by which mindfulness may improve functioning. Mindfulness and aspects of individual experience relevant to sleeplessness (such as stress, personality and mood) were also discussed. Finally, this chapter introduced a discussion about the measurement of mindfulness and efficacy of mindfulness interventions that will be elaborated on in Chapters 5 and 6.
CHAPTER 5: Treating Insomnia with Mindfulness

5.1 Introduction

The second and third chapters of this thesis focused on the theoretical models, diagnosis and current treatment of insomnia. Chapter 4 provided a detailed description of mindfulness, including an outline of what mindfulness is and its clinical application. Based on this background literature, it was concluded that there is evidence that mindfulness may be a viable and effective treatment for insomnia. The aim of Chapter 5 is to present and evaluate the empirical research focused on the treatment of insomnia using mindfulness-based therapies.

5.2 Differences in Study Design

5.2.1 Uncontrolled and Controlled

Research examining the benefit of MBSR on insomnia before 2012 consisted largely of uncontrolled pilot studies that compared data collected in a single group before and after treatment (Britton et al., 2010a; Carlson & Garland, 2005; Gross et al., 2009; Heidenreich et al., 2006; Ong et al., 2008b). This was appropriate, given the stage of research, as it would be premature to move straight to large-scale randomised controlled trials before sufficient evidence had indicated that the treatment may be clinically effective (Rounsaville, Carroll, & Onken, 2001). As support for the treatment has mounted, several randomised control trials have been published in the past two years (Andersen et al., 2013; Cukrowicz et al., 2006; Garland et al., 2014). These studies have all involved different comparison groups.

Andersen and colleagues (2013) investigated MBSR compared with a control arm of routine, self-directed, follow-up in a group of cancer outpatients. The control group was described as “treatment as usual” (Andersen et al., 2013, p. 338), however, there was no
information about what this entailed. The next randomised-controlled trial focused on comparing MBSR with CBT-I, again using a sample of cancer outpatients (Garland et al., 2014). Ong and colleagues (2014) compared MBT-I and MBSR with a self-monitoring control-arm. The differences in these study designs enabled a variety of research questions to be tested regarding the effectiveness of mindfulness as a treatment for insomnia. The outcomes of these studies are discussed later in this chapter.

5.2.2 Target Population

A large proportion of research investigating mindfulness-based therapy and insomnia has focused on sleep problems in the context of other psychological or medical conditions where insomnia was secondary or occurred as a comorbid condition, for example with cancer (Andersen et al., 2013; Carlson & Garland, 2005; Garland, Campbell, Samuels, & Carlson, 2013; Nakamura, Lipschitz, Kuhn, Kinney, & Donaldson, 2013), substance abuse (Bootzin & Stevens, 2005; Britton et al., 2010a), depression (Britton, Haynes, Fridel, & Bootzin, 2010b, 2012), anxiety (Yook et al., 2008), a range of mental health diagnoses (Heidenreich et al., 2006), hot flushes (Carmody et al., 2011) and transplant patients (Gross et al., 2009).

When research is conducted on insomnia populations with a comorbid condition, it is difficult to ascertain the direct impact of mindfulness on insomnia. Another weakness of a specific population is the reduced generalisability of outcomes (Creswell, 2013). However, the array of more complicated populations may also provide support for clinical effectiveness of mindfulness in a range of circumstances. The combination of insomnia and comorbid medical or psychological conditions is likely to lead to a wider array of symptoms or increased symptom severity. Therefore, type II errors may be more likely to occur when studying comorbid populations. On the other hand, if treatment is effective in comorbid conditions, it provides support for the use of mindfulness in a wide range of sleep disorders, representative of the population of insomnia sufferers (McCrae & Lichstein, 2001).
Research has also focused on the direct impact of mindfulness on insomnia. A proportion of this research has focused on insomnia symptoms without the requirement of formal diagnoses on insomnia (Cincotta et al., 2011; Gross et al., 2009), whereas other studies have focused on chronic insomnia (Cincotta et al., 2011; Gross et al., 2011; Heidenreich et al., 2006; Ong et al., 2014; Ong, Shapiro, & Manber, 2008a; Ong et al., 2008b; Ong et al., 2009). Studies that have focused on symptoms of disturbed sleep often include samples with a low pre-treatment severity of sleep problems (e.g. Andersen et al., 2013). Low pre-treatment symptom severity can contribute to the likelihood of non-significant effect sizes and change scores. However, it may be useful to conceptualise these presenting complaints as prodromal insomnia symptoms. If a mindfulness intervention can lead to decreases in sleep disturbance from a level of pre-clinical sleep disturbance to ‘normal’, it may prevent symptoms of insomnia becoming a chronic sleep condition. It is valuable research therefore, however, less emphasis should be given to the effect sizes reported in these research designs.

5.2.3 **Experience of Facilitators**

Some researchers in the field have placed particular emphasis on the experience of facilitators. As such, they have conducted research using highly experienced facilitators who have practiced meditation for many years and have formal qualifications in mindfulness (e.g., Cincotta et al., 2011). The advantages of using facilitators with high levels of experience is that the treatment is more likely to be effectively delivered. On the other hand, high levels of experience are less accessible. They are often more costly and may not be able to be replicated in routine clinical practice. Treatment that is administered by qualified facilitators (e.g., psychologists) with moderate personal experience with meditation and knowledge about mindfulness, rather than that administered by highly experienced facilitators, is more accessible and is likely to come at more affordable cost.
5.2.4 Intervention Differences

The type of mindfulness intervention has varied across research studies, with three significant ‘brands’ of mindfulness emerging as contenders in the treatment of insomnia. Mindfulness has been delivered as a standard Mindfulness Based Stress Reduction (MBSR) treatment (Andersen et al., 2013; Carlson & Garland, 2005; Cincotta et al., 2011; Gross et al., 2011; Gross et al., 2009), a standard Mindfulness Based Cognitive Therapy (MBCT) intervention (Britton et al., 2012; Heidenreich et al., 2006; Ree & Craigie, 2007) and MBSR combined with behaviour therapy for insomnia, called Mindfulness Based Therapy for Insomnia (MBT-I) (Bootzin & Stevens, 2005; Ong et al., 2014; Ong et al., 2008b).

Theoretically, mindfulness interventions do not address aspects known to perpetuate insomnia. For example, it is known that high caffeine intake can contribute to increased wakefulness at night. Mindfulness is unlikely to address this behaviour directly. Therefore, the addition of behaviour therapy is warranted. However, the disadvantage of combining behavioural treatment components with mindfulness treatment is that it makes it difficult to ascertain which component of the treatment is contributing to outcomes. Recently, in a randomised control trial, Ong and colleagues (2014) found that MBT-I was marginally superior for improving subjective sleep parameters such as total wake time and total sleep time when compared with MBSR. On many other outcome measures, MBT-I and MBSR did not differ significantly from one another, indicating that the behavioural component of treatment had the largest impact on total wake time and total sleep time. Both treatments were significantly superior to a self-monitoring control arm (Ong et al., 2014).

As such, there is currently insufficient research to determine which of the three mindfulness-based interventions (MBSR, MBCT or MBT-I) is superior for the treatment of sleep. At this stage of research, it is beneficial to continue the investigation of all three options until superiority is established. The current study utilised MBT-I. The rationale for
this decision was that it has some preliminary indications of superiority with respect to sleep outcomes (Ong et al., 2014), and that it addresses all potential causative factors identified in the models of insomnia presented in the first chapter.

5.2.5 **Treatment Length**

The length of treatment is another point of difference in study designs in research on mindfulness as an intervention for insomnia. Treatment length in the studies varied between six weeks (Bootzin & Stevens, 2005; Ong et al., 2008b) and eight weeks (Andersen et al., 2013; Carlson & Garland, 2005; Gross et al., 2009; Ong et al., 2014). There have been no interventions that have been outside these timeframes. There is insufficient data at present to establish if one treatment length is superior. Differences in the intervention content and length make it difficult to directly compare the outcomes of each trial, so it is important that all treatment options continue to be investigated unless there are clear adverse consequences or evidence of vast superiority of one of these interventions. The findings of each study will enhance understanding of the potential relationship between mindfulness and sleep.

The current study utilised the six-week intervention established by Ong and colleagues (2008). There were several reasons for this decision. There are some advantages in a six-week treatment. First, it may be easier for those with insomnia to commit to a six-week treatment length, as the time commitment is smaller. Second, two fewer sessions make it more cost effective, and third, it fits with the current model of treatment sessions as set out by the Australian Medicare Scheme known as the Mental Health Care Plan. This model requires individuals to see a general practitioner for a referral to a psychologist. After six sessions with the psychologist, the progress of individuals must be reviewed by their general medical practitioner before additional sessions can be funded. Limiting groups to six sessions reduces the cost to the patient as well as the public health system by eliminating the necessity of another visit to the doctor.
Alongside these financial and accessibility advantages, it is also beneficial to replicate treatment in a different setting before concluding that the length of treatment needs to be longer. Ong and colleagues developed a six week protocol of MBT-I (Ong et al., 2008b) and, in a later study, the treatment protocol was amended from six to eight sessions (Ong et al., 2014). There is some evidence to suggest that treatment gains continue after treatment has come to a close (Gross et al., 2009; Ong et al., 2014). Further, there is evidence that suggests that self-reported sleep benefits increase with the amount of meditation reported (Bootzin & Stevens, 2005). Therefore, it is possible that it takes some time for meditation to influence sleep. The two additional sessions may produce larger effect sizes because the follow-up is two weeks later, and not necessarily because of the content delivered in the two additional sessions. These points are speculative, and further research may be able to identify the ideal intervention length.

5.2.6 Follow-up Periods

In treatment development studies, the timing of assessments is important. The way data is collected can determine the types of hypotheses and research questions that can be explored. A primary expectation is that there are at least two time points (usually prior to and immediately following intervention). If there is change in outcome measures between these time points, it can be assumed that whatever happened between those two time points (e.g., the intervention) was responsible for the change. However, in a single-group design, external factors can influence the dependent variable, and therefore influence the results. Because of this, interpretation of results must not exclude the possibility of experimental error, particularly a type I error. Most studies investigating the impact of mindfulness on insomnia have used simple pre-post design analyses (e.g., Carlson & Garland, 2005; Cincotta et al., 2011; Heidenreich et al., 2006). Other studies, however, have used follow-up time periods of varying lengths. Gross and colleagues (2009) followed-up their participants at three months
and six months, Andersen and colleagues (2013) reported follow-up information at six and twelve months, and Ong and colleagues (2009) reported on follow-up data after twelve months.

The advantage of follow-up data is that it enables the possibility of monitoring the benefits of treatment over time. It also allows for the investigation of treatment maintenance and potential post-treatment improvement. It is commonly reported that medication assists with the management of the symptoms of insomnia while the drug is active. However, these benefits cease to have effect once the medication is discontinued (Jacobs et al., 2004). Therefore, if gains from mindfulness are maintained, or increased, following treatment, it may provide support for its use and perhaps indicate superiority in the treatment of chronic insomnia.

5.2.7 Outcome Measures

The majority of the studies have used a self-report questionnaire as the primary outcome measure (e.g., the Insomnia Severity Index or the Pittsburgh Sleep Quality Inventory). Some earlier studies have utilised self-report questionnaires only (e.g., Carlson & Garland, 2005; Gross et al., 2009), whereas others have used them in combination with more specific sleep measures, such as a sleep diary (Garland et al., 2014; Ong et al., 2008b). Table 3 contains a list of commonly used sleep diary abbreviations. Sleep diaries are useful for providing specific and continuous measures of sleep. This is beneficial for investigating patterns of change.
Table 3

Sleep diary abbreviations

<table>
<thead>
<tr>
<th>Sleep Parameter</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sleep Time</td>
<td>TST</td>
</tr>
<tr>
<td>Sleep Onset Latency</td>
<td>SOL</td>
</tr>
<tr>
<td>Wake After Sleep Onset</td>
<td>WASO</td>
</tr>
<tr>
<td>Total Wake Time</td>
<td>TWT</td>
</tr>
<tr>
<td>Number of Awakenings</td>
<td>NWAK</td>
</tr>
</tbody>
</table>

Some studies have also included objective measurements of sleep, such as actigraphy (Cincotta et al., 2011; Garland et al., 2014; Gross et al., 2011; Ong et al., 2014) and polysomnography (Britton et al., 2010b, 2012; Ong et al., 2014). The addition of objective sleep measurements is advantageous, as it is known that subjective sleep does not always match objective measures of sleep. In cases of insomnia, it is more common that individuals underestimate their sleep and overestimate wakefulness at night, than those in the general population (Bonnet & Arand, 1997b; Harvey & Tang, 2012). The addition of an objective measurement makes it possible to compare objective and subjective sleep measurements, and investigate if change happens across both objective and subjective sleep outcomes. Specific objective and subjective sleep outcomes following mindfulness interventions will be discussed below.

5.3 A Review of the Current Literature Relating to the Use of Mindfulness as a Treatment for Insomnia

The findings for different outcome measures will be reviewed for the most commonly reported outcome measures, along with a discussion of other notable outcomes, in the sections that follow.
5.3.1 Insomnia Severity

Insomnia severity is commonly assessed in research and clinical practice with the use of the Insomnia Severity Index (ISI), a 7-item self-report questionnaire designed to assess the severity, impact and nature of insomnia (Bastien, Vallieres, & Morin, 2001; Morin, Belleville, Bélanger, & Ivers, 2011a). The ISI has good validity and reliability (Bastien et al., 2001). Scores range from 0 to 28, representing the following categories of severity: 0–7 = no problem, 8–14 sub-threshold insomnia, 15–21 = moderate insomnia, 22–28 = severe insomnia. A clinical cut-off of 10 has been used by some with this index (Morin et al., 2011a). In a clinical sample, a change score of -8.4 points (95% CI: -7.1, -9.4) is associated with moderate improvement (Morin, Belleville, Bélanger, & Ivers, 2011b).

Several studies investigating the impact of mindfulness on sleep have utilised the ISI as an outcome measure, with the overall pattern of change supporting a reduction in insomnia severity following mindfulness interventions. A significant reduction in insomnia severity was found ($M_{\text{pre}} = 10.22$ to $M_{\text{post}} = 5.34$, $d = -0.84$) following the six week intervention of MBCT in adults with subclinical to mild insomnia symptoms (Ree & Craigie, 2007). Ong and colleagues (2008) found a significant reduction in the ISI following a MBT-I intervention ($M_{\text{pre}} = 14.9$ to $M_{\text{post}} = 9.57$, $d = -1.32$). In this case, 87% of the sample no longer met the inclusion criteria for insomnia of an ISI score greater than 10. Treatment gains were largely maintained at six and twelve month follow-up (Ong et al., 2009). A small but significant reduction in ISI was found in a large pilot study investigating the effectiveness of MBSR on insomnia symptoms from $M_{\text{pre}} = 11.07$ to $M_{\text{post}} = 9.16$, $d = 0.38$ (Cincotta et al., 2011).

Although none of these changes were associated with a change score of -8.6, it is important to consider that all samples had low pre-treatment levels of insomnia severity. Cincotta and colleagues reported that those with higher pre-treatment insomnia severity experienced more
dramatic reductions in symptoms (Cincotta et al., 2011). For example, those who fell in the moderate clinical insomnia category reduced by a mean of 10.

In a randomised controlled trial comparing MBSR with pharmacotherapy, Gross and colleagues (2011) found a significant reduction of ISI change = -6.89 ($d = -2.03$) following an eight week MBSR intervention. This outcome improved further at a five-month follow-up (ISI change = -8.06, $d = -2.38$). However, the magnitude of change was smaller than that found with the pharmacotherapy group who took eszopiclone for eight weeks and then “as needed” for the follow-up period (Gross et al., 2011, p. 79). In a randomised controlled trial investigating the difference between CBT-I and MBSR, there was an immediate superiority of CBT-I following treatment, however, at a five month follow-up, MBSR was found to be non-inferior to CBT-I (Garland et al., 2014). Another study found a significant reduction in sleep disturbance as measured by the Medical Outcomes Study Sleep Scale was found following MBSR in a group of breast cancer patients ($d = 0.24$). (Andersen et al., 2013). Care should be taken when generalising these results, however, as the participants in this study were cancer sufferers, therefore they are not representative of the population of those with insomnia.

There is a relatively large degree of variability between these studies in their outcomes, with some studies finding larger changes post-treatment. As discussed earlier, in populations selected for displaying insomnia symptoms rather than having a diagnosis of insomnia, it is common to see low pre-treatment sleep disturbance severity. For example, participants in the sample studies by Cincotta (2011) had a mean ISI score of 11.07. This falls within the ‘pre-clinical’ ISI range (Bastien et al., 2001) and is likely to contribute to the small change score found following intervention. Nevertheless, the pattern of change appears to be consistent across the range of studies. It is likely that mindfulness intervention has the potential to reduce the severity of insomnia as assessed by the ISI. There are also indications
that the severity of insomnia may continue to improve following treatment (Cincotta et al., 2011).

5.3.2 Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI) is a common measure of sleep quality, used both clinically and in research settings (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a self-rated questionnaire that assesses sleep quality over a one-month period. There are 19 individual items which generate seven component scores ranging from 0 to 3 (sleep quality, use of sleep medications, sleep duration, habitual sleep efficiency, sleep disturbance, and daytime dysfunction) to give a total score reflecting sleep quality of 0-21. Higher scores reflect poorer sleep quality.

Several studies have used the PSQI as an outcome measure. A significant improvement in sleep quality (across all components of the PSQI) was found following an eight week MBSR program (Carlson & Garland, 2005). Another study examining an eight week MBSR intervention in a group of transplant patients ($n = 20$) also found a significant improvement in sleep as measured by the Pittsburgh Sleep Quality Inventory (PSQI), with changes stable at three month and six month follow-ups (Gross et al., 2004). In a pilot study investigating the impact of MBCT on sleep in a group of anxiety sufferers with insomnia, there was a large treatment effect for the PSQI ($d = 1.32$), decreasing from a median of five (which is the clinical cut-off), to a median of three (below the clinical range of sleep disturbance). The majority of the component scores also improved significantly (Yook et al., 2008). Significant improvements were found for subjective sleep quality, habitual sleep efficiency, sleep latency, use of sleeping medication and daytime dysfunction.

5.3.3 Sleep Diary

Sleep diaries are subjective measures of sleep, which participants complete daily (usually in the morning). A wide variety of sleep diary measures have been used in studies
evaluating mindfulness as a treatment for insomnia. Some of these papers are short in length and it was therefore common that null findings were not presented.

5.3.3.1 **Sleep Onset Latency (SOL)**

Sleep onset latency (SOL) describes the average time from switching off the lights with the intention to sleep to the onset of sleep. SOL durations of longer than 30 minutes are considered problematic, and form part of the diagnostic criteria for insomnia. Significant improvements in SOL have been found in a number of mindfulness studies. For example, SOL reduced significantly from 36 to 17 minutes (S.D. = 22.9 min, *p* < 0.01), following a six week MBSR plus behaviour therapy treatment (Bootzin & Stevens, 2005), and a pilot study investigating MBCT as a treatment for chronic insomnia found a small but significant decrease in SOL of four minutes (Heidenreich et al., 2006). A significant 19 minute reduction in SOL was found in another study in response to a MBT-I intervention (Ong et al., 2008b).

5.3.3.2 **Wake After Sleep Onset (WASO)**

Wake after sleep onset (WASO) refers to the amount of wakefulness that occurs following the first transition to sleep and prior to the final awakening in the morning. This reflects a difficulty with maintenance of sleep. Only a small proportion of studies have reported significant changes in WASO following MBSR. The study that did report a significant decrease in WASO was an eight week MBSR intervention in depressed individuals (Britton et al., 2012). Although this does not confirm that mindfulness has limited effect on WASO, it does suggest that there is a lack of support for the use of mindfulness in reduction of WASO. As discussed in Chapter 2, the transition between sleep and wake is usually discreet. In those with hyperarousal, the filtering process and gating of cognitive activity from the brainstem to the cortex may be ineffective, causing short intrusions in sleep. Although this may lead to fragmentation of sleep, it may not result in large WASO, which may contribute to the lack of findings in this area. Therefore, the quality of sleep and
frequency of awakenings may be more important sleep diary outcome measures than wake after sleep onset.

5.3.3.3 **Sleep Efficiency (SE)**

Sleep efficiency (SE) reflects the proportion of time spent asleep when compared with the total amount of time spent in bed. Apart from one study (Britton et al., 2012), studies that have not utilised a behavioural component have generally not reported significant differences in sleep efficiency. In contrast, a six week MBSR plus BT treatment (Bootzin & Stevens, 2005) and six week MBT-I intervention (Ong et al., 2008b) both led to significantly improved sleep efficiency. This suggests that mindfulness alone may not lead to changes in the proportion of time in bed spent asleep. It may be that sleep education is required to understand the notion of conditioning. Two of the main components of behaviour therapy for insomnia are stimulus control and sleep consolidation. These techniques teach individuals to spend less total time in bed and remove activity that is not sleep-related from the bedroom (e.g. watching TV). These are active methods for increasing sleep efficiency. Mindfulness itself is unlikely to lead to these changes, which provides us with an understanding of why MBSR or MBCT have not commonly resulted in improved SE.

5.3.3.4 **Total Sleep Time (TST)**

Total sleep time (TST) is the number of hours or minutes slept. Several studies have reported improvements in TST. For example, TST increased from 440 to 501 minutes following a six week MBSR plus behaviour therapy intervention ($p < 0.05$, $n = 17$, S.D. = 91.4 min) in a sample of adolescents (Bootzin & Stevens, 2005). This was consistent with the findings of a six week MBSR combined with CBT intervention (Britton et al., 2010a), where the average total sleep time increased by an average of 74 minutes. Both of these studies focused on substance abusing adolescents. A small pilot study investigating MBCT as a treatment for chronic insomnia also found a significant increase in mean total
sleep time from 5.5 hours to 6.5 hours (Heidenreich et al., 2006), while two further studies reported no difference in TST (Ong et al., 2008b; Yook et al., 2008).

On first impression, it might seem that total sleep time is the most important outcome for those with insomnia. However, on closer examination, merely increasing the number of hours of slept may not lead to any improvement in functioning. Individual sleep need varies. Some people with insomnia who have a sleep need that is somewhat less than the average actually struggle with sleep because they are attempting to force their bodies to sleep more than necessary. Mindfulness may improve this by helping people to accept their sleep and work on reducing their striving for sleep. Further, if the quality of sleep is poor, more time asleep will not necessarily lead to improved functioning.

5.3.3.5 **Total Wake Time (TWT)**

Total wake time (TWT) is a combined score that reflects the combination of SOL and WASO. It is not as commonly reported as other measures on the sleep diary. However, two studies reported significant reductions in TWT. The first was a six week MBT-I intervention (Ong et al., 2008b) where TST was reported to reduce from 107.91 (S.D. = 60.68) minutes to 53.47 (S.D. = 41.61) minutes, $d = -1.17$. In a randomised controlled trial comparing an eight week MBSR intervention with a control group in a sample of depressed individuals, TWT reduced significantly in the treatment group ($\eta^2 = 0.19$), whereas the control group did not change (Britton et al., 2012).

5.3.3.6 **Sleep Quality**

Sleep quality is occasionally recorded in sleep diaries, usually in the form of a scale from 0 to 5. Most studies did not report any differences in sleep quality, however, it is likely that a majority did not measure it, rather than failing to report it because there was no change.
Ong and colleagues (2008) reported no significant difference in sleep quality in a six week MBT-I intervention (Ong et al., 2008b).

5.3.3.7 Total Time in Bed (TTIB)

The total time in bed (TTIB) measure reflects the time duration from getting in to bed to getting out of bed, minus any time out of bed during the night. Most studies did not report on TTIB or any differences in total time in bed. One study that reported a significant reduction in time in bed used a combination of behaviour therapy and MBSR (Ong et al., 2008b). This suggests that mindfulness interventions alone are unlikely to address the amount of time individuals spend in bed.

5.3.3.8 Number of Awakenings (NWAK)

The number of awakenings from sleep (NWAK) is a subjective recollection of the number of times a person recalls waking from sleep throughout the night. Significant improvements in NWAK were found following a six week MBSR plus behaviour therapy intervention (2.29 to 1.41, S.D. = 0.78, p < 0.001; Bootzin & Stevens, 2005) and a six week MBT-I intervention (2.21 to 1.22, S.D. = 1.35, d = -0.61, p = .002; Ong et al., 2008). Again, this reflects that behaviour therapy might be a closer match than mindfulness alone to improving the subjective number of awakenings at night. This is interesting because there is a theoretical expectation that mindfulness might reduce the number of awakenings at night, on the basis of the hyperarousal model of insomnia. There is not enough evidence at present to conclude that mindfulness does not impact the amount of wakefulness at night. However, the lack of significant findings may indicate that it takes time for the meditation component of the intervention to have an impact on the number of awakenings or the problems that people with insomnia tend to have with their perception of sleep (Bonnet & Arand, 1997b; Harvey & Tang, 2012).
5.3.4 Other Sleep Outcome Measures

Apart from the typical outcome measures discussed above, there are also several other outcomes that give further information about the impact of mindfulness on symptoms of insomnia. Fatigue is one symptom commonly reported by insomnia sufferers (Lamassiaude-Peyramaure, 2009). Results of an eight week MBSR intervention on cancer outpatients revealed a significant reduction in fatigue as assessed by the Profile of Mood States ($d = 0.38$; Carlson & Garland, 2005).

Sleep self-efficacy is the belief people hold about their ability to sleep (Rutledge, La Guardia, & Bluestein, 2013). A trial of MBSR combined with CBT for insomnia symptoms in substance abusing adolescents found there was a significant positive relationship between the number of meditations and sleep self-efficacy ($r = 0.50, p = .02$; Britton et al., 2010a), which fits with the principal of trust (Kabat-Zinn, 1990). It may suggest that people improve in sleep self-efficacy because they learn how to place trust in their body’s ability to sleep.

The cognitive model of insomnia poses that dysfunctional beliefs about sleep often lead to increased anxiety about sleep and perpetuate safety behaviours (Morin et al., 1993b). Although the theory behind the use of mindfulness in insomnia is to reduce arousal and improve the relationship with thoughts rather than the thought content itself (Ong et al., 2012), there is some evidence that dysfunctional beliefs about sleep may change during an MBT-I treatment. Following a six week MBT-I trial, reductions in cognitive measures of sleep disturbance such as sleep effort ($d = -0.96$) and dysfunctional sleep-related beliefs ($d = -1.05$) were found. This indicates that mindfulness may result in changes to problematic cognitions known to influence sleep disturbance (Ong et al., 2008b). In the same way that sleep self-efficacy was shown to increase, these findings may suggest that the principles of
mindfulness, or improvement in insight, could lead to some people reconsidering some of their beliefs about sleep.

5.3.5 **Objective Measurements**

5.3.5.1 **Polysomnography (PSG)**

Relatively few studies into mindfulness for insomnia have utilised PSG as an outcome measure. This is likely to be because of the difficulties of using PSG in cases of insomnia. However, Britton and colleagues have conducted several studies to explore cortical markers of hyperarousal and sleep quality before and after mindfulness training (Britton et al., 2010a; Britton et al., 2012). These data are useful to test hypotheses surrounding the impact of mindfulness on cortical arousal.

Participants with partially remitted depression ($n = 26$) were randomised into an eight week MBCT program or a waitlist control. Outcome measurements included PSG, as well as subjective measures of sleep and depression. Contrary to expectations, those in the MBCT group displayed several indices of increased cortical arousal (more awakenings in stage one sleep as well as less slow wave sleep compared to controls). The degree of change was found to be proportional to the amount of meditation practice. Sleep diaries reflected improvements in sleep, however, these did not differ significantly from the self-reported sleep of the control group. In those with improvements in depression, increased subjective sleep continuity as well as increased arousal was noted on PSG results. The authors make the point that this pattern of results is similar to the profiles of positive responders to common antidepressants (Britton et al., 2010b).

Following on from their previous work, Britton and colleagues retained the same idea of examining the PSG data following an MBSR treatment, and conducted another study focused on antidepressant users. Antidepressants are known to create disruptions in sleep continuity. Treatment consisted of an eight week MBCT program or a waitlist control.
Results indicate that MBCT participants had improvements in both PSG and subjective measures of sleep. Specific changes included decreased wake time and increased sleep efficiency. There were no apparent changes in sleep depth as measured by PSG (Britton et al., 2012). In a recent randomised controlled trial, Ong and colleagues did not find any differences in PSG parameters following an eight week MBT-I program (Ong et al., 2014).

It is too early to reach any firm conclusions regarding the impact of mindfulness on cortical arousal in people with insomnia. However, the limited information that is available suggests that it may not be reductions in cortical arousal that improve perceptions of sleep.

5.3.5.2 **Actigraphy**

Some studies into mindfulness as an intervention for insomnia have explored objective sleep using actigraphy (Cincotta et al., 2011; Garland et al., 2014; Gross et al., 2011; Ong et al., 2014). Actigraphs consist of an accelerometer and light sensor and are worn on the wrist. They possess inbuilt algorithms to calculate whether the individual is asleep or awake. The outcome measures that are collected by actigraphy are similar to those of a sleep diary, such as SOL, TST and WASO. Actigraphs record continuously over a long period of time (e.g. 30 days) so there is a large amount of data collected. This is usually averaged to display weekly sleep information.

Most studies that used actigraphy did not report any significant changes in sleep (Cincotta et al., 2011; Garland et al., 2014; Ong et al., 2008b). However, a recent randomised controlled trial by Ong and colleagues did find a difference in total wake time ($d = 0.76$) and total sleep time ($d = 0.81$), as measured by actigraphy, following an eight week MBT-I program (Ong et al., 2014). Other outcome measures of sleep collected by actigraphy, such as WASO or SE, did not change significantly. Another randomised controlled trial found significant changes in TST and WASO using actigraphy from baseline to follow-up after MBSR (Garland et al., 2014).
Given the limited amount of research, it would be premature to make any conclusions regarding the nature of change detected by actigraphy following a mindfulness intervention. However, it appears that mindfulness has less impact on sleep as measured by actigraphy than it does on self-reported sleep measures. This may be because actigraphy and PSG fail to detect the subtle differences in the sleep quality of people with insomnia and good sleepers, or because there are changes in subjective sleep perception. Further research using actigraphy is required to better understand this relationship.

5.3.6 Arousal

Chapter 2 presented a discussion of the hyperarousal model of insomnia. This model posits that overactivation of the sympathetic nervous system can precipitate or perpetuate insomnia (Bonnet & Arand, 1997a; Bonnet & Arand, 2010; Drake, Richardson, Roehrs, Scofield, & Roth, 2004; Fernandez-Mendoza et al., 2010; Riemann et al., 2010). High levels of arousal make it difficult for the body to shift into sleep (Bonnet & Arand, 2000), and therefore changes in arousal are of interest in studies exploring mindfulness and insomnia.

Relatively few studies exploring mindfulness interventions for insomnia have assessed arousal. The pre-sleep arousal scale (PSAS) is a 16-item self-report questionnaire designed to measure both cognitive and somatic manifestations of arousal (Nicassio, Mendelowitz, Fussell, & Petras, 1985). Two studies have found significant reductions in arousal according to PSAS following mindfulness intervention. A study investigating MBSR for insomnia symptoms reported a reduction in total arousal \((d = 0.66)\), somatic arousal \((d = 0.47)\) and cognitive arousal \((d = 0.58)\) after MBSR treatment for insomnia symptoms (Cincotta et al., 2011). Longer duration of meditation in the final week was associated with greater reductions in cognitive arousal (Cincotta et al., 2011).

There were also significant reductions in measurements of arousal following a six week pilot MBT-I treatment (Ong et al., 2008b). A large treatment effect \((d = -1.00)\) was
found for the primary measure of pre-sleep arousal (PSAS). Both the cognitive \( (d = -0.95) \) and somatic \( (d = -0.69) \) subscales of the PSAS reduced significantly. A moderate treatment effect \( (d = -0.46) \) was also found for trait arousal as assessed by the Hyperarousal Scale (HAS). The HAS is designed to measure arousal as a trait and has the potential to differentiate between people with insomnia and normal sleepers (Pavlova et al., 2001). There was a positive correlation between the number of meditation sessions and hyperarousal scores, suggesting that more meditation may lead to enhanced effects on arousal reduction (Ong et al., 2008b). Follow-up analysis indicated that participants with high pre-sleep arousal and sleep effort at the end of treatment were at greater risk of re-occurrence of insomnia during the 12 months following treatment (Ong et al., 2009).

In a randomised controlled trial, Ong and colleagues explored the difference between MBSR and MBT-I (Ong et al., 2014). Pre-sleep arousal reduced significantly in both meditation conditions, with MBSR producing a larger effect size immediately after treatment \( (d = 1.02) \) than MBT-I \( (d = 0.89) \). However, follow-up analyses indicated that MBSR had a smaller long-term effect \( (d = .88) \) than MBT-I \( (d = 1.02) \). This study will be discussed in more detail later.

Stress is known to increase arousal (Drake et al., 2004). A pilot study found significantly reduced stress \( (d = 1.22) \) in a group of cancer outpatients following an eight week MBSR program, as measured by the Symptoms of Stress Inventory (Carlson & Garland, 2005). The Symptoms of Stress Inventory (SOSI’ perceptions of physiological, behavioural, and cognitive components of stress (Thompson, 1989). Thompson, 1989).

All studies that have recorded pre-sleep arousal following mindfulness intervention in the context of insomnia have found significant reductions. This provides support for the argument that mindfulness may improve sleep by reducing hyperarousal. Further support is provided by the relationships found between the amount of mindfulness practice undertaken
and the subsequent reductions in pre-sleep arousal, but more research is required to make firm conclusions regarding the impact of mindfulness on arousal in the context of insomnia. However, preliminary analyses support the notion that mindfulness reduces hyperarousal.

5.3.7 Mindfulness

It is very surprising that very few studies investigating mindfulness and insomnia have investigated changes in mindfulness. One study that did assess mindfulness skills found no differences in mindfulness skills following a six week MBT-I intervention (Ong et al., 2008b), although a single case study described a significant improvement in mindfulness following MBT-I (Ong & Sholtes, 2010). Although this may indicate that, in these situations, mindfulness interventions do not increase mindfulness, it may also be suggestive of the difficulty in measuring mindfulness via self-report. One difficulty is that participants may commence treatment with little understanding of mindfulness. This may lead them to report their level of mindfulness as higher than it is, based on their lack of mindfulness. Increased learning about mindfulness, along with greater awareness of mindlessness, may lower self-reported mindfulness in individuals who have completed a mindfulness course. This and other difficulties in the measurement of mindfulness will be discussed in more detail in Chapter 6.

5.3.8 Other Outcome Measures

5.3.8.1 Mood

Mood disturbance is often cited as a symptom of insomnia (Carney et al., 2013; Hetta, Riman, & Almqvist, 1985). This may be related to high levels of rumination as a result of being focused on sleep disturbance (Carney et al., 2013). Several studies investigating mindfulness interventions in insomnia have explored mood as an outcome measure. A study examining an eight week MBSR intervention in a group of transplant patients ($n = 20$) found a significant improvement in mood following treatment ($d = 0.59$; Gross et al., 2009).
Another study found that anxiety \((Z = -3.73, p < .01)\), depression \((Z = -3.06, p < .01)\), rumination \((Z = -3.83, p < .01)\) and worry \((Z = -3.83, p < .01)\) all reduced significantly after MBCT in a group of anxiety sufferers with insomnia (Yook et al., 2008), as measured by a range of scales including the Hamilton Anxiety Rating Scale, the Hamilton Depression Rating Scale, the Penn State Worry Questionnaire and the Ruminative Response Scale. However, in an MBT-I pilot study, there were no significant differences in mood following the intervention, as measured by the PANAS (Ong et al., 2008b).

### 5.3.8.2 Hot Flushes

One study showed that after an eight week MBSR treatment, the menopausal participants reported a significantly reduced amount of ‘bother’ created by their hot flushes. There were also clinically significant improvements in quality of life, subjective sleep quality and perceived stress. These changes were maintained at three months post-treatment (Carmody et al., 2011). Hot flushes and night sweats naturally disturb sleep. Although this study did not focus directly on sleep, it provides support for the use of MBSR for treatment of the condition, which may have indirect benefit to insomnia in the middle-aged female population.

### 5.3.9 Relationships between Outcome Measures

Some studies have explored the relationships between sleep, mindfulness and other outcome variables. The aim of this section is to discuss the relationships that provide information which contributes to our understanding of the impact of mindfulness and sleep. In one study, a moderate negative correlation was found between reduction of stress and sleep improvement following an MBSR intervention (Carlson & Garland, 2005). This suggests that the MBSR may improve sleep in cancer outpatients via reducing the stress response. However, further analyses revealed that reductions in subjective physiological measures of stress (such as gastrointestinal complaints) had a stronger impact on sleep than
psychological indications of stress (such as habitual patterns). Cincotta and colleagues also found a significant relationship between cognitive arousal change scores and changes in insomnia severity in a group of cancer outpatients (Cincotta et al., 2011). This supports the notion that mindfulness reduces arousal (particularly cognitive arousal), which in turn may lead to reductions in the severity of insomnia symptoms (Cincotta et al., 2011).

A trial investigating MBSR combined with CBT for insomnia symptoms in substance abusing adolescents found that frequency (but not length) of meditation was related to increases in total sleep time (Britton et al., 2010a). This indicates that having regular meditation sessions is important to the effectiveness of mindfulness interventions on sleep.

The relationships between mindfulness and a range of measures known to be associated with self-regulation of sleep were examined in a correlational study of 334 psychology students (Howell, Digdon, & Buro, 2010). Analyses were conducted using structural equation modelling, with the result that mindfulness predicted more adaptive sleep across a range of sleep variables. Relationships were also found between sleep variables and wellbeing, and mindfulness and wellbeing. Mindfulness was found to predict wellbeing in part by its association with self-regulated functioning (Howell et al., 2010).

5.3.10 Case Discussions and Focus Groups

Ong and Sholtes (2010) present a detailed description of the MBT-I treatment protocol, along with a case discussion of an individual insomnia sufferer (Ong & Sholtes, 2010). Their case discussion tracked a patient through an eight week MBT-I course. The patient, Maria, experienced a dramatic shift in the sixth session, when she embraced the principles of ‘acceptance’ and ‘letting-go’. She is quoted as saying: ‘For a long time I thought I had to get rid of my thoughts to sleep better. It’s funny that once I stopped trying to make that happen, my sleep seemed to get better’ (Ong & Sholtes, 2010, p. 1182). At this point, Maria reported a large decrease in pre-sleep arousal scores.
In a randomised controlled trial, MBSR was compared with pharmacotherapy for insomnia (Gross et al., 2011). This study is discussed in more detail in the following section. However, focus groups were conducted 12 months post-intervention (Hubbling, Reilly-Spong, Kreitzer, & Gross, 2014) and analysis revealed four common themes. The first theme was about the positive impact of mindfulness on sleep, together with an increased willingness to adopt a healthy lifestyle. Participants often reported greater awareness of their actions, body sensations and urges. It was common that participants noted the benefits of MBSR to extend far beyond sleep, to life aspects such as self-compassion, physical wellbeing, emotion regulation, relationship satisfaction, acceptance and insight/self-perception.

5.3.11 Randomised Controlled Trials

When the protocol for the present study was established, there were no randomised controlled trials exploring mindfulness-based interventions for insomnia. However, the field has progressed, and there have been four randomised controlled trials published over the past four years. The aim of this section is to present the results of these trials in detail.

Gross and colleagues conducted a two-arm randomised controlled study comparing MBSR ($n = 20$) with pharmacotherapy ($n = 10$) in a group of people with insomnia. A high proportion of the sample (46%) reported concomitant medical conditions (Gross et al., 2011). Participants’ sleep was measured using actigraphy, sleep diary and self-report at three time points (pre-treatment, post-treatment, follow-up). Sleep diary changes for the MBSR arm were significant and moderate in strength for SOL, WASO, and SE, and by the five-month follow-up there was also a significant effect on TST (with an increase of 30 minutes). MBSR was found to be more effective in reducing SOL than pharmacotherapy. However, pharmacotherapy produced larger changes in other measures on the sleep diary. Actigraphy data revealed a small, but significant, reduction in SOL only.
Although the pharmacotherapy arm showed stronger changes in sleep outcomes, other questionnaires detected more complex changes. For example, the MBSR group had a significant reduction in dysfunctional beliefs about sleep and self-sleep efficacy, whereas there were no changes in these variables in the pharmacotherapy group. This is likely to reflect the potentially enduring nature of these changes, as these address the cognitive model of insomnia. Another interesting change was that the MBSR group reported a significant reduction in activity impairment. Again, this suggests that MBSR has the potential to improve other aspects of health and wellbeing that are supportive of ongoing positive changes in sleep.

A large-scale randomised control trial was conducted investigating insomnia symptoms in a group of breast cancer patients (Andersen et al., 2013). There were 168 people in each arm of the trial (control and MBSR). Sleep quality was measured using the Medical Outcomes Study (MOS) sleep scale (Hawthorne, Osborne, Taylor, & Sansoni, 2007). Following treatment, the MBSR arm showed significantly lower mean sleep problem scores than the control group. The differences between the two groups were not maintained at six and twelve-month follow-up periods, indicating that MSBR had a short-term benefit only.

This research was a component of a larger trial where sleep was not the main focus, so participants were not required to meet the criteria for insomnia. As such, the level of sleep disturbance pre-treatment was low, which may have impacted upon the maintenance of the immediate treatment effect. Another potential issue with the study was with the assessment of sleep disturbance. The MOS sleep scale is not a commonly used sleep scale and there are no cut-offs for clinical disturbance levels. This means the scale may not have the sensitivity to adequately and reliably pick up changes following treatment.

In the following year, another large-scale clinical study was published (Garland et al., 2014), which differed in the population studied and study design from the previous
randomised control trials. In this study, participants \((n = 111)\) were required to meet criteria for insomnia as established by the *DSM-5*. This trial compared MBSR with CBT-I in block random assignment, rather than the use of a control group. Outcome measures were also more specific, with the ISI as the primary outcome measure, sleep diary and actigraphy as secondary sleep measures, and tertiary measures of mood, dysfunctional beliefs about sleep, and stress. CBT-I produced superior results with some subjective measurements of sleep immediately after treatment (i.e. SOL, SE). However, non-inferiority was suggested at follow-up. For some measures (e.g. WASO), changes were observed to be greater at follow-up assessment than post-intervention for the MBSR group. There were also some changes in sleep from baseline to follow-up in the MBSR group in actigraphy recordings (e.g. TST, WASO). This suggests that MBSR may take longer to impact on sleep than CBT-I (Garland et al., 2014). However, it is difficult to generalise these findings to the population of those seeking help for insomnia due to the specific nature of the sample.

Drawing on their previous work, Ong and colleagues (2014) conducted the first randomised controlled trial with three arms (MBSR, MBT-I and self-monitoring). This allowed for the investigation of the additional benefits that behavioural components play in MBT-I as compared to MBSR, as well as for comparison against a control group (Ong et al., 2014). A rigorous three-step screening procedure was conducted (telephone screen, medical review and PSG) with strict exclusion criteria, such as the use of hypnotic drugs. The sample size of 54 provided enough power to detect moderate to large changes in self-reported sleep based on previous findings. In comparison to the earlier pilot studies (Ong et al., 2008a; Ong et al., 2008b), the treatment for this trial was for eight weeks rather than six (for both MBSR and MBT-I). Furthermore, practice compact discs with guided meditations on them, were given. Outcome measures included sleep diaries and
diaries and self-report assessments for pre-sleep arousal and insomnia severity, along with objective measures of sleep (PSG and actigraphy).

This study also extended past research by using more sophisticated data analysis than had previously been used. Linear mixed models (LMM) were used to analyse change over time in data provided by daily diaries and actigraphy. Both of the meditation arms proved superior to the self-monitoring arm for self-reported total wake time, at both immediate and follow-up data collection points. Pre-sleep arousal was also reduced significantly in both mediation conditions, relative to self-monitoring. With regard to insomnia severity and remission rates, both meditation conditions demonstrated a significant reduction. However, the MBT-I condition was superior due to the immediate improvement as well as its long-term effect on insomnia severity, which continued to improve post-intervention. There were no statistically significant differences found between MBSR and MBT-I.

With regard to objective sleep measures, both meditation arms resulted in a significant decrease in total wake time and an increase in total sleep time compared with self-monitoring, but there were no differences between the meditation conditions. Overall, the pattern of change for insomnia severity and pre-sleep arousal favoured the MBT-I combination. However, the lack of difference between the two conditions, and their joint superiority over the self-monitoring condition on a number of variables, suggests that BT is not the key ingredient for overall change.

In this paper, Ong and colleagues point out that a problem with their study is that the majority of the sample were Caucasian women with hyperarousal problems. They suggest that further analysis of this treatment intervention with a more diverse population would assist to provide further evidence of validity for the treatment.

The next chapter outlines on the rationale and benefit of treatment as used in the current study, including a discussion of the gaps in the literature. The focus of Chapter 7 is a
review of current mindfulness measures, while Chapter 8 provides a description of the method and outcome measures used in this research, followed by the procedure.
6 CHAPTER 6: Rationale and Treatment Benefit

The current study aims to replicate the MBT-I treatment protocol developed by Ong et al., (2008) and employ a waitlist period pre-treatment. Furthermore, the study aims to investigate if the treatment is successful in reducing symptoms of insomnia in a pragmatic trial of individuals with insomnia.

6.1 Significance of the Problem

As previously noted, insomnia affects a large number of Australians, with the prevalence of primary insomnia (PI) estimated to be 3% in 2010 (Deloitte, 2011). This statistic does not capture the total population of people with insomnia, for the majority of cases of insomnia are secondary to a medical or psychiatric condition, and are therefore not considered primary insomnia. Epidemiological studies have shown that secondary insomnia (SI) accounts for up to 73% cases of insomnia (McCrae & Lichstein, 2001). A large proportion of Australians, furthermore, report dissatisfaction with their sleep, even though they may not meet the full criteria for insomnia (Deloitte, 2011). Epidemiological studies indicate that this proportion of the population may be as high as 50% (Buysse et al., 2008a; Dohnt et al., 2012).

The implications associated with insomnia are of concern, as it negatively impacts the quality of life of individuals who suffer with the condition (Leger et al., 2001), as well as placing a significant direct and indirect financial burden on society (Deloitte, 2011). The presence, severity and chronicity of insomnia (whether primary or related to a medical condition) has been found to be a predictor of psychiatric illness (Breslau et al., 1996; Ohayon & Roth, 2003). Refer to Chapter 3 for a discussion of the prevalence rates and associated cost of insomnia. In summary, insomnia is a highly prevalent condition with a large impact at both an individual and societal level.
6.2 Gaps in the Literature

Research investigating the use of mindfulness in insomnia is still in its infancy. This section aims to identify some of the avenues of study that are worth exploring. These have led to the development of the research protocol used in this thesis, which will be discussed in the next section.

6.2.1 Controlled Studies

At the stage of protocol development for the present study, there were no published randomised controlled trials in this area. Study designs other than randomised controlled designs can detect associations between an intervention and an outcome. However, they cannot rule out the possibility that the association was caused by a third factor linked to both intervention and outcome. Randomised controlled trials are the most rigorous way of determining whether a cause and effect relationship exists between treatment and outcome, and for assessing the cost effectiveness of a treatment (Sibbald & Roland, 1998). Although randomised controlled trials are powerful tools, their use is limited by ethical and practical concerns. Exposing patients to an intervention believed to be inferior to current treatment is often thought unethical. Randomised controlled trials also typically require larger sample sizes, which is not always feasible.

To date, no studies focusing on mindfulness as a treatment for insomnia, have utilised a waitlist period, also known as a long run-in time. A waitlist period is slightly different from a waitlist comparison group (i.e. a group of participants included in an outcome study that is assigned to a waiting list and receives intervention after the active treatment group). A waitlist period is a period before a clinical trial commences, during which no treatment is given. Data from this period of time can be useful for screening, investigating the stability of a condition, and providing baseline observations. It is also useful to identify any
improvements that are related to enrolling in a treatment, but are not related to the treatment itself.

6.2.2 Target Population

The target populations that have been used in the studies investigating mindfulness as a treatment for insomnia have varied from those meeting strict criteria for psychophysiological insomnia (e.g., Ong, 2014) to populations that were highly specific, such as breast cancer patients (Shapiro et al., 2003), and also groups of participants who were not assessed for sleep disturbance prior to enrolment symptoms (Cincotta et al., 2011; Gross et al., 2009). Section 5.2.2 provides a description of target populations. When assessing the clinical effectiveness and feasibility of a treatment, it is useful to investigate clinical outcomes in a sample of patients that closely represent the variety of patients who are likely to self-refer for treatment of insomnia. To date, no studies have reported on samples that have presented to a sleep physician with complaints of insomnia. This is an area of research that is worthy of attention.

6.2.3 Outcome Measures

The outcome measures used in early pilot studies were often limited. This restricted the amount of information that could be derived from the research. As time has progressed, outcome measures have become more specific, and have included both objective and subjective measures.

6.2.3.1 Objective Sleep Measures

At the time of protocol development, only one study had used actigraphy as a measure of sleep when investigating the impact of mindfulness on insomnia (Bootzin & Stevens, 2005). This would not be considered a gap in the literature now, as more recent studies have
consistently used objective sleep measurements. However, in developing the protocol, it was considered important that the study included objective measures of sleep.

6.2.3.2 Arousal and Mindfulness

Mindfulness interventions are proposed to influence sleep by increasing mindfulness and reducing arousal (Ong & Sholtes, 2010), yet interestingly, relatively few studies have used measures of arousal or mindfulness as outcome measures. These outcome measures are useful in order to confirm if changes in sleep are related to reductions in arousal and increases in mindfulness. As such, they are included as outcome measures in the present study.

6.3 Rationale

6.3.1 Weaknesses in the Current Treatment for Insomnia

Current treatment for insomnia includes both pharmacological and non-pharmacological treatment. Pharmacological treatment for insomnia includes sedatives, melatonin and some antidepressants. These treatments have been shown to decrease SOL duration and reduce the duration of WASO (Harvey, 2005). However, pharmacological treatments have limitations. For example, the use of medication to treat insomnia is associated with rebound insomnia on cessation of treatment, dependence and withdrawal, and it can cause serious side effects in some individuals (Benca et al., 2004). Essentially, pharmacological treatments are intended to treat patients with acute insomnia but not chronic insomnia (Harvey, 2002a).

Cognitive behaviour therapy for insomnia (CBT-I) is the most widely used non-pharmacological treatment option for insomnia (Harvey, 2002b). Typically provided by a psychologist, CBT-I includes aspects such as cognitive therapy, stimulus control, sleep restriction, sleep hygiene (sleep-promoting behaviour) and relaxation (Harvey, 2005). While CBT-I has been shown to have moderate effect sizes, these are lower than the effect sizes
reported for CBT for a range of other psychological disorders, and may not adequately
dress hyperarousal (Harvey, 2002b; Ong et al., 2012; Riemann et al., 2010). Therefore,
although CBT-I is effective, there is scope to improve overall treatment outcomes for people
with insomnia.

6.3.2 Rationale for Further Research on Mindfulness-Based Interventions for
Insomnia

Although there is convincing evidence to suggest that mindfulness may be a potential
treatment avenue for insomnia, there are many unanswered questions regarding the feasibility
and efficacy of mindfulness-based treatments. The gaps in the literature, discussed earlier in
this chapter, provide an opportunity to enhance the body of knowledge regarding such
interventions. They also form a solid rationale for undertaking the research described in this
thesis. Participant samples have often been too narrow, limiting the potential extrapolation of
the findings to the general population of people with insomnia. For this reason, the design of
this research has included a sample that is representative of the natural population of
insomnia sufferers. Further, at the time this research was developed, the existing study
designs were largely quasi-experimental, with subjective measurements of sleep only. This
has several weaknesses. For example, statistical association does not imply causality, as there
may be other reasons for the change in scores that are unrelated to the treatment.
Furthermore, quasi-experimental designs are vulnerable to threats to internal validity, such as
the difficulty in controlling for confounding variables and regression towards the mean
(Harris et al., 2006).

Ideally, a randomised controlled design would have been utilised in this research.
However, the resources and timeframe required to conduct a randomised controlled trial were
not available. In order to provide a unique contribution to the existing literature, and partially
address the weaknesses in the study design of prior research in this area, a non-concurrent
multiple baseline design, with a three-month follow-up, was utilised in the research described in this thesis. Continuous objective and subjective recording was collected throughout the baseline and treatment periods. This was employed to enhance the design of the research, and to provide valuable and clinically relevant information to improve evidence for the use of MBT-I for insomnia.

In clinical practice, healthcare practitioners are often faced with decisions regarding treatment avenues for their patients. This suggests that information about the types of people who will benefit most from mindfulness interventions is a useful area of research that has not yet been explored. For example, there is some research to suggest that personality types are associated with higher or lower levels of mindfulness (Giluk, 2009), as discussed in Chapter 4. Personality may influence an individual’s willingness to engage in mindfulness-based interventions and may influence treatment outcomes. These outcomes may also be influenced by other socioeconomic and demographic information, such as education level, family income and age. This hypothesis has not been addressed in the literature exploring mindfulness and insomnia, and warrants examination.

6.4 Aims

The overarching goal of the present study was to investigate if MBT-I can be successfully replicated using a naturalistic sample (i.e., a sample seeking treatment for insomnia). Specifically, the first aim was to examine insomnia severity, subjective and objective sleep quality, problematic sleep-related cognition, and daytime symptoms at baseline, post-treatment and follow-up stages, to identify any changes that may indicate treatment response. The second aim was to investigate the clinical effectiveness of the treatment response. The third aim was exploring the characteristics of people who improved
under the treatment, and to identify common characteristics. The final aim was to explore if changes in mindfulness or pre-sleep arousal were related to reductions in insomnia severity.

### 6.5 Hypotheses

In line with these aims, a number of hypotheses were proposed. Sleep quality is a multifactorial construct, and all of the measures described in Chapter 8 are considered to be of equal importance, both theoretically and clinically, to the outcome of the study. The design and analytic strategy for the research in this thesis recognises this and makes the necessary adjustments (e.g., adjusting the per comparison error rate to prevent over-inflation of the familywise error rate due to multiple testing). These are discussed in greater detail in Chapters 8 and 9, particularly in Section 9.4. The primary endpoint was certainly change at post-treatment, and the analyses and hypotheses focus on this. Change at follow-up, the secondary endpoint, was incorporate into the analysis strategy because of its clinical importance.

A full description of the design, methods, measures, and analysis strategy is provided in Chapters 8 and 9; however, to contextualise the hypotheses it is necessary to preview some of this material here.

The majority of outcome measures were recorded at three time periods in the protocol (i.e., baseline, post-treatment, and follow-up); these were: the Insomnia Severity Index (Main Outcome), the Pittsburgh Sleep Quality Index, the Epworth Sleepiness Scale, the Anxiety and Preoccupation with Sleep Questionnaire. Sleep diary variables (total sleep time, sleep efficiency, sleep onset latency, wake after sleep onset and number of awakenings) were recorded continuously throughout the baseline period, and treatment period, and recorded for two weeks at follow-up. The Profile of Mood States was assessed only at baseline and post-treatment, and the actigraphy outcome data (total sleep time, sleep efficiency, sleep onset
latency and wake after sleep onset) was recorded continuously from baseline to post-treatment and averaged to generate scores for baseline and post-treatment. The reason for this is described in Chapter 8 [you might want to provide a more specific reference here], and a table showing the schedule of assessments is provided (see Table 6).

The hypotheses focusing on those outcome measures that were assessed at three time points were analysed using polynomial growth curves in order to identify significant linear or quadratic trends. A linear mixed models approach was taken for these analyses. Where either a significant linear or quadratic trend emerged, multiple pairwise comparisons were conducted—with appropriate error rate correction—as a post-hoc procedure in order to assist in the interpretation of the significant trend. For those outcome variables that were measured twice—at baseline and post-treatment—ANOVAs based on linear mixed models were used to test the hypotheses. This approach is recommended and described in Twisk (2006) and Gelman and Hill (2007).

With this context, it was hypothesised that participants would score lower on insomnia severity and higher on objective and subjective sleep quality indicators at post-treatment compared with baseline, and that this difference would maintain at follow-up for those outcomes assessed at that phase. For outcome measures recorded at three phases, this would be reflected by significant linear or quadratic trends followed by significant pairwise comparisons between baseline and post-treatment and baseline and follow-up. For outcome measures recorded at two phases, this would be reflected in significant baseline to post-treatment differences. Similarly, and using the same analysis evidence as just described, it was hypothesised that measures of sleep-related cognitive processes known to disrupt sleep (such as pre-sleep arousal and selective attention and monitoring), and daytime symptoms (such as anxiety, depression and fatigue) would be significantly lower at post-treatment.
compared with baseline, and these differences would maintain at follow-up for those outcomes assessed at that phase.

In addition to the hypotheses described above, which are based on inferential testing of mean differences, clinical significance was evaluated for all outcome measures, focusing on baseline to post-treatment change. A slightly modified version of the approach to analysing clinical significance described by Jacobson and Truax (1991) was adopted for this analysis. This is described in more detail in Chapter 9. Based on this, it was hypothesised that the majority of the participants (i.e., more than half) would demonstrate clinically significant change on at least one outcome measure.

Finally, it was hypothesised that participants’ sleep-specific baseline to post-treatment change scores would be correlated with: (a) each other (e.g., changes in insomnia severity would be correlated with changes in subjective and objective sleep efficiency); (b) changes in daytime symptoms (e.g., changes in insomnia severity would be positively correlated with changes in fatigue); (c) changes in sleep-related cognitive processes known to disrupt sleep (e.g., reductions in insomnia severity would be correlated with changes in sleep-related monitoring); and (d) changes in pre-sleep arousal and mindfulness. Pearson correlations were used to test these final hypotheses.

### 6.6 Exploratory Questions

In line with the aims of the study, further exploratory questions were of interest. First, given the background literature on the discrepancies between objective and subjective sleep in insomnia patients, the differences and similarities in these were explored. Second, it was considered clinically beneficial to be able to identify factors that might lead to greater therapeutic change. It was expected that some factors, such as personality, might be correlated with changed scores in insomnia or mindfulness.
6.7 Study Design

To design a study that matched the current state of the literature, the stage model of behavioural therapies was used as a guide (Rounsaville et al., 2001). At the time the present study was being developed, research on mindfulness as an intervention for insomnia was at Stage One. This stage consists of pilot studies, with a focus on feasibility testing, manual writing, training development and assessments of adherence for new and untested treatments (Rounsaville et al., 2001). Research has since progressed to Stage Two, which initially consists of randomised controlled clinical trials to evaluate manualised protocols that have shown to be effective in pilot studies and also includes a focus on mechanisms of action or effective components of treatment (Rounsaville et al., 2001).

This study was constructed as a replication of a pilot study (Ong et al., 2008b), with the use of a naturalistic (treatment seeking) sample. This was in fitting with Stage One research (Rounsaville et al., 2001). In order to contribute to the literature, sleep was recorded throughout a six-week non-treatment period and additional outcome measures were included, such as mood and fatigue severity. In addition, sleep was measured objectively, with the use of actigraphy, as well as subjectively. To advance the research on mindfulness and insomnia towards Stage Two, measures of arousal and mindfulness were included, in order to explore the mechanisms of change (Rounsaville et al., 2001), and personality and demographic data were collected to explore information that may predict greater treatment outcomes. More detail of the study design will be presented in Chapter 8.

6.8 Implications of this Study

This research aims to explore the usefulness of mindfulness combined with behaviour therapy for insomnia (MBT-I) in an Australian naturalistic population. There are a number of theoretical and practical implications for such research. Preliminary evidence suggests that
there are improvements in sleep following MBT-I (Bootzin & Stevens, 2005; Ong et al., 2014; Ong et al., 2008b). However, further research is required to provide support for its clinical effectiveness in a range of settings. Applying MBT-I in an Australian population, without the application of strict inclusion and exclusion criteria, will add to the current body of literature by providing support for its clinical usefulness in a sample that closely represents individuals who would self-refer for treatment.

The design used in this research has features that will allow for the exploration of novel research questions, as well as providing data to explore hypotheses that have already been put forward. The use of a control period will contribute to the literature by eliminating the possibility that change occurs as a result of increased optimism from enrolling into a trial. The addition of actigraphy will allow for a comparison of objective versus subjective sleep outcomes. The range of outcome measures, such as pre-sleep arousal, mood and mindfulness, will allow for a more thorough examination of treatment effect. Finally, information about personality and demographic features may improve treatment outcomes, and may guide practitioners with respect to referrals to an MBT-I treatment group.

Given the inherent difficulties in measuring mindfulness, the next chapter will present an overview of measuring mindfulness. It will explore the theoretical considerations of measuring mindfulness before presenting an overview of research on the available measures of mindfulness. This information guides the selection of a mindfulness measure to be used in this research.
7 CHAPTER 7: Mindfulness Measures

7.1 Introduction

The idea of measuring mindfulness first appeared in the literature in 2001 (Bodner & Langer, 2001). Several mindfulness measures were published in the succeeding decade, each approaching the task of mindfulness differently. The aim of this chapter is to briefly introduce the key differences among the available measures of mindfulness and discuss the selection of the mindfulness measures used in the present study. First, the use of mindfulness measurement is considered.

7.2 The Importance of Measuring Mindfulness

7.2.1 Research

Empirical literature supporting the efficacy of mindfulness-based interventions has grown dramatically over the past two decades (Grossman, Niemann, Schmidt, & Walach, 2004b; Hofmann et al., 2010; Sharma & Rush, 2014). While support for the efficacy of mindfulness interventions is increasing in strength, the process or mechanisms involved in mindfulness interventions remain unclear. A considerable proportion of studies have established symptom reduction in a range of areas, however, few have investigated if these changes are related to increased mindfulness (Baer, Smith, & Allen, 2004). Valid and reliable tools are required to investigate the process by which mindfulness interventions have produced such valuable changes. Good quality mindfulness measures are needed to enable research studies to strengthen the current mindfulness techniques, encourage the development of new techniques, and lead to a greater understanding of the mechanisms involved in mindfulness interventions.
7.2.2 Clinical

Measures of mindfulness may be useful clinically, with a variety of possible applications. Mindfulness could be measured prior to treatment, which may allow a therapist to tailor treatment to an individual. A mindfulness measure may also be utilised to investigate a client’s subjective mindfulness before and after a mindfulness intervention. This may improve communication about mindfulness between therapists, their clients, and other treating health professionals. The next sections will explore some of the considerations for selecting a mindfulness measure.

7.2.3 Variability in Definition of Mindfulness

As discussed in Chapter 4, variability in definitions of mindfulness still exists in the literature, despite attempts to come to a consensus (Bishop et al., 2004). Differing opinions about the definition of mindfulness are reflective of differences in views about the central components of mindfulness. Mindfulness is a concept derived from Eastern philosophy and Buddhist teachings and, in its original context, is taught as a component of an overall approach to life ("The Foundations of Mindfulness: Satipatthana Sutta," 1994; Gethin, 2011). Mindfulness is also known as a differentiated concept, particularly in the context of psychological interventions in Western countries, such as MBSR (Kabat-Zinn, 1990, 2003). When selecting a measurement of mindfulness, it is important to consider the impact of differences in definitions of mindfulness.

Some mindfulness measures have been developed to assess mindfulness in a way that is representative of its origin. Whereas other researchers have attempted to identify and measure mindfulness as a distinct, secular construct (e.g., Langer, 1992). Not surprisingly, there is some disagreement throughout the literature on mindfulness measurement. For example, Grossman (2008) published an article that discussed his concerns with some
measures which, in his opinion, were developed by researchers who lacked theoretical awareness of the construct of mindfulness.

It is likely that differing perspectives on the definition of mindfulness have influenced exactly what is measured. Therefore, when selecting a mindfulness measure, it is essential to consider the foundation from which it has been derived. Table 4 displays the current measures of mindfulness, and includes a section that identifies the developmental source of a measure of mindfulness. Sauer and colleagues provide a detailed review of the theoretical differences in mindfulness measures (Sauer et al., 2013).

7.2.4 Is Mindfulness a State or Trait?

It is important to consider whether the aim of mindfulness measurement is to measure a feature of a person’s character (trait) or a particular condition or mode of being that may be transient across time (state). There is minimal discussion of whether mindfulness is better measured as a state or trait. Considering the measurement of other constructs such as anxiety (Bieling, Antony, & Swinson, 1998; Spielberger, 2010), it may be inferred that mindfulness could be measured as either a state or as a trait. The option of scales to explore state or trait mindfulness may facilitate a wider range of potential research questions. For research requiring a state measure of mindfulness, the choice of instrument is relatively straightforward because, to date, there is only one scale designed to measure state mindfulness (Bishop et al., 2003). Details of this can be found in Table 4.

7.2.5 Dimensionality

There is disparity in the literature as to whether mindfulness is a unidimensional (e.g., Brown and Ryan, 2003; Chadwick, Hember, Symes, Peters, Kuipers & Dagnan, 2008) or a multidimensional (e.g., Baer et al., 2008; Lau et al., 2006) construct, as it has been measured as both. There has been minimal debate concerning the dimensions of mindfulness, with
discussions limited to specific scales, rather than encompassing the broader question. For example, Cardaciotto and colleagues (2008) criticised the Five-Factor Mindfulness Questionnaire (FFMQ; Baer et al., 2008) by stating that it contains subscales that are redundant with one another and are not reflective of the core components of mindfulness. As with state-trait assessments of mindfulness, both short unidimensional and longer multidimensional measures of mindfulness are useful for research purposes. Test selection should reflect the intended use of the instrument. For example, if examining mechanisms of change, the FFMQ (Baer et al., 2008) may provide more specificity. However, in clinical practice, a short unidimensional scale may be more suitable (e.g., MAAS; Brown and Ryan, 2003).

### 7.3 Current Mindfulness Measures

To date, eleven mindfulness measures have been reported in the literature. This does not include unpublished work or scales designed specifically for particular target populations such as adolescents. Table 4 presents information regarding the background of the current measures of mindfulness. The table displays a range of information about each of the mindfulness measurements and was constructed using key sources as well as the review of mindfulness measures by Sauer and colleagues (2013).
Table 4

*Measures of mindfulness*

<table>
<thead>
<tr>
<th>Scale</th>
<th>CAMS-R</th>
<th>DMS</th>
<th>EOM</th>
<th>FFMQ</th>
<th>FMI-14</th>
<th>KIMS</th>
<th>MAAS</th>
<th>MMS</th>
<th>PHLMS</th>
<th>SMQ</th>
<th>TMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Used</td>
<td>Students/community</td>
<td>Students</td>
<td>Community</td>
<td>Students</td>
<td>Commun ity</td>
<td>Students, clinical</td>
<td>Community, students, clinical</td>
<td>Students</td>
<td>Students, clinical</td>
<td>Communit y, Clinical</td>
<td>Community</td>
</tr>
<tr>
<td>State/Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>Trait</td>
<td>State</td>
</tr>
<tr>
<td>Naive/Experienced</td>
<td>Both</td>
<td>Both</td>
<td>Trained</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
</tr>
<tr>
<td>Type of Analysis</td>
<td>CFA</td>
<td>IRT</td>
<td>EFA</td>
<td>EFA, CFA</td>
<td>CFA, IRT</td>
<td>EFA, CFA</td>
<td>EFA, CFA</td>
<td>CFA</td>
<td>EFA</td>
<td>EFA</td>
<td>EFA, CFA</td>
</tr>
<tr>
<td>Number of Factors/Facets</td>
<td>4</td>
<td>1</td>
<td>5 and 7</td>
<td>5</td>
<td>1 or 2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 4

*Measures of mindfulness (cont.)*

<table>
<thead>
<tr>
<th>Scale</th>
<th>CAMS-R</th>
<th>DMS</th>
<th>EOM</th>
<th>FFMQ</th>
<th>FMI-14</th>
<th>KIMS</th>
<th>MAAS</th>
<th>MMS</th>
<th>PHLMS</th>
<th>SMQ</th>
<th>TMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Items</td>
<td>12</td>
<td>30</td>
<td>29 and 35</td>
<td>39</td>
<td>14</td>
<td>39</td>
<td>15</td>
<td>9</td>
<td>20</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Number of Response Options</td>
<td>4</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Internal Consistency</td>
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<td>.90 - .93</td>
<td>.68 - .87</td>
<td>.67 - .92</td>
<td>.86</td>
<td>.76 - .91</td>
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<td>.76 - .85</td>
<td>.85 - .8</td>
<td>.82 - .89</td>
<td>.84 - .88</td>
</tr>
<tr>
<td>Variance Explained</td>
<td>Not Available</td>
<td>57%</td>
<td>33%</td>
<td>51%</td>
<td>43%</td>
<td>43%</td>
<td>95%</td>
<td>Not Available</td>
<td>26%</td>
<td>56%</td>
<td>95%</td>
</tr>
</tbody>
</table>
7.4 Selection for the Current Study

Three of the research aims of this study influenced the selection of a mindfulness measure. The first hypothesis was to explore the efficacy of MBT-I. The second was to explore the mechanisms involved in symptom reduction in insomnia patients who have been involved in an MBT-I intervention. Finally, it is of interest to ascertain if there are certain personality or demographic measures that are related to greater improvements in mindfulness or sleep measures, or if there are any factors that predict non-responders to MBT-I. To explore these research questions, it was desirable to select a scale that provides specific assessment of the components of mindfulness, as well as an overall measure of mindfulness. The questionnaire needed to be valid for administration to novices, as well as to experienced meditators. To examine the effectiveness of the intervention, it was important that the instrument reflected any changes to trait mindfulness that were made, as transient states of mindfulness are not likely to impact SOL or arousal levels.

The Five-Facet Mindfulness Questionnaire (FFMQ) was selected as the most appropriate measure for the current study. The FFMQ is a 39-item questionnaire derived from all existing mindfulness measures at the time its publication. These existing measures comprise the MAAS (Brown & Ryan, 2003), the FMI (Walach, Buchheld, Buttenmuller, Kleinknecht, & Schmidt, 2006), the KIMS (Baer et al., 2004), the CAMS (Feldman et al., 2007), and an unpublished version of the Southampton Mindfulness Questionnaire, which was originally called the Mindfulness Questionnaire (Chadwick, Hember, Mead, Lilley, & Dagnan, 2005). The FFMQ measures mindfulness as five facets (describe, actaware, nonjudge, and nonreact and observe), with items scored on a 5-point Likert-type scale, and it shows good internal consistency. It is a psychometrically-sound tool that offers two unique contributions to the literature. First, it was derived from items from a variety of mindfulness
scales and therefore capitalises on the high level of experience of the developers of a range of scales, and second, it includes differences in perspectives on the definition of mindfulness. Furthermore, the FFMQ is capable of measuring five different facets critical to mindfulness, which may be especially beneficial to the exploratory questions of this research. The next chapter provides an explanation of the methods used in this research.
8 CHAPTER 8: Method

8.1 Study Design

8.1.1 Background and Rationale

The research literature exploring mindfulness as a potential treatment for insomnia was at Stage One when this study was designed (Rounsaville et al., 2001). All previous research involved small scale, pilot studies. The primary aim of the present research was to replicate a previously tested treatment protocol of MBT-I (Ong et al., 2008b) in a naturalistic sample. The next aim was to build on previous research by adding an extended baseline period, objective sleep measurement and outcome measures that may help to understand the mechanisms behind treatment outcomes. The next section incorporates a rationale for the use of a control period, rather than a control group.

Overall, it is accepted that randomised controlled trial designs are the superior model for evaluating treatment efficacy. However, there are some challenges inherent to this design that prevented its feasibility in the current study. First, the use of a control group requires a much larger sample, which was not possible within the time restraints of the author’s candidature. Second, in order to implement an ethically sound design, a non-inferiority trial using a comparison group rather than a placebo group would have been a sensible option. For example, a comparison between MBT-I with CBT-I would have provided relevant information about the treatment benefit of MBT-I compared with the current gold standard. However, this would have required double the amount of the therapist’s time, which was not possible with limited funding. Given the barriers preventing the use of a randomised controlled trial design, a strategic approach to the research design was taken. One goal of this design was to make the best use of the data that could be collected from a small sample size. The next section describes the approach taken to the design of the current study.
8.1.2 **Design**

To address the challenge of not having a control group, this research design included a baseline period in which all recruited participants did not receive treatment. The benefit of the baseline period is that it allows for comparing participants at pre-treatment and post treatment, and also that it enables changes to be tracked over time. During this period, data (both subjective and objective) concerning sleep were collected. This design also allowed the influence of some extraneous variables to be avoided, such as perceived change after enrolment.

The baseline period included the time between enrolment and treatment, which was of six weeks’ duration. In some cases, baseline was a little longer and in two cases it was shorter (no less than four weeks). This was due to the timing of treatment sessions and the length of recruitment time. Additionally, only three participants could be enrolled each week due to the availability of actigraphs for downloading and charging purposes. The flow of recruitment, enrolment, timing of data collection, and outcome points are presented in *Figure 5*. Each of these stages is discussed in detail throughout this chapter.
The aim of this study was to recruit a sample of participants who were representative of the population that present with insomnia complaints to a general medical practitioner or a respiratory physician. To ascertain characteristics of this sample, a team meeting was held at the Melbourne Sleep Disorders Centre during the study development stage. All members of the research team at the time attended this meeting. The practicing physicians at Melbourne Sleep Disorders Centre (Dr David Cunnington, Dr John Swieca and Dr Juan Mulder), along with the research team (Allison Peters, Dr Moira Junge and Professor Ken Greenwood), discussed and decided on the key selection criteria discussed below.

**8.1.3 Participant Characteristics**

Figure 5. Recruitment, enrolment and study flow.
8.1.3.1 **Inclusion Criteria**

Individuals eligible for the trial were aged 18 or above, willing to comply with study protocols, and reported sleep disturbance three or more times a week for at least one month. The reported sleep disturbance symptoms must have been severe enough to cause clinically significant distress or impairment in social, occupational or other important areas of functioning according to the *DSM-IV-TR* (4th ed., text rev.; American Psychiatric Association, 2000). At the time of recruitment, the most recent edition was the *DSM-IV-TR*. There was no restriction regarding the type of sleep disturbance. Participants with difficulties initiating or maintaining sleep, with early morning awakenings, or with a combination of these problems were all included in the trial.

8.1.3.2 **Exclusion Criteria**

Potential participants were excluded from the trial if they displayed evidence of any other untreated sleep disorder, such as obstructive sleep apnoea (OSA), restless legs syndrome, or periodic leg movement disorder. Individuals with treated (and stable) sleep disorders were not excluded. Information required to ascertain if a person was a suitable participant was collected by a self-reported history (during a telephone screen) or by indications during their medical screen. Participants were excluded if there were any other cause of insomnia (for example social, medication), unstable mood, untreated or unstable major mental illness, or dementia as indicated by the *DSM-IV-TR*. Participants were also excluded if they met the criteria for alcohol abuse or dependence, had a caffeine intake greater than five cups of coffee per day, were experiencing planned life stresses (e.g., moving house, divorce), were shift workers, were not able to comply with study requirements such as attendance of sessions, or were unwilling or unable to give consent.

8.1.4 **Sampling Procedures**

8.1.4.1 **Recruitment**
A cohort of community-dwelling men and women over the age of 18 was recruited through citywide promotion of the study in Melbourne, via sleep physicians (including those at the Melbourne Sleep Disorders Clinic) and via an advertisement in The Age, a widely distributed Victorian newspaper. This population was reflective of the types of individuals likely to present to respiratory and sleep physicians in the wider Melbourne community in both private and public sectors. Given these sampling procedures, participants were more likely to have higher socioeconomic backgrounds than the general population. To allow clear inferences to be drawn from the sample population, demographic information was collected, including income and education level.

In order to minimise the waiting time for participants, a phased recruitment style was used. This was carried out by beginning a new recruitment phase ten weeks before the treatment was scheduled. Ideally, eight participants were enrolled with enough time to record six weeks of baseline data before the treatment started. This recruitment style allowed four groups to move through data collection with minimal waiting times.

8.1.4.2 Location

The groups were run at the Melbourne Sleep Disorders Centre (MSDC), located in East Melbourne, Victoria, Australia. MSDC is a privately run centre, housing physicians, scientists and psychologists specialising in sleep disorders.

8.1.4.3 Agreements and Payments Made to Participants

Participation in the study was not rewarded by monetary payments. This was clearly stated to participants in the enrolment procedure detailed below. However, participants did not pay for their treatment.
8.1.4.4 *Ethical Board Review*

The Royal Melbourne Institute of Technology (RMIT) University requires that all research is approved via the RMIT Human Research Ethics Committee (HREC). The HREC review research protocols and all relevant questionnaires, and consider if the project meets ethical standards. The RMIT HREC is accountable to the Pro-Vice-Chancellor (Research and Innovation), and the National Health and Medical Research Council (NHMRC) through the Australian Health Ethics Committee (AHEC). This project was approved by the RMIT HREC on 28 September 2010.

8.1.4.5 *Screening*

Subjects were screened in a two-part process, as detailed below.

8.1.4.5.1 *Part One*

Interested participants were contacted by the researcher, who gave an explanation of the study. Those still interested after hearing this explanation were assessed for overall eligibility for the study by administration of a brief telephone questionnaire (Appendix 11.2) to ensure that they met inclusion criteria, including the presence of insomnia and the ability to comply with the requirements of the protocol. The telephone screen provisionally assessed exclusion criteria such as major mental illness or the existence of another sleep disorder. If eligible, and willing to comply with the protocol, participants were booked in for an initial consultation with a respiratory and sleep physician, and the patient information and consent form was mailed to the potential participant to read prior to the second screening phase.

8.1.4.5.2 *Part Two*

During a consultation with a respiratory and sleep physician at the Melbourne Sleep Disorders Centre, participants were screened to see if they met the inclusion and exclusion criteria. First, the potential participants and study physicians discussed the requirements of
the trial and any questions the potential participant raised. If potential participants felt able to meet the requirements, they signed the patient information and informed consent form (PICF). A medical history and evaluation were then conducted by the sleep physician. In the case that potential participants were identified to have an untreated major mental illness or another untreated primary sleep disorder, they were referred to their local general medical practitioner or a sleep physician. A letter was sent to all eligible participants’ general medical practitioners informing them of their patient’s participation in the trial and asking them to report any changes in medication.

8.1.5 Attendance and Retention

In the circumstances where participants were unable to attend a one of the six treatment sessions, they were sent the homework and worksheets via email and encouraged to keep up with the group. In the results section, there are further details about attendance. Out of the participants recruited for this study, only four dropped out. The first withdrew before the commencement of the treatment group because her family had bought her a surprise ticket to travel overseas. The second participant withdrew after the fourth treatment session because she needed to have surgery on her shoulder, which had been increasing in pain during the four weeks of the treatment. She had not completed homework exercises including daily meditation or followed sleep consolidation instructions. The final two participants did not attend any treatment sessions. Both participants did not return any data and did not give a reason for withdrawing. Data from these four participants were not included in the overall analysis.

8.1.6 Sample Size Determination

A prospective power analysis based on the original pilot study (Ong et al., 2008b) was conducted in order to gain an estimate of the required sample size. The primary outcome variable, the ISI, was also used by Ong and colleagues (2008b), with results indicating a large
baseline to post-intervention treatment effect size \( (d = -1.32) \) with a sample size of 27. The power analysis was conducted using ‘G*Power’ (Erdfelder, Faul, & Buchner, 1996). Results indicated that a sample size of 24 would be able to provide 80% power to detect a large effect size \( (d = 0.8, \) which is considerably lower than that reported by Ong, et al.) This was based on a two-tailed test with \( \alpha = .05 \) and a pre- to post-treatment design. To account for attrition rates, the study aimed to recruit 30 participants.
8.1.7 **Recruitment and Intervention Dates**

Information regarding the procedure for recruitment can be found in Chapter 7. Table 5 provides information on the specific dates that define periods of recruitment, intervention and data collection and follow-up.

Table 5

**Dates of enrolment and treatment**

<table>
<thead>
<tr>
<th>Group Number</th>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Recording</td>
<td>30/11/2010 – 11/01/2011</td>
</tr>
<tr>
<td></td>
<td>Date of First Group</td>
<td>11/01/2011</td>
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<tr>
<td></td>
<td>Date of Last Group</td>
<td>15/02/2014</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
<td>15/05/2014</td>
</tr>
<tr>
<td>Group Two</td>
<td>Enrolment Period</td>
<td>15/02/2011 – 22/03/2011</td>
</tr>
<tr>
<td></td>
<td>Baseline Recording</td>
<td>22/03/2011 – 03/05/2011</td>
</tr>
<tr>
<td></td>
<td>Date of First Group</td>
<td>03/05/2011</td>
</tr>
<tr>
<td></td>
<td>Date of Last Group</td>
<td>07/06/2011</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
<td>07/09/2011</td>
</tr>
<tr>
<td>Group Three</td>
<td>Enrolment Period</td>
<td>03/05/2011 – 03/08/2011</td>
</tr>
<tr>
<td></td>
<td>Baseline Recording</td>
<td>22/06/2011 – 03/08/2011</td>
</tr>
<tr>
<td></td>
<td>Date of First Group</td>
<td>03/08/2011</td>
</tr>
<tr>
<td></td>
<td>Date of Last Group</td>
<td>07/09/2011</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
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</tr>
<tr>
<td></td>
<td>Date of First Group</td>
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</tr>
<tr>
<td></td>
<td>Date of Last Group</td>
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<tr>
<td></td>
<td>Follow-up</td>
<td>16/03/2012</td>
</tr>
</tbody>
</table>
8.2 Measures

Insomnia is diagnosed using subjective sleep complaints. A popular and reliable subjective measure of sleep quality, the Insomnia Severity Index (ISI), was selected as the primary outcome variable of this study. The original treatment development study (Ong et al., 2008b) also used the ISI as a primary outcome measure. Using the ISI allowed for comparisons to be drawn between the current study and many treatment outcome studies with insomnia samples. The ISI is described in more detail later in this chapter.

In addition to the ISI and other measures of subjective sleep quality, it was decided to include an objective measure of sleep. It is widely accepted that there is often discrepancy between subjective and objective measures of sleep in people with insomnia. This is thought to be due to the tendency people with insomnia have to overestimate sleep latency and time awake after sleep onset and to underestimate total sleep time (Harvey & Tang, 2012). Harvey and Tang (2012) provide a review of sleep state misperception. The addition of actigraphy as an objective measure of sleep allowed the current study to answer research questions about the participants’ objective sleep quality and subjective sleep quality before, during and after the intervention, and the relationship between objective and subjective sleep quality.

8.2.1 Subjective Sleep Quality

Subjective sleep outcomes for the study were assessed by the following questionnaires: the ISI (primary); the Pittsburgh Sleep Quality Index (PSQI); the Epworth Sleepiness Scale (ESS); and the Fatigue Severity Scale (FSS). The average sleep efficiency (SE), total wake time (TWT) and wake after sleep onset (WASO) were obtained from participants’ daily sleep logs.
8.2.1.1 *The Insomnia Severity Index (ISI)*

The ISI is a 7-item questionnaire in which participants’ perception of the severity of their sleep disruption is measured. Responses are recorded on a 5-point Likert scale (0 to 4) and match criteria in the *DSM-IV-TR* including: severity of sleep onset difficulties; sleep maintenance; early morning awakenings; satisfaction with current sleep patterns; interference with daily dysfunction; and, the degree of worry or distress experienced (Bastien et al., 2001). Scores are summed over the seven items and interpreted as follows: 0–7 = no clinically significant insomnia; 8–14 = sub-threshold insomnia; 15–21 = moderate clinical insomnia; and 22–28 = severe clinical insomnia (Morin, Belleville, & Belanger, 2006a). A 6 point reduction has been shown to represent a clinically meaningful improvement in individuals with insomnia (Yang, Morin, Schaefer, & Wallenstein, 2009). A significant reduction in insomnia severity as measured by the ISI has been associated with a decrease in health fatigue, work stress and depression (Yang et al., 2009). The ISI has a Cronbach’s α > .70 and good validity (Morin et al., 2006a) and is a useful outcome measure tool both clinically and for insomnia treatment research (Bastien et al., 2001).

8.2.1.2 *The Pittsburgh Sleep Quality Index (PSQI)*

The PSQI is a self-rated questionnaire that assesses sleep quality over a one-month time interval. There are 19 individual items, which generate scores on seven components (sleep quality, use of sleep medications, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance and daytime dysfunction) ranging from 0 to 3. The component scores are added to give a total score reflecting sleep quality (0–21). Higher scores reflect poorer sleep quality. In validation studies, a global PSQI score greater than five indicates poor sleep quality, including severe difficulties in two areas of sleep or moderate difficulties in three or more areas. The PSQI has good internal consistency (α = .83) and has been reported to be a valid, sensitive and specific measure of sleep quality (Buysse et al., 1989).
The PSQI includes items that are of interest in the current study. For example, participants rate the frequency of daytime symptoms as well as rating their opinion on the level of interference (ranging between ‘not a problem at all’ to ‘a very big problem’) of these daytime symptoms. These specific questions are important when evaluating the outcome of a treatment.

8.2.1.3 The Epworth Sleepiness Scale (ESS)

The ESS is a self-administered, 8-item questionnaire that measures perceived daytime sleepiness in adults in situations such as sitting down and reading, in a car stopped in traffic or during conversation (Johns, 1991). Items are measured on a 4-point scale ranging from 0 = no chance of dozing to 3 = high chance of dozing. Overall scores can range between 0 and 24. The reference range for Australian normal sleepers is between 0 and 10 with a mean of 4.6. Scores above 10 indicate clinically severe levels of sleepiness (Johns & Hocking, 1997). The ESS is a unidimensional scale with a high internal consistency (Cronbach’s α = .88) and is a very popular tool to measure sleepiness in many countries (Johns, 1992). Total ESS scores have been found to be significantly correlated with sleep latency measures, such as the multiple sleep latency test (MSLT). The ESS does not identify the cause of sleepiness and is not used as a diagnostic tool. However, it is a useful to provide specific information on sleepiness.

8.2.1.4 The Daily Sleep Log

The daily sleep log is completed upon waking and documents the SOL (recorded to the nearest 5 minutes), TST (recorded to the nearest 15 minutes), frequency of awakenings (total across night), time taken to return to sleep (to the nearest 5 minutes), and WASO (to the nearest 5 minutes). Sleep Efficiency (SE) is calculated as a percentage derived from total sleep time divided by total time in bed.
Two forms of sleep diary were used in the current study. The first was for the baseline period and the second for the treatment period. The second sleep diary included questions about meditation completed (type of meditation and duration) each day. This allowed a measure of compliance with homework tasks and investigation into meditation time and treatment outcomes.

8.2.2 **Objective Sleep Assessment**

The Actiwatch 2 by Phillips Respironics was used as an objective measure of sleep. Actigraphy has been used for over 25 years to assess sleep-wake behaviour (Blackwell et al., 2008). It utilises a single channel that collects data on movement and a sensor to record the amount and duration of ambient white light luminance, in units of lux. This information is then used to infer time spent asleep and awake. Although polysomnography (PSG) is the most widely used assessment device for measuring sleep, there are several advantages of using actigraphy over PSG in insomnia research. PSG involves approximately 20 different leads that are attached to the participant and can disrupt sleep (Blackwell et al., 2008).

![The Respironics Actiwatch-2.](image)

*Figure 6. The Respironics Actiwatch-2.*

The Actiwatch displayed in Figure 6 is non-intrusive, can be used over extended periods of time and is relatively cheap. PSG is costly and time consuming, particularly for chronic conditions such as insomnia. It has been suggested that actigraphy may be the more desirable option for measuring the sleep of insomnia suffers (Blackwell et al., 2008). For these reasons, actigraphy was chosen to measure objective sleep.
Participants were instructed to wear the Actiwatch-2 for the 12 weeks’ duration of their participation (six weeks extended baseline, plus six weeks’ intervention). They were asked to press the button on the watch when they turned out the lights to go to sleep and again when they woke in the morning. This created an event marker to assist validation. It was anticipated that participants would not always remember to push the button on the Actiwatch-2 to mark the beginning of the rest period. Actigraphy measures light using an inbuilt sensor. However, it may also pick up other light sources such as a TV or lamp. Research has suggested that SOL is not accurately measured by actigraphy (Buysse, 2008). Therefore, in the case that the participant did not remember to mark the beginning of their rest period, sleep diary information was used.

Output data derived from the actigraph included TST, SE and WASO, using the Actiware 5.5 software. These measures matched those collected in the sleep diary and allowed for direct comparison. Actiware 5.5 uses sleep-scoring algorithms to determine sleep from wakefulness. Taking into account the activity levels prior to, and after, the current minute, the algorithms determine if each time point should be coded as sleep or wake. Each data set was scored by the Actiware software, and then the raw data set was manually checked to ensure that the Actiware software did not misinterpret sleep as wake or wake as sleep. This was interpretation conducted by looking at patient determined markers of bedtime and rise time, sleep diary information and average latencies. Data that were not able to be interpreted as sleep or wake by automatic and manual scoring were excluded from analysis. This occurred once.

8.2.3 Secondary Outcome Measures

To answer the secondary research questions regarding the outcome of the treatment, the following secondary outcome measures were used.
8.2.3.1 *Quality of Life*

Health and wellbeing was evaluated by the Medical Outcome Survey (Rand SF-36), a 36-item measure of health-related quality of life, comprising eight subscales: physical functioning, role limitations because of physical health problems, bodily pain, social functioning, general mental health, role limitations because of emotional problems, and vitality (energy and fatigue; Ware & Sherbourne, 1992). The SF-36 is a reliable and valid measure for community-dwelling adults with published norms for Australian healthy and clinical populations (Hawthorne et al., 2007). Marossezeky (2005) presents a detailed report of all papers relating to validity and reliability for the SF-36.

The SF-36 was deemed to be an appropriate tool to further understand the impact of the treatment with respect to physical and emotional health. The subscales are useful in investigating if changes in major outcome variables have any correlation with a change in specific health outcomes as measured by the SF-36.

8.2.3.2 *Mood*

Mood and sleep are intimately related. Sleep (in particular REM sleep) plays a vital role in emotional regulation (Hetta et al., 1985). Accumulating research has identified insomnia to be a risk factor for the development of depression (Buysse, Germain, Nofzinger, & Kupfer, 2006a). It has been suggested that these overlapping features indicate insomnia and mood disturbances may arise from common neurobiological pathways (Buysse, Germain, Nofzinger, & Kupfer, 2006b). Recently, mindfulness treatment outcome studies have revealed a relationship between increased meditation and improved mood (Jimenez et al., 2010; Zeidan et al., 2010).

Mood was measured in the study by the Profile of Mood States (POMS; McNair, Lorr, & Droppleman 1971). The POMS consists of 65 adjectives describing mood. The POMS collects information regarding transient feelings occurring “during the past week,
including today” rather than on personality traits. Responses are constrained to one of five possibilities, ranging from “not at all” to “extremely”. The POMS standard form measures six factors (tension-anxiety, depression-dejection, anger-hostility, fatigue-inertia, vigour-activity, and confusion-bewilderment). This is a reliable and valid instrument, able to be repeated as frequently as weekly (Pollock, Cho, Reker, & Volavka, 1979). Moore, Stanley and Burrows (1990) present Australian normative data on the POMS, which was used in the analysis for the current study.

The Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) is a self-assessment scale designed for use in hospitals or outpatient settings. It is a 14-item questionnaire designed to assess symptoms of anxiety and depression. The HADS provides two subscales, one for anxiety (HADS-A) and one for depression (HADS-D). A review of the HADS reported a mean correlation between the two subscales of .56, and a mean Cronbach’s alpha of .83 for HADS-A and .82 for HADS-D (Bjelland, Dahl, Haug, & Neckelmann, 2002). The HADS has good reliability and validity. A score of 11 or higher indicates high probability of a mood disorder. The advantage of using the HADS over other common measures of depression (such as the Beck Depression Inventory) is that it excludes somatic features of depression. A sample of people with insomnia is likely to score higher on somatic elements of depression, which is likely to heavily influence the results.

A relationship between anxiety and SOL in people with insomnia has been suggested in recent research (Jansson-Fröjmark et al., 2011). This relationship suggests that worries have the potential to increase physiological arousal, thus leading the body to respond by remaining awake. Cognitive therapy has been successful in reducing sleep-related worry (Jansson-Fröjmark et al., 2011). However, there is limited research about the impact of MBSR on sleep-related anxiety. The principles of mindfulness, such as acceptance, letting
go, non-judgement and non-striving may reduce sleep-related anxiety. It was hypothesised in the current study that there would be a decrease in sleep-related anxiety post-intervention.

Specific anxiety relating to sleep was measured using the Anxiety and Preoccupation about Sleep Questionnaire (APSQ) (Tang & Harvey, 2004). The APSQ aims to collect information about a person’s sleep worries. The APSQ items are responded to on a 10-point scale that assesses how true each statement is over the past three days (1 = not true, 10 = very true). The reliability and validity of the questionnaire has been established (Jansson-Fröjmark et al., 2011).

Cognitive and physiological arousal have been linked with sleep difficulties (Jansson-Fröjmark & Linton, 2007). A recent study (Cincotta et al., 2011) suggested that a mindfulness based stress reduction intervention led to decreased pre-sleep arousal scores and insomnia severity. This preliminary study did not use a measure of mindfulness, so it is difficult to determine the relationship between pre-sleep arousal and mindfulness. This relationship may be an important element of insomnia treatment and requires investigation.

Arousal prior to sleep was measured using the Pre-Sleep Arousal Scale (PSAS) which has been shown to be a valid and reliable measure (Nicassio et al., 1985). It is comprised of 16 items rated on a 5-point scale (1 = not at all to 5 = extremely). Eight of the items measure somatic arousal (e.g., “cold feeling in your hands, feet or your body in general”), and the other eight measure cognitive arousal (e.g., “worry about falling asleep”).

8.2.3.3 Fatigue

Fatigue can be a chronic and disabling problem (Krupp, LaRocca, Muir-Nash, & Steinberg, 1989) and it is a common symptom of insomnia (Buysse et al., 2007). People with insomnia commonly use fatigue (or lack of fatigue) as a marker of their sleep quality. A recent study indicated that fatigue on awaking and during the day accounted for 84% of variance in self-assessed sleep quality in a sample of people with insomnia (Harvey, Stinson,
Whitaker, Moskovitz, & Virk, 2008). Although fatigue may indicate poor sleep in some cases, it is common that people with insomnia fail to acknowledge the fact that fatigue can be caused by a number of other factors such as diet, stress, health issues and anxiety (Krupp et al., 1989). A measurement of fatigue to evaluate this important symptom of sleepiness was identified to be a useful secondary outcome measure of the study.

Fatigue was measured using the Fatigue Severity Scale (FSS), which is a 9-item self-report questionnaire that asks the user to rate their level of agreement (on a 7-point Likert scale) with statements regarding their level of fatigue over the past week. The scale is used to rate the severity of fatigue symptoms (Krupp et al., 1989). The FSS has been validated in several populations including patients with multiple sclerosis, systemic lupus, and hepatitis C, and has been found to have adequate reliability and validity (Krupp et al., 1989).

8.2.3.4 Mindfulness

As explained in Chapter 4, measuring mindfulness has a variety of uses. In this study, it was important to identify if participants’ mindfulness improved over the course of treatment. A measure of mindfulness was thus important to include in the test battery in order to address the aims of the study. Mindfulness was measured using the Five Facet Mindfulness Questionnaire (FFMQ) (Baer et al., 2006), which is a 39-item self-report instrument that is based on a factor analytic study of five independently developed mindfulness questionnaires. The FFMQ assesses five aspects of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. The FFMQ was chosen as the questionnaire of preference based on the analysis provided in Chapter 7. It is a robust measure of mindfulness that allows independent parts of mindfulness to be looked at independently, and it was able to provide more information than any other mindfulness measure available when this study was conducted.
8.2.3.5 Monitoring

Compared with good sleepers, individuals with insomnia report more frequent monitoring of factors they fear may leave them more vulnerable to sleep difficulties, such as the clock, bodily sensations and environmental factors (Semler & Harvey, 2004). Mindfulness meditation aims to strengthen an individual’s ability to let go of distracting thoughts and to approach observations about the body (and other experiences) with an attitude of acceptance and non-judgement. One aspect of treatment aimed to explore the distinction between reaction and response, assisting individuals to consider their response to an observation. A measure of monitoring was required to explore potential changes in this area after the intervention.

Monitoring was measured by the Sleep Associated Monitoring Index (SAMI; Semler & Harvey, 2004). The SAMI is a 32-item self-report questionnaire, with items measured on a 5-point scale on which participants indicate what is true for them over the past month (1 = not at all, 5 = all the time). This test is considered a reliable and valid instrument to index monitoring for sleep-related threats (Semler & Harvey, 2004)

8.2.3.6 Predictors of Treatment Outcome

There is very little information regarding the types of people likely to benefit from a mindfulness-based treatment. One of the research questions of this study was to explore some factors that may be able to provide information on who would be suited to MBT-I. Demographic information and an assessment of personality were collected to assist with this research question. Although it was unclear if there would be sufficient power in the sample to give clear information about this, it was considered worthwhile to include as it may yield some information useful for future research.

There is some evidence that mindfulness delivered as part of dialectical behaviour therapy (DBT) is useful in working with aspects of borderline personality disorder, such as
impulsivity and inattention (Soler et al., 2012). There has also been suggestion that a lack of mindfulness may underpin some of the problematic symptoms of borderline personality disorder (Wupperman, Neumann, & Axelrod, 2008). Although research on this topic is extremely limited, there is a plausible argument for further exploration of personality traits and the treatment outcomes of mindfulness interventions. Chapter 4 contains a discussion of mindfulness and personality.

The 60-item, NEO-FFI version 3 (Costa & McCrae, 1992) was selected to measure personality. The NEO-FFI is a shortened version of the NEO PI-R that provides a quick and reliable measure of five domains of adult personality (openness, conscientiousness, extraversion, agreeableness and neuroticism). Participants score their agreement on a 5-point Likert-type scale ranging from ‘strongly agree’ to ‘strongly disagree’ in response to self-statements such as “I shy away from crowds of people”. The NEO-FFI-3 is commonly used in clinical practice and research. The reliability and validity of the NEO-FFI has been well established (Costa Jr & McCrae, 1997). The questionnaire battery for the second time-point (pre-treatment) can be found in Appendix 12.5.

8.2.3.7 Demographic Information

In addition to personality, it was anticipated that certain demographic factors may predict treatment outcomes. Demographic information on gender, marital status, employment and housing status, family income, drug and alcohol use, and past exposure to psychotherapy, CBT and mindfulness were collected. The demographic questionnaire can be found in Appendix 12.2.

8.2.4 Data Collection

Data were collected by the researchers and recorded on a case record form (CRF). De-identified data were entered into a secure computer database. The quality of the data was confirmed by randomly checking five per cent of the database against the CRFs.
### 8.2.5 Schedule of Assessments

**Table 6**

*Schedule for Data Gathered*

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<tr>
<th>Outcome Name</th>
<th>Outcome Focus</th>
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<th>Follow-up</th>
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<tr>
<td>SAMI Total</td>
<td>Sleep-associated Monitoring</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

*Note:* ISI = Insomnia Severity Index, PSQI = Pittsburgh Sleep Quality Index, ESS = Epworth Sleepiness Scale, APSQ = Anxiety and Preoccupation with Sleep Questionnaire, TST = Total Sleep Time, SE = Sleep Efficiency, WASO = Wake After Sleep Onset, SF-36 = SF-36 Health Questionnaire, POMS = Profile of Mood States, HADS = Hospital Anxiety and Depression Scale, PSAS = Pre-Sleep Arousal Scale, FSS = Fatigue Severity Scale, FFMQ = Five Facet Mindfulness Scale, SAMI = Sleep Associated Monitoring Index.
8.2.5.1 Facilitators

The thesis author was the primary facilitator for the treatment groups. She is a registered psychologist. At the commencement of the trial, she had three years’ clinical experience in numerous settings, such as groups and individual therapy, across a wide range of client groups. She practiced at St Vincent’s Hospital Sleep Disorders Centre and Melbourne Sleep Disorders Centre. She had also worked as a sleep scientist for seven years at the Austin Hospital.

Dr David Cunnington is a respiratory and sleep physician and a director at Melbourne Sleep Disorders Centre who trained in sleep medicine both in Australia and at Harvard Medical School in the United States. He has international qualifications in sleep medicine and the use of behavioural and psychological treatments in sleep and was also a facilitator in this study. Dr Moira Junge is a registered psychologist. She has twenty years’ experience in the healthcare sector and has worked in the sleep field since 1994. She is currently the Chairperson of the Australasian Sleep Association's Insomnia and Sleep Health Special Interest Group. Dr Junge uses cognitive behavioural therapy (CBT) techniques with her patients, as well as drawing on hypnosis, mindfulness, acceptance and commitment therapy (ACT), imagery rehearsal therapy (IRT), and her well-developed counselling skills. She was also an associate supervisor of the thesis author.

8.2.5.2 Additional members

For approximately one session for each group, an additional member affiliated with the Melbourne Sleep Disorders Centre was chosen to observe the group for education purposes. Participants were either students at RMIT University or advanced trainees in sleep medicine training at the Melbourne Sleep Disorders Centre. This was explained to group members and, at most times, the observer remained silent during the session.
8.2.6 Protocol

The protocol used in the current research was an amended version of that previously used by Ong and colleagues (Ong et al., 2008a; Ong et al., 2008b) and was provided by the author (Ong, personal communication, September 3, 2009). Changes were made to the protocol to allow the content to be covered in six sessions rather than eight. No original content was removed. Content removed included but adjustments included omission of repetition of meditations and a reduction in some meditation times and discussion sessions. The protocol can be found in Appendix 11.4.

8.3 Procedure

8.3.1 Stage One – Pre-treatment Data Collection

After participants were identified as suitable candidates, they attended an enrolment session. During this session they were given two packs comprising a) baseline questionnaires and b) actigraph and sleep diaries. Participants were instructed to complete the questionnaires on the day of their enrolment and return them via a reply-paid envelope. The initial battery of questionnaires included demographic information, the NEO-FFI, and the outcome questionnaire battery. Participants were asked to commence wearing the actigraph immediately, and were shown how to press the marker button when they intended to go to sleep. They were encouraged to continue to wear the actigraph consistently and only remove it if they feel it might be damaged. Participants were asked to fill out their sleep diary each morning. They were reminded not to watch the clock and to record their best estimate of their sleeping and waking times.

The enrolment interviews spanned four weeks. This was to: a) ensure the availability of the researchers, physicians, and potential participants; and b) minimise participant burden.
Participants were asked to attend one appointment during their baseline period to collect a charged actigraph. All other actigraph changeovers were conducted at the end of treatment sessions. As charging of actigraphs takes at least 24 hours and there were only three spare units, it was not possible to have more than three actigraphs due to be charged in the same week. The outcome of this was that several participants had longer baseline testing than others, however, all participants had a period of at least four weeks between enrolment and the beginning of the group.

8.3.2 Stage Two – Treatment

Participants were mailed the questionnaire battery to complete the night before their first group session. This allowed them to complete the questionnaires at home to fit in with their other commitments and did not require a visit the clinic two days in a row. Group sessions were held at the Melbourne Sleep Disorders Centre between 6pm and 8pm and occurred at weekly intervals. At the beginning of the first session, participants introduced themselves and explained what brought them to the program. Rules of the program were discussed, which included confidentiality and the avoidance of advice giving between group members. The reason for this was to ensure that it was clear this was a treatment group, not a support group. The protocol was strictly adhered to, including the timeframe, and topic areas.

In the original study using this protocol, there was moderate compliance with the meditation practice. Given the relationship between the number of meditation sessions and a reduction in hyperarousal, it was considered important to improve compliance for this study. Focus groups indicated that participants would like more guidance for meditation practice between sessions. It was also in the pilot study suggested that meditation practice CDs would be of benefit (Ong et al., 2008b).

During session three, there was a discussion about the potential to see behavioural and mindfulness components as contradictory. Participants were informed that the principals of
mindfulness (e.g., beginner's mind, patience and acceptance) would help them to adhere to these important principals, therefore giving them the best chance of good treatment outcomes.

Throughout each session, participants were given the opportunity to ask questions. These were answered by the thesis author, Dr David Cunnington or Dr Moira Junge. At the end of the fifth session, participants were given the questionnaires to fill out the night before the sixth session. They were given handouts to enhance their understanding of concepts, such as sleep consolidation. These handouts can be found in Appendix 12.4. During the final session, actigraphs and diaries were collected. As such, any change occurring after the final session is not detected in questionnaires. This decision was made to reduce participant burden and maximise the likelihood that participants would complete the set of questionnaires.

8.3.2.1 Sleep Consolidation

To ensure compliance with sleep consolidation instructions, the facilitator checked sleep diaries periodically over the course of treatment. In situations where a participant was spending longer than the prescribed amount of time in bed, they were given encouragement to continue with the instructions.

8.3.2.2 Session Overview

This section provides an overview of the six sessions that comprised the treatment program.

Session 1: Introduction and overview of program Estimated Time

1. Provide overview of the program rules, and participant expectations 10
2. Introductions 20
3. Introduce mindfulness 10
4. Eating meditation and inquiry 30
5. Sitting with breath meditation and inquiry 30
6. Model of insomnia 15
7. Homework and farewell 05

Session 2: Stepping out of automatic pilot

1. Body scan 30
2. Discussion about body scan 10
3. Walking meditation 20
4. Discussion about walking meditation 10
5. Establishing practice 15
6. Awareness and insomnia 25
7. Sleep hygiene (revision) 5
8. Homework and farewell 5

Session 3: Acceptance

1. Mindful movement (yoga) and inquiry 40
2. Sleep consolidation program 40
3. Acceptance and letting go 20
4. Poem 10
5. Homework and farewell 05

Session 4: Working with sleeplessness at night

1. Half-way point discussion 15
2. Stimulus control 20
3. Adjustment to sleep window 10
4. Territory of insomnia 30
5. Sitting meditation with emotions 20
6. Discussion 20
7. Homework and farewell 05

Session 5: Nurturing relationships with the self and sleep

1. Discussion 10
2. Three-minute breathing space and discussion 25
3. Meditation with choiceless awareness and discussion 20
4. Relationship with sleep 30
5. Nurturing/depleting exercise 30
6. Homework and farewell 05

Session 6: Eating, breathing, and sleeping mindfulness: Living the full catastrophe

1. Informal mindfulness mediation and group discussions 40
2. Breathing meditation inquiry and discussion 20
3. Overview of progress (group time) 10
4. Review and long-term goal setting 10
5. Action plan for insomnia 15
6. Closing ceremony (wisdom circle) 25

The complete treatment manual can be found in Appendix 12.3.
8.3.3 **Stage Three**

In the final session, a discussion covered recommendations to continue to practice mindfulness meditation, sleep consolidation and stimulus control. Participants were informed that they would be sent some questionnaires in three months’ time. They were asked to give feedback about their experience in the trial and what they felt were the most important parts of the treatment. This information is discussed in Chapter 9.

Follow-up questionnaires were sent out precisely three months after the final session, including an addressed, postage-paid envelope for return of the forms. Participants were given one courtesy telephone call to indicate this information had been sent. However, they were not given any further telephone calls if they did not choose to return the questionnaires.
CHAPTER 9: Results

9.1 Attendance

Two of the four groups had 100% attendance. In the other two groups, there were several participants who missed one or two treatment sessions, and one participant who missed three. In cases where a participant missed a session, a follow-up telephone call or email was issued with instructions for participants to keep them up-to-date with the program.

9.2 Participant Characteristics

Demographic characteristics for the 30 participants involved in the intervention are displayed in Table 7. The sample consisted of a high proportion of women, which is representative of the greater population of insomnia sufferers (Krishnan & Collop, 2006). The sample involved people from 18 to 77 years. Of interest is that 80% of the sample had private health insurance and the majority of the sample reported their highest level of education was an undergraduate or post-graduate university degree. The Australian Bureau of Statistics (ABS) identified that in 2011 to 2012, 52.7% of the Australian population had private health insurance (ABS, 2012), which is less than in the sample involved in this study. The sample is also more educated than the average Australian population, according to the ABS (2014). Together, these aspects indicate a somewhat higher socioeconomic status in the sample than that the average Australian population.
Table 7

Demographic characteristics of participants (N = 30)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>70.0</td>
</tr>
<tr>
<td>Age at the time of treatment</td>
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<td></td>
</tr>
<tr>
<td>18–27</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>28–37</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>38–47</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>48–57</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>58–67</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>68–77</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>English as first language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>29</td>
<td>96.4</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>3.6</td>
</tr>
<tr>
<td>Marital status</td>
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<td></td>
</tr>
<tr>
<td>Single</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>Married</td>
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<td>53.3</td>
</tr>
<tr>
<td>Live with partner</td>
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<td>10.0</td>
</tr>
<tr>
<td>Widowed</td>
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<td>3.3</td>
</tr>
<tr>
<td>No response</td>
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<td>6.7</td>
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<tr>
<td>Work situation</td>
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<tr>
<td>Part-time</td>
<td>7</td>
<td>23.3</td>
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<tr>
<td>Not employed</td>
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<td>16.7</td>
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<tr>
<td>No response</td>
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<td>3.3</td>
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<td>Annual household income</td>
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<td>10.0</td>
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<td>$75,000–$100,000</td>
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</tr>
<tr>
<td>Over $100,000</td>
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<td>33.3</td>
</tr>
<tr>
<td>Prefer not to say</td>
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<td>13.3</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>6.7</td>
</tr>
</tbody>
</table>
Table 7

Demographic characteristics of participants (N = 30) (cont.)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Housing</strong></td>
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<td></td>
</tr>
<tr>
<td>Rented house</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>Owned house</td>
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</tr>
<tr>
<td>Other</td>
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<td>3.3</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Health insurance</strong></td>
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<tr>
<td>Private health insurance</td>
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</tr>
<tr>
<td>No private health insurance</td>
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<td>10.0</td>
</tr>
<tr>
<td>No response</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Number of caffeinated drinks per week</strong></td>
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<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>1–7 (1 or less per day)</td>
<td>8</td>
<td>26.7</td>
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<tr>
<td>8–14 (2 or less per day)</td>
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<td>33.3</td>
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<tr>
<td>15–21 (3 or less per day)</td>
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<td>16.7</td>
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<tr>
<td>22–30</td>
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<td>6.7</td>
</tr>
<tr>
<td>30–38</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>No response</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
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<tr>
<td>Non-smoker</td>
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<td>83.3</td>
</tr>
<tr>
<td>Smoker</td>
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<td>13.2</td>
</tr>
<tr>
<td><strong>Alcohol status</strong></td>
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<td></td>
</tr>
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</tr>
<tr>
<td>Drinker</td>
<td>22</td>
<td>73.3</td>
</tr>
<tr>
<td>Missing</td>
<td>3</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Note. Demographic data were collected at intake.

9.3 Compliance

9.3.1 Meditation

The average number of minutes of mediation per day, for all participants, was calculated for the five weeks of treatment (with session six marking the end of treatment). Participants were instructed to meditate on six days each week for a particular duration of
time, which ranged between 15 and 35 minutes. Table 8 presents the mean duration of time participants were instructed to perform meditation, along with means and standard deviations for the actual meditation duration participants reported in their diaries. Although this analysis is not precise, it provides an overview of the compliance with weekly meditation. The results of this analysis indicates that, on average, participants meditated more than instructed, with the exception of Week 5. It was therefore assessed that overall compliance with meditation instructions was adequate.

Table 8

*Compliance with meditation instructions*

<table>
<thead>
<tr>
<th>Week</th>
<th>Instructed Duration (min per day)</th>
<th>Actual Duration (min per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>(SD)</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

9.4 Data Assumption Testing

9.4.1 Normality and Homogeneity of Variance

Exploratory data analyses involved visual inspection of stem-and-leaf and normality plots, and assumption testing procedures on all scale measures were performed to ensure that there were no serious violations of the assumptions underlying parametric procedures. Specifically, assumption testing focused on assessing normality, linearity and homogeneity of variance. Although many variables demonstrated some degree of skew, in no case was this considered serious enough to warrant either transformation or the use of non-parametric
procedures. Homogeneity of variance was assessed across phases using Levene’s test, and was met for all outcome measures; hence, parametric procedures were considered appropriate. Adequate linearity was evident for all variables. Some outliers were identified, however, in all instances, these were evaluated as legitimate scores rather than the result of identifiable sources of error, and so were retained in analyses, particularly given their minimal impact on normality.

9.4.2 Management of Missing Data

There were some issues with missing data due to problems with the actigraphy recording. Over 50% of the 13 actigraphs failed and were replaced with new actigraphs during the period of data collection. This resulted in 50% of participants missing a period of four weeks of objective recording. The second issue of missing data was that the Profile of Mood States (POMS) was only collected for the first two groups. This was because several participants in the first two groups had commented on the burden of the time required to complete the questionnaire. Given that the POMS is a long questionnaire and was related to an exploratory question, it was decided to remove this questionnaire for the second two groups. Aside from the POMS and the actigraphy data, it was estimated that the remainder of the missing data was less than 5%, and was randomly distributed and spread evenly across the variables.

With the large amount of missing data for the actigraphy recording and the POMS, any form of missing value estimation would be inappropriate for those two variables (Graham, 2009). Even though the patterns of missing data for the other outcome variables met the assumptions for missing value estimation, it was decided for a number of reasons to evaluate the main outcome variables on an intention-to-treat (ITT) basis using linear mixed modelling, rather than impute missing values (see Twisk, 2006, and Gelman and Hill, 2007, for a discussion of these issues and relevant recommendations). First, the use of linear mixed
modelling meant that the same procedure could be used for all outcome measures, bringing a measure of consistency to the analyses. Second, linear mixed modelling permitted the assessment of a range of covariance structures for model fitting. Third, unlike general linear modelling, linear mixed modelling does not require complete data across all phases in order for a case to be included in analysis, hence, all data can be incorporated. Finally, simulation of analyses on some selected outcome variables using multiply imputed data failed to reveal any notable differences in outcomes, so it was felt that an ITT analysis with no imputed data using linear mixed models represented a more ‘honest’ approach to data analysis.

9.4.2.1 Repeated Measures ANOVAs and Trend Analyses

To investigate the pattern of change for the outcome variables that were measured over three time points (averaged baseline, post-treatment, follow-up scores), linear mixed modelling was used to model orthogonal polynomial (trend analyses) growth curves across the three intervention time points (Twisk, 2006; Gelman and Hill, 2007). Averaged baseline was calculated by creating a new variable that was equal to the average of the two baseline scores (intake and pre-treatment). Given the sequential nature of the independent variable (i.e., phase), and the design of the study, trend analysis was seen as more informative than an analysis of mean differences, an approach endorsed by Keppel (1991) and Kirk (2013).

Goodness-of-fit indices indicated that a covariance structure based on compound symmetry generally provided the best fit for the linear mixed models. As three time points were used for the analyses, only linear and quadratic trends could be investigated. If a linear or quadratic trend was found to be significant, pairwise comparisons using paired sample t-tests with Bonferroni adjusted \( \alpha \) values were conducted as a post-hoc procedure in order to clarify the nature of the significant trend. These compared baseline and post-treatment, post-treatment and follow-up, and baseline and follow-up.
For those outcome variables that were measured at only two time points, single-factor within-subjects ANOVAs were used to test for mean differences. Interpretation of effect sizes are based on Hopkins’ guidelines (Hopkins, 2002). Hopkins recommends the following range for interpretation of $\eta^2$: small: $\eta^2 = .01$; moderate: $\eta^2 = .10$; large: $\eta^2 = .25$; very large: $\eta^2 = .5$; nearly perfect: $\eta^2 = .75$; perfect: $r^2 = 1$ (Hopkins, 2002).

Because of the large number of inferential tests conducted, all of the trend analyses reported were evaluated against Bonferroni adjusted $\alpha$ values, which were calculated automatically by SPSS. Although this does not reflect a full Bonferroni correction across the complete family of comparisons making up the suite of analyses, it was felt that a) a full Bonferroni correction would be too conservative, and b) adopting a corrected $\alpha$ level per analysis (which corresponds approximately to $\alpha < .01$) would provide a reasonable level of protection against over-inflation of the familywise error rate. Descriptive statistics can be seen in Table 9 and the results for the trend analyses are located in Table 10.

### 9.5 Results

This section displays the results of the analysis in the following order: descriptive statistics, main trend analysis, summary of trend analysis, primary outcome, secondary outcomes, correlational analysis, and qualitative research outcomes.
Table 9

Descriptive statistics for outcome measures across phases

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Post-Treatment</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Sleep ISI (Main Outcome)</td>
<td>17.75</td>
<td>3.40</td>
<td>12.25</td>
</tr>
<tr>
<td>Sleep Outcomes PSQI Subjective Sleep Quality</td>
<td>2.16</td>
<td>0.83</td>
<td>1.42</td>
</tr>
<tr>
<td>PSQI Sleep Latency</td>
<td>1.73</td>
<td>1.01</td>
<td>1.30</td>
</tr>
<tr>
<td>PSQI Sleep Duration</td>
<td>2.04</td>
<td>0.71</td>
<td>1.78</td>
</tr>
<tr>
<td>PSQI Habitual Sleep Efficiency</td>
<td>1.93</td>
<td>0.94</td>
<td>1.15</td>
</tr>
<tr>
<td>PSQI Sleep Disturbances</td>
<td>1.48</td>
<td>0.44</td>
<td>1.22</td>
</tr>
<tr>
<td>PSQI Use of Sleeping</td>
<td>1.71</td>
<td>1.10</td>
<td>0.96</td>
</tr>
<tr>
<td>Sleep Diary TST (hours)</td>
<td>5.99</td>
<td>1.20</td>
<td>5.72</td>
</tr>
<tr>
<td>SE (%)</td>
<td>72.41</td>
<td>13.85</td>
<td>80.04</td>
</tr>
<tr>
<td>WASO (mins)</td>
<td>63.33</td>
<td>21.22</td>
<td>31.62</td>
</tr>
<tr>
<td>SOL (mins)</td>
<td>44.75</td>
<td>41.29</td>
<td>32.34</td>
</tr>
<tr>
<td>Number of Awakenings</td>
<td>2.25</td>
<td>1.30</td>
<td>1.76</td>
</tr>
<tr>
<td>Actigraphy TST (hours)</td>
<td>6.08</td>
<td>0.76</td>
<td>5.37</td>
</tr>
<tr>
<td>SE (%)</td>
<td>74.82</td>
<td>9.05</td>
<td>79.29</td>
</tr>
<tr>
<td>SOL (mins)</td>
<td>14.52</td>
<td>9.85</td>
<td>7.15</td>
</tr>
<tr>
<td>WASO</td>
<td>97.99</td>
<td>49.47</td>
<td>73.14</td>
</tr>
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</table>
Table 9

Descriptive statistics for outcome measures across phases (cont.)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Post-Treatment</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Quality of Life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF-36 Physical</td>
<td>77.68</td>
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<td>84.44</td>
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<tr>
<td>SF-36 Role Limits</td>
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<td>40.03</td>
<td>68.52</td>
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<tr>
<td>SF-36 Role Limits</td>
<td>82.72</td>
<td>35.05</td>
<td>83.95</td>
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<td>Emotional</td>
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<td></td>
<td></td>
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<tr>
<td>SF-36 Energy</td>
<td>41.49</td>
<td>17.99</td>
<td>52.59</td>
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Descriptive statistics for outcome measures across phases (cont.)

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Note. ISI = Insomnia Severity Index, PSQI = Pittsburgh Sleep Quality Index, ESS = Epworth Sleepiness Scale, APSQ = Anxiety and Preoccupation with Sleep Questionnaire, TST = Total Sleep Time, SE = Sleep Efficiency, WASO = Wake After Sleep Onset, SF-36 = SF-36 Health Questionnaire, POMS = Profile of Mood States: T = Tension-Anxiety, D = Depression-Dejection, A = Anger-Hostility, F = Fatigue-Inertia, C = Confusion-Bewilderment, V = Vigour-Activity; HADS = Hospital Anxiety and Depression Scale, PSAS = Pre-Sleep Arousal Scale, FSS = Fatigue Severity Scale, FFMQ = Five Facet Mindfulness Scale, SAMI = Sleep Associated Monitoring Index – Components: 1 = Pre-sleep monitoring for body sensations consistent with falling asleep, 2 = Pre-sleep monitoring for body sensations inconsistent with falling asleep, 3 = Pre-sleep monitoring the environment, 4 = Pre-sleep monitoring the clock, 5 = Calculation of time, 6 = Waking monitoring for body sensations, 7 = Daytime monitoring of body sensations, 8 = Daytime monitoring of functioning.
9.5.1 **NEO Personality Inventory**

Participant scores for the NEO Personality Inventory were as follows: Neuroticism: $M = 53.69$, $SD = 12.60$; Extroversion: $M = 46.93$, $SD = 11.50$; Openness to Experience: $M = 53.45$, $SD = 9.59$; Agreeableness: $M = 50.62$, $SD = 9.14$; Conscientiousness: $M = 49.86$, $SD = 11.23$. 
Table 10

Analysis of orthogonal polynomials and overall ANOVAs

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$\eta^2$ denotes the effect size and (95% CI) denotes the 95% confidence interval.
### Table 10

*Analysis of orthogonal polynomials and overall ANOVAs (cont.)*

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Table 10

*Analysis of orthogonal polynomials and overall ANOVAs (cont.)*

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*Note:* ISI = Insomnia Severity Index, PSQI = Pittsburgh Sleep Quality Index, ESS = Epworth Sleepiness Scale, APSQ = Anxiety and Preoccupation with Sleep Questionnaire, TST = Total Sleep Time, SE = Sleep Efficiency, WASO = Wake After Sleep Onset, SF-36 = SF-36 Health Questionnaire, POMS = Profile of Mood States, HADS = Hospital Anxiety and Depression Scale, PSAS = Pre-Sleep Arousal Scale, FSS = Fatigue Severity Scale, FFMQ = Five Facet Mindfulness Scale, SAMI = Sleep Associated Monitoring Index – Components: 1 = Pre-sleep monitoring for body sensations consistent with falling asleep, 2 = Pre-sleep monitoring for body sensations inconsistent with falling asleep, 3 = Pre-sleep monitoring the environment, 4 = Pre-sleep monitoring the clock, 5 = Calculation of time, 6 = Waking monitoring for body sensations, 7 = Daytime monitoring of body sensations, 8 = Daytime monitoring of functioning.
Table 11

*Summary of orthogonal polynomials and overall ANOVAs*

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<th>Outcome Name</th>
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*Note.* * Denotes variables collected at baseline and post-treatment only. Significant or non-significant overall ANOVA is displayed for variables that were only collected at two time points. The subscales are not displayed for variables that have a total score; refer to Table 10 for the detailed findings. ISI = Insomnia Severity Index, PSQI = Pittsburgh Sleep Quality Index, ESS = Epworth Sleepiness Scale, APSQ = Anxiety and Preoccupation with Sleep Questionnaire, TST = Total Sleep Time, SE = Sleep Efficiency, WASO = Wake After Sleep Onset, SF-36 = SF-36 Health Questionnaire, POMS = Profile of Mood States, HADS = Hospital Anxiety and Depression Scale, PSAS = Pre-Sleep Arousal Scale, FSS = Fatigue Severity Scale, FFMQ = Five Facet Mindfulness Scale, SAMI = Sleep Associated Monitoring Index

Data in Table 11 displays a summary of the outcomes from the analysis of orthogonal polynomials. As reflected in this table, there were many significant results across a range of
treatment outcomes. There were 11 significant quadratic trends, 6 significant linear trends, and 5 significant overall ANOVAs, along with 5 non-significant changes. Many of these outcome variables, such as the ISI, PSQI and the APSQ reveal that the data significantly fit both a linear and quadratic trend. When this was the case, the highest order significant trend (i.e., the quadratic trend) was the focus of interpretation. These findings generally indicate that the outcomes significantly increased or decreased across the three time points, with an increase or decrease in the slope of this change between post-treatment and follow-up. In these cases, the change tended to flatten off between post-treatment and follow-up.

The majority (92.86%) of sleep-related variables changed significantly over time. All of these changes were in the desired direction, except TST, which decreased rather than increased. Sleep-related outcome changes were robust, with effect sizes ranging from moderate (TST $\eta^2 = .10$) to very large (ISI $\eta^2 = .68$). There were also significant changes in variables selected to assess daytime symptoms of sleep disturbance including fatigue and mood, reflected by modest effect sizes, ranging between small (HADS Depression $\eta^2 = .15$) to moderate (FSS $\eta^2 = .27$).

To clarify the changes, a series of post hoc, pairwise comparisons were conducted on those variables where a significant result was evident. A significant quadratic trend was associated with a significant improvement in scores between baseline and post-treatment, in 13 of 18 primary variables. Six variables were found to be significantly different between baseline and follow-up. Only one variable (HADS Depression), was significantly different between post-treatment and follow-up, which reflected a regression in symptoms of depression. Overall, change occurred between baseline and post-intervention, but not generally between post-intervention and follow-up. This reflects a pattern of change, where changes persisted, but didn’t increase once intervention ceased. A summary of these
comparisons is shown in Table 12 followed by a series of graphs displaying the means and standard error bars for significant trends.
Table 12

Summary of post hoc pairwise comparisons for outcome variables

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<th>Post-Intervention – Follow-up</th>
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Table 12

Summary of post hoc pairwise comparisons for outcome variables (cont.)

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Note. ISI = Insomnia Severity Index, PSQI = Pittsburgh Sleep Quality Index, ESS = Epworth Sleepiness Scale, APSQ = Anxiety and Preoccupation with Sleep Questionnaire, TST = Total Sleep Time, SE = Sleep Efficiency, WASO = Wake After Sleep Onset, RSF36 = Rand SF-36 Health Questionnaire, POMS = Profile of Mood States: T = Tension-Anxiety, D = Depression-Dejection, A = Anger-Hostility, F = Fatigue-Inertia, C = Confusion-Bewilderment, V = Vigour-Activity; HADS = Hospital Anxiety and Depression Scale, PSAS = Pre-Sleep Arousal Scale, FSS = Fatigue Severity Scale, FFMQ = Five Facet Mindfulness Scale, SAMI = Sleep Associated Monitoring Index – Components: 1 = Pre-sleep monitoring for body sensations consistent with falling asleep, 2 = Pre-sleep monitoring for body sensations inconsistent with falling asleep, 3 = Pre-sleep monitoring the environment, 4 = Pre-sleep monitoring the clock, 5 = Calculation of time, 6 = Waking monitoring for body sensations, 7 = Daytime monitoring of body sensations, 8 = Daytime monitoring of functioning, NEO = Revised NEO Personality Inventory.
9.6 Primary Outcome – The Insomnia Severity Index

The mean scores for insomnia severity as measured by the Insomnia Severity Index (ISI) are presented in Figure 7. A significant linear trend was found for this variable, indicating a pattern of ongoing reduction in symptoms across three phases. Post hoc testing revealed significant reductions in insomnia severity between baseline and both post-intervention and follow-up, but no significant difference between baseline and follow-up, despite the significant linear trend and the descriptive indication of an ongoing reduction of symptoms at follow-up.

Figure 7. Insomnia severity across phases.
9.7 Secondary Sleep Outcomes

9.7.1 Pittsburgh Sleep Quality Index

Sleep quality was measured using the PSQI and changed significantly over time. Both linear and quadratic trends were significant (Table 10). The significant quadratic trend reflects an initial baseline to post-treatment reduction, reversing slightly from post-treatment to follow-up. This was reflected in the post hoc results, which revealed a significant difference between baseline and post-treatment scores, and also between baseline and follow-up. There was no difference between post-treatment and follow-up. Figure 8 displays the means and standard error for sleep quality over time. Figure 9 shows a detailed analysis of the contribution of each component score to overall sleep quality, showing that some components changed more than others.

![Figure 8. PSQI Scores across phases.](image)
Figure 9. PSQI total score and component scores across phases.

9.7.2 The Daily Sleep Log

Sleep was also assessed using sleep diaries to measure subjective sleep, alongside actigraphy as an objective measure. These daily data were averaged weekly into measures of total sleep time (TST), sleep onset latency (SOL), wake after sleep onset (WASO), number of awakenings (NWAK; diaries only) and sleep efficiency (SE). Comparisons were made between three time points: baseline, post-treatment and follow-up. Sleep diary and actigraphy data were averaged during the baseline period, which became the baseline time point. Post-treatment scores consist of sleep diaries and actigraphy during Week 5 of treatment. Follow-up scores reflect the average of two weeks of sleep diaries collected at follow-up. There were
no follow-up actigraphy recordings. Figure 10 displays mean and standard error for the sleep diary variables and Figure 11 displays the mean and standard errors for objective sleep variables collected using actigraphy.

There were significant improvements across all sleep variables, except for total sleep time. The significant quadratic trends for TST, SOL, WASO and NWAK reflect a reduction between baseline and follow-up, reversing slightly from post-treatment to follow-up. The significant quadratic trend for SE reflects the opposite, showing an initial increase followed by a slight reversing of SE between post-treatment to follow-up. Post hoc comparisons indicated that SE increased significantly between baseline and post-treatment on both objective and subjective measurements. Post hoc tests indicated that SO and WASO decreased significantly between baseline and post-treatment for both objective and subjective measures.

For all subjective measurements, there was no difference between post-treatment and follow-up, despite the significant linear trends (TST, SE, WASO, SOL) and the descriptive indication of an ongoing improvement of symptoms at follow-up. Objective measures were not included in this analysis, as there were no objective sleep measurements at follow-up. Both objective and subjective total sleep time decreased significantly between baseline and post-treatment, which was in the opposite direction than expected.
Figure 10. Subjective sleep variables across time.
Figure 11. Objective sleep variables across time.
9.7.3 **Sleepiness and Fatigue**

Fatigue was measured using the Fatigue Severity Scale (FSS). There was a significant quadratic trend associated with a moderate treatment effect, as displayed in Figure 12. This trend appears to be reflective of a reduction of fatigue between baseline and post-treatment, with a slight increase in fatigue at follow-up. This was supported by post hoc comparisons, which revealed a significant difference between baseline and post-treatment, but not between baseline and follow-up. The increase in fatigue between post-treatment and follow-up was not significant.

![Fatigue severity scale across time](image)

*Figure 12. Fatigue severity scale across time.*

Sleepiness was measured by the Epworth Sleepiness Scale. There was no change in sleepiness detected.
9.7.4 Anxiety and Depression

9.7.4.1 The Hospital Anxiety and Depression Scale (HADS)

The HADS was used to assess symptoms of anxiety and depression. There was a significant quadratic trend, which reflected a reduction in depression between baseline and post-treatment, followed by a return of depressive symptoms at follow-up. This trend is displayed in Figure 13. Post hoc testing revealed that the only significant difference was between post-treatment and follow-up. While depression scores increased significantly between post-treatment and follow-up, they did not change between baseline and follow-up, meaning that participants did not develop symptoms of depression, but rather that their symptoms reduced and then increased following the treatment.

Figure 13. HADS depression score across time.

The anxiety component of the HADS did not significantly change throughout the treatment.
9.7.4.2 **Anxiety and Preoccupation with Sleep Questionnaire (APSQ)**

Specific anxiety and preoccupation with sleep was assessed using the APSQ. Both linear and quadratic trends were significant. The quadratic trend reflects an initial reduction in anxiety and preoccupation with sleep, followed by a period of stable anxiety and preoccupation with sleep following the treatment. This trend is displayed in Figure 14. Post hoc comparisons investigating the difference between each phase indicated that anxiety and preoccupation with sleep decreased significantly between baseline and post-treatment, but did not change between post-treatment and follow-up. This is reflective of maintenance of treatment gains.

*Figure 14. Anxiety and preoccupation with sleep questionnaire across time.*
9.7.5 Quality of Life

Quality of life was measured by the SF-36 (SF-36). This is comprised of 36 items that assess eight health concepts: physical functioning, role limitations caused by physical health problems, role limitations caused by emotional problems, social functioning, emotional wellbeing, energy, pain, and general health perception. Only one of the subscales (energy) changed significantly over time, and was associated with a moderate treatment effect. This change was associated with a significant linear trend, which reflected an overall increase in energy across the time periods. This trend is displayed in Figure 15. This was reflected in post hoc comparisons, which identified a significant increase in energy between baseline and post-treatment scores.

Figure 15. SF-36 energy score across time.
9.7.6 **Sleep-Related Monitoring**

Monitoring of internal and external stimuli related to sleep is a central aspect of the cognitive model of insomnia, whereby increased focus increases alertness and impairs a person’s ability to shift into sleep (Semler & Harvey, 2004). Monitoring was measured by the Sleep Associated Monitoring Index (SAMI; Semler & Harvey, 2004). Results of the analysis revealed a significant quadratic trend, which appears to be associated with an initial decrease in sleep-associated monitoring, followed by a slight increase in sleep-related monitoring between post-treatment and follow-up. This trend is displayed in Figure 16. The quadratic trend was associated with a small to moderate treatment effect size. Post hoc comparisons indicated there was a significant decrease in sleep-related monitoring between baseline and post-treatment. There was no difference between baseline and follow-up or post-treatment and follow-up.

*Figure 16. Sleep-related monitoring score across time.*
9.7.7 Arousal

The rationale for including mindfulness as a treatment for insomnia is heavily influenced by the arousal model of insomnia. While there were no changes identified in the assessment of somatic arousal across the three phases, there was a significant quadratic trend identified for cognitive arousal. This trend appears to be reflective of an initial reduction in cognitive arousal between baseline and the cessation of treatment, followed by a slight increase in cognitive arousal between post-treatment and follow-up. The trend is displayed in Figure 17. This was supported by post hoc comparisons, which revealed a significant baseline to post-treatment reduction in cognitive arousal with no change found at follow-up.

Figure 17. PSAS (Cognitive) across time.
9.7.8 Mindfulness

There were no significant trends for the overall score for mindfulness. Even though no significant trends were found for this variable, it is worth noting that post hoc testing revealed a significant increase between baseline and post-treatment in non-reactivity to inner experience. This is shown by the lower solid grey line in Figure 18.

*Figure 18. FFMQ across time.*
9.7.9 **Mood**

Mood was measured by the Profile of Mood States (POMS; McNair, Lorr & Droppleman 1971). As the POMS was only measured at two time points, a one-way, repeated measures analysis of variance was used to identify if there was a difference across time. This is displayed in Figure 19. There was a significant difference over time as determined by one-way ANOVA with a small treatment effect indicating an increase in total mood disturbance (TMD) between baseline and post-treatment.

*Figure 19. POMS (TMD) across time.*
9.8 Clinical Significance

To assess the clinical significance of MBT-I, the five outcome measures with available clinical cut-off scores were evaluated. Clinical cut-offs were obtained for: the ISI (Morin et al., 2011b) and the PSQI (Buysse et al., 2008b) to evaluate insomnia severity and sleep quality respectively; the HADS anxiety and depression subscales (Bjelland et al., 2002; Zigmond & Snaith, 1983); and the POMS total mood disturbance (Moore, Stanley, & Burrows, 1990; Nyenhuis, Yamamoto, Lucheta, Terrien, & Parmentier, 1999). For these selected measures, baseline scores were plotted against post-treatment scores, with solid lines defining the clinical cut-off score and dotted lines defining the range of standard error of measurement, which was obtained from the available normative data from each test. Data points above the diagonal line indicate that scores got worse and data points below the line indicate improvement. To meet the criteria for clinically significant change, a person’s scores needed to be reliably above the clinical cut-off at baseline, and reliably below the clinical cut-off after treatment. Data points in the bottom right corner below the dotted lines indicate a person’s score improving clinically; these are represented by open circles. These are displayed in Figures 20 to 24. For the primary outcome measure, an analysis of the change scores (post-treatment scores, subtracted from baseline scores) is presented.

Results of the clinical investigation into the primary outcome, the ISI, indicated that four out of 25, or 16% of participants, moved from reliably measured clinically significant insomnia severity to a post-treatment score of insomnia severity which was reliably below the clinical cut-off. An investigation into clinical effectiveness for the ISI over the follow-up period was conducted, given that this was the primary outcome variable. This evaluation identified five out of 14, or 36% of participants met the criteria for reliable clinically significant insomnia severity at the three-month follow-up.
Investigation into the clinical significance of the PSQI changes revealed that three participants moved from clinically problematic sleep quality to fall below the clinical cut-off.
This equated to three out of 25 participants, or 12%. One participant experienced increases in scores of sleep quality. The remainder of participants improved, but did not reach clinical improvement.

The majority of participants did not have clinically significant levels of depression at baseline as assessed by the HADS. Out of the six participants (23%) who had clinically significant depression at baseline, two (8%) moved under the clinical cut-off. Anxiety was also assessed using the HADS. Sixteen participants’ anxiety levels reduced between baseline to follow-up (62%). Four out of 26 participants (15%) improved from clinically significant anxiety to fall below the clinical cut-off at baseline. No participants moved from below to above the clinical cut-off.

Total mood disturbance was measured for the first two groups, with data available for 13 participants. The clinical cut-off for total mood disturbance was selected to be the upper limit of the first quartile. Of the 13 participants, two (15%) moved from above to below the clinical cut-off. Eight participants reported a reduction in mood disturbance, and one remained the same. The four participants who regressed remained under the clinical cut-off.
Figure 21. PSQI clinical change.

Figure 22. HADS depression clinical significance.

Figure 23. HADS anxiety clinical change.

Figure 24. POMS total mood disturbance clinical change.
9.9 **Intercorrelations**

Bivariate correlations were conducted to investigate the direction and magnitude of the linear relationships between the change scores for all variables. Change scores were calculated by subtracting post-treatment scores from baseline scores. Bivariate correlations were also conducted to investigate the relationships among a range of variables associated with treatment change as identified in Chapter 5. The outcome of this analysis is grouped and presented in separate tables due to the large number of variables. Table 13 displays the intercorrelations among the change scores of sleep variables, Table 14 presents the intercorrelations among change scores of sleep variables and change scores for mood, anxiety, depression and arousal scores, and Table 15 presents intercorrelations among change scores of mood, anxiety, depression and arousal scores. There were a number of significant relationships detected.

9.9.1 **Variables Related to Improvement**

One of the aims of this study was to explore the relationships between engagement with treatment and improvement in insomnia severity. This was largely driven by observations in clinical practice that there are specific types of people who do not respond well to mindfulness treatment, often because they seem opposed to the principles of mindfulness. As an exploration, personality and several socioeconomic demographic variables were explored as predictors of change in insomnia severity. Table 16 and Table 17 display intercorrelations among predictors of change and change scores for outcome variables.
9.9.1.1 Correlations with the ISI

Changes in insomnia severity were moderately correlated with subjective sleep efficiency (as measured by sleep diaries) and energy (a subscale of the SF-36). This indicates that larger changes in insomnia severity were associated with larger changes in energy and subjective sleep efficacy. There was a moderate to strong negative correlation between changes in insomnia and change scores for the ISI and PSQI. People who had a higher change in insomnia severity had lower changes in sleep quality. Larger changes on the ISI were also significantly related to smaller changes in anxiety and preoccupation with sleep, objective total sleep time, and objective wake after sleep onset. One variable, conscientiousness, was negatively correlated with insomnia severity. People who scored higher on conscientiousness demonstrated lower change scores for insomnia severity.

9.9.1.2 Correlations with the PSQI

Change scores on the PSQI were moderately positively correlated with anxiety and preoccupation with sleep, subjective wake after sleep onset and number of awakenings, and objective wake after sleep onset. This suggests that greater improvements in sleep quality were more likely to occur in the presence of greater improvements in anxiety and preoccupation with sleep, number of awakenings, and the amount of time awake at night.

Greater changes in sleep quality were moderately correlated with lower scores for objective and subjective sleep efficiency, suggesting that people who demonstrated greater improvements in sleep quality were less likely to experience improvements in sleep efficiency. No variables were significantly related to improvement in sleep quality.

9.9.1.3 Other Notable Correlations

Another notable correlation was the positive moderate to strong relationship between change scores on sleepiness and change scores of anxiety (as measured by the HADS), and sleepiness and overall distress (as measured by the POMS). Participants who demonstrated
greater improvements in sleepiness were more likely to do so in the context of greater improvements in anxiety and mood disturbance. Anxiety and preoccupation with sleep (APSQ) was moderately positively associated with depression (HADS) and sleep-associated monitoring (SAMI), indicating that greater change in anxiety and preoccupation with sleep was related to greater changes in depression and sleep-associated monitoring.

Improvements in mindfulness were positively correlated with subjective number of awakenings, with a moderate to strong degree of association. This indicates that those who improved more on mindfulness were more likely to also improve on the number of awakenings at night. There was also a moderate, positive relationship detected between sleep-related monitoring and fatigue. People with greater reductions in sleep-related monitoring were less likely to improve in scores on mindfulness.
Table 13

*Intercorrelations between change scores for sleep variables*

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*Note.* *p < .05, ** p < .001.
Table 14

*Intercorrelations between change scores for sleep and health, mood, anxiety, depression, pre-sleep arousal and fatigue*

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*Note: *p < .05, **p < .001.*
Table 15

*Intercorrelations between change scores for health, mood, anxiety, depression, pre-sleep arousal and fatigue*

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*Note.* *p < .05, **p < .001.
Table 16

*Intercorrelations between predictors and change scores for sleep variables*

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*Note: *p < .05, **p < .001.*
Table 17

*Intercorrelations between predictors and change scores for health, mood, anxiety, depression, pre-sleep arousal and fatigue*

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*Note. *p < .05, **p < .001.
9.10 Qualitative Results

Qualitative impressions of the intervention were collected from participants at follow-up. These were returned in a separate envelope to the quantitative results, which allowed these results to be anonymous. Surveys were returned by 15 out of the 30 participants.

9.10.1 Frequency of Mindfulness Practice at Follow-up

At follow-up, 11 of the 15 participants who responded reported practicing mindfulness between two and four times per week. Three participants reported practicing daily and one participant reported meditating up to 20 times per week. The average meditation time was varied for the 11 participants who reported regular meditation. One participant focused on the three minute meditation, three participants continued with shorter meditations (15 minutes), and the remainder of the participants who responded at follow-up continued with 20 to 40 minute meditation sessions.

9.10.2 Types of Meditation at Follow-up

There was no obvious pattern in participants’ preferences for the specific meditation techniques they continued with regularly, although some techniques appeared to be more popular choices. At follow-up, 10 of the regular meditators reported that they continued using the audio CD provided. No participants reported continuing with ‘mindfulness of emotions’ regularly, and only one participant reported continuing with the ‘choiceless awareness’ meditation. Details of these can be found in Appendix 12.3. The more popular meditations that participants continued with were the breathing meditation, the three minute meditation, the body scan meditation,
mindful yoga and mindful walking. One participant reported continuing with informal practice, such as sitting with outdoor sounds and mindfulness with quiet music.

9.10.3 Intention to Continue Practice

Ten participants out of 15 who responded at follow-up indicated that they intended to continue mindfulness practice in the future. One participant reported that they did not intend to continue, given that they did not attribute their sleep improvements to meditation practice. One participant was unsure about carrying on with mindfulness, but intended to continue with yoga practice. The participants who intended to continue practice reported a range of reasons for this. One participant indicated they would continue for enjoyment and spiritual wellbeing, several indicated they would continue as they acknowledged the benefits of meditation to sleep, and several indicated they could see the benefits of mindfulness in managing stress levels. One participant identified the need to change their routine to keep interested, and one participant identified they had let work stress interfere with their commitment to practice, but intended to find their way back to mindfulness.

9.10.4 Difficulties with Mindfulness Practice

There was a strong theme in the difficulties participants identified with mindfulness practice. Overall, most participants noted that they struggled to continue with regular practice. The reason for this varied from issues with “self-disciple”, “motivation”, “boredom”, finding or prioritising the time to meditate, and “setting routine”. Out of the 13 participants who responded to this question, only one participant reported no difficulties with the practice of regular meditation.
9.10.5 Suggested Improvements in Mindfulness Teaching

The majority of participants did not indicate any suggestions for improvements in the teaching of mindfulness. For example, one participant stated: “You did a good job, no improvements necessary”. Other participants were satisfied with the teaching, but identified that more sessions or a refresher session may have helped them to continue with their practice. One example response is: “Overall I thought you did a brilliant job teaching us mindfulness meditation. A couple of extra sessions would have been useful”. One participant identified they would have liked to spend some time summarising the previous weeks’ learning, and another indicated that they would have liked the option of shorter meditations on the CD.

9.10.6 Impressions about the Impact of Mindfulness Meditation on Sleep

Participants were asked if they thought mindfulness meditation improved their sleep. There was a range of responses to this question. Several participants were convinced there was a strong positive impact of mindfulness meditation on sleep. Example responses include: “Absolutely! On a whole I’m getting to sleep effectively”; “Yes, it definitely generated a shift. I’m now sleeping through the early hours and not as nervous about sleep”; and “Mindfulness, and regular meditation is a key feature of success”.

Several participants identified that the program was successful. However, their difficulties in implementing it reduced the long-term effectiveness. For example: “During the program, and for a while afterwards, I believed that engaging in the practice assisted me greatly. But unfortunately, the increased stress levels of my job have thrown me back into not sleeping”; and “Yes, to a degree. I have no doubt that a more regular and sustained effort on my part would
be even more beneficial for me”. One participant observed that their sleep changed when they altered their meditation practice: “Yes I think it has helped. I have gone back to waking at 4.20 a.m., and I think that is because I had let [regular meditation] lapse”.

Other participants identified a mild improvement in sleep based on the contribution of meditation. Responses included “yes, slightly” and “yes, but I don’t think it is the key element for sleep. If I have managed to do the meditation, I have a sense that things are ‘under control’, a feeling that’s relaxing and reassuring in itself. Mindfulness is in living, not just sleeping”. Others weren’t sure of the direct contribution, but identified that mindfulness meditation assisted them to manage sleep in other ways; for example, “Not really. I still feel totally unrefreshed each day and it is incredibly difficult to perform normal functions. But mindfulness has brought me more in touch with my thinking and I am definitely a better person for it”. Finally, two participants reported that mindfulness meditation did not help them, but did not expand on this beyond a response of “no”.

9.10.7 Impressions about the Impact of Mindfulness Theory on Sleep

Overall, participants felt that the principles of mindfulness (e.g., acceptance, non-striving, letting go) added to the improvement of sleep; for example, “Yes, I put less pressure on myself to sleep”, “I’m a lot more accepting of my life and my sleep difficulties”, and “yes definitely”. It was also common that participants identified that the principles of mindfulness were also valuable in managing their overall quality of life. For example: “Yes. Letting go of the importance of half the [stuff] in your head can only be beneficial”; “The acceptance and non-striving are part of my everyday consciousness”; and “Yes, if you don’t allow stress to overtake
your path”. One participant was unconvinced that the principles and theory of mindfulness were useful, offering the response “Marginal [impact] at best”.

9.10.8 Impressions about the Overall Treatment Benefit

The majority of participants who responded to the follow-up questionnaire indicated that they felt that the program had led to improvements in their sleep. For example, one participant reported that the program went beyond sleep and “most definitely” improved overall health, noting: “There has been a huge improvement in my ability to fall asleep. I have a theoretical understanding of issues relating to sleep and practical approaches to apply in obtaining a positive response. I am convinced that it also improves my health in a more general sense”.

Several participants highlighted changes in their sleep quality and quantity. Responses included: “Yes, sleep has improved, medication has reduced, less bad nights and wake times have reduced in duration”; “Yes, it put it in perspective and unconsciously I seem to have relaxed about the whole issue”; “Yes, I am taking less time to fall asleep”; “Yes, my sleep has definitely improved”; and “Yes, I no longer worry about going to sleep once I woke up in the night, was able to retrain my thoughts”.

Some participants also acknowledged that the acquired techniques were useful to help manage poor sleep, thereby reducing the negative impact it has on their lives: “Yes, I feel more empowered to manage insomnia by having the tools to do so. Emotionally I am relaxed and less stressed or obsessed with my sleeping patterns”; “Yes, taking part has helped a lot and has taught me some very useful techniques”; and “Yes, it gave me the tools to unwind and made me more aware of the reasons for my sleep problems”. Two participants were unsure of the impact on
their sleep, however, they identified other benefits to the program: “Marginal at best. I found mindfulness practice has calmed my thinking mind down, but I still wake up numerous times a night and wake up feeling unrefreshed”; and “I feel very positive about my involvement in the program. I’m not sure that my sleep has improved, but my attitude definitely has. I no longer get stressed if I can sleep very well”. No participants who responded at follow-up reported dissatisfaction with the intervention.

9.10.9 Impressions about the Most Important Components of Treatment

Participants’ impressions about the most valuable components of treatment were varied. Several participants identified that the overall approach was important, observing that “the multi-pronged approach was most important to me”, and “I valued it all”. Other participants identified a range of important components, such as the breathing meditation, sleep consolidation and stimulus control, integrating mindfulness in everyday life, techniques to manage worry about not sleeping, awareness of the body (“Going to bed when sleepy, not tired”), discussions with professionals and other group members, and developing perspective about sleep problems. One participant selected mindfulness in a general sense as the most important ingredient in the intervention: “I loved the idea behind mindfulness, in that it has brought me a far greater awareness of how my thinking impacts how I’m feeling. I am now far calmer in stressful situations. Before mindfulness training I was pretty much unaware of my thoughts”.

9.10.10 Difficulties with the Intervention

The difficulties participants had with the overall intervention echoed their difficulties with finding time to meditate. Some participants identified that they had difficulty with particular
meditations (e.g., the body scan, mindful walking or yoga), and one participant identified that they would often fall asleep when they were attempting to meditate. Several participants identified difficulty with the behavioural instructions, specifically: difficulty getting out of bed during the night, particularly when it was cold; spending less time in bed; and getting up consistently early. Another participant identified difficulties with applying the overall principles of mindfulness: “I’m still having difficulties with letting go and acceptance when I’m upset or anxious about an event during the day”.

9.10.11 Least Important Parts of Intervention

In general, participants struggled to identify what they considered to be the least important parts of the treatment. For example, responses included: “all aspects were important”; “I found every session important”; and “[there were] no irrelevant sections”. Two participants, who found particular meditations hard, identified them as least important, with one commenting that “the more complicated meditations were too difficult (and least important)”.

9.10.12 Endorsement of Treatment

Participants endorsed the treatment strongly, with all 15 participants who responded indicating that they would recommend this treatment. Common responses were: “Most definitely”; “yes”; “yes and have done so”; and “I would highly recommend this treatment to others”. One participant found that others were asking them about the treatment based on their outcome: “Yes. Lots of people have asked me about this treatment as they know how long and how problematic my sleep has been”. One participant indicated their endorsement was based on the non-pharmacological approach, saying “definitely, given its non-medical”. One participant
was not sure, responding with a “perhaps”. Finally, there was a particularly insightful response from one participant who observed: “I would [recommend this treatment], ’though I think its success would vary with a person’s anxiety level and his/her capacity to accept a ‘non-traditional’ approach and also a willingness to obey the set of instructions as well as accept the philosophy”.

9.11 Summary of Qualitative Findings

Overall, participants appeared to find benefit in this treatment. Although a significant number of participants reported that sleep improved as a result of treatment, not all participants identified that their sleep had changed. It was also common that participants identified the benefits of treatment also included techniques to manage overall stress and to cope better with poor sleep. The majority of participants had difficulty in continuing consistently with their meditation practice. However, despite this, almost all participants would highly recommend the treatment to others with insomnia.

9.12 Summary of Results

The results of the study include analyses of variance and trends across time, correlations between the change scores of variables, correlations between predictors and change scores, analyses of clinical change, and qualitative findings. From these, there were clear indications that treatment led to a number of positive changes. Generally, the majority of participants experienced improvement in sleep over the course of treatment. Furthermore, there were also a
number of participants who exhibited significant improvements in other variables, such as anxiety and depression. Although the quantitative results did not highlight improvements in mindfulness as a key correlate of sleep improvement, participants who responded to the follow-up qualitative survey commonly associated mindfulness with improvements with sleep, stress reduction and wellbeing. In the final chapter, these results will be discussed with reference to hypotheses and the existing literature.
10 CHAPTER 10: Summary and Discussion

10.1 Introduction

This final chapter restates the research problem and reviews the major methodology as an aid for the reader. Following this, the chapter contains a summary and discussion of the results with reference to the study aims and hypotheses, followed by a discussion of the implications of the research.

10.1.1 Statement of the Problem

Insomnia is a serious problem in Australia, with recent prevalence rates indicating the condition was estimated to affect at least 3% of Australians in 2010 (Deloitte, 2011). In addition, a large number of Australians report dissatisfaction with their sleep, in a proportion that may be as high as 50% (Buysse et al., 2008a; Dohnt et al., 2012). Insomnia has been found to negatively impact the quality of life of sufferers (Leger et al., 2001), and it places a significant direct and indirect financial burden on society (Deloitte, 2011). Pharmacological treatment is commonly used to address insomnia. However, evidence suggests this approach has limitations and is associated with side effects that may reduce the efficacy of treatment (Benca et al., 2004). CBT-I, the most widely used non-pharmacological treatment for insomnia, has been associated with moderate effect sizes, which are comparatively lower than those achieved using CBT for other psychological disorders (Harvey, 2002b). While CBT-I has been found to be effective in the treatment of insomnia (Trauer et al., 2015), there is scope to improve the treatment options for insomnia. The development of an alternative treatment is likely to be of benefit.
There is substantial evidence that mindfulness-based therapies may offer a unique avenue to improve sleep by reducing hyperarousal and through training individuals to respond differently to thoughts and emotions that can impede the natural sleep process. Mindfulness and Behaviour Therapy for Insomnia (MBT-I) is a treatment combining Mindfulness Based Stress Reduction (MBSR) with behaviour therapy for insomnia. The research in this thesis has focused on the potential of MBT-I to successfully treat insomnia in a naturalistic sample.

10.1.2 Review of the Methodology

The stage model of behavioural therapies was used as a guide to construct a study design that matched the state of the literature (Rounsaville et al., 2001). In 2010, when this research was in the development stage, research on mindfulness as an intervention for insomnia was at Stage One, and progressed to Stage Two after 2012. This research project was constructed as a replication of a pilot study (Ong et al., 2008b), with the use of a naturalistic sample, objective and subjective sleep measurement, and a range of outcome variables and predictive measures.

10.2 Summary of the Results

The aim of the present study was to evaluate the effectiveness of MBT-I in a naturalistic Australian sample. The hypothesis that participants would score lower on insomnia severity and higher on objective and subjective sleep quality at post-treatment and follow-up when compared with baseline was generally supported by the analyses. There were many significant improvements across a variety of subjective and objective sleep variables. The hypothesis that cognitive processes known to impair sleep would reduce between baseline and post-treatment
was also supported. There was less support for changes in daytime functioning and mood, as fatigue and SF-36 energy were the only variables that changed significantly between baseline and follow-up. Mood, anxiety, and depression did not change significantly.

There was partial support for the hypothesis that there would be clinical improvement in insomnia severity, with four participants showing improvement from clinically significant insomnia to falling below the clinical cut-off after the intervention. The majority of participants demonstrated improvement in scores on insomnia severity. The hypothesis that there would be relationships among the sleep variables was also partially supported. For example, there were significant correlations between scores on the Insomnia Severity Index and five out of 12 sleep-related variables. Other variables did not correlate with many other sleep-related variables. For example, subjective total sleep time was only correlated with one other variable.

The hypothesis that changes in insomnia severity would be correlated with changes in problematic sleep-related cognitions was not supported. However, the two measures assessing sleep-related monitoring, and anxiety and preoccupation with sleep were correlated, possibly suggesting that they may be capturing a similar construct. Finally, the hypotheses that changes in insomnia severity would be correlated with changes in mindfulness and pre-sleep arousal were not supported. These hypotheses, along with the exploratory questions and other interesting findings, will now be discussed.
10.3 Efficacy of MBT-I: Comparison of Baseline, Post-treatment and Three Month Follow-up

To answer the first research question, scores at baseline were compared with those at post-intervention and at three month follow-up. Information was analysed using repeated-measures ANOVA, trend analysis, and post hoc pairwise comparisons for each of the target variables. Clinical efficacy was then evaluated for five selected outcome measures using an examination of baseline and post-treatment scores. Results of these analyses suggest that MBT-I can be successfully administered to a naturalistic sample, with evidence of clinical improvement. The sections that follow will discuss each of the outcome measures, and discuss the results with reference to the hypotheses, exploratory questions, and background literature.

10.4 Evaluation of Sleep Outcomes

10.4.1 Insomnia Severity Index

ANOVA results indicated that participants’ insomnia severity changed significantly over time. There was a significant quadratic trend with a moderate effect size. Closer examination revealed a significant reduction of severity of insomnia from baseline to post-treatment. There was also a significant reduction in insomnia severity between baseline and follow-up. This pattern of results indicates that, overall, participants experienced a reduction in symptoms of insomnia following treatment, which was maintained at follow-up.

This finding was consistent with previous research investigating six week mindfulness interventions. One of these studies utilised MBCT (Ree & Craigie, 2007), one used MBSR
(Cincotta, Gehrman, & Baime, 2009) and another used MBT-I, with this same protocol being used in the current study (Ong et al., 2008b; Ong et al., 2009). The mean baseline severity of insomnia for participants in previous research was lower than that in the sample used in this study, and the results of these previous studies indicated that the majority of participants were below the clinical cut-off following treatment. Participants in the present sample scored higher on baseline insomnia severity ($M = 17.75 \text{ } SD = 3.40$), when compared with $M = 10.22$ (Ree & Craigie, 2007), $M = 11.07$ (Cincotta et al., 2011), and $M = 14.9$ (Ong et al., 2008b) in the previous studies. At the three month follow-up, the current sample reported insomnia severity only slightly over the clinical cut-off of 10 ($M = 10.14$). This finding provides a helpful contribution to the existing literature, as it suggests that MBT-I may also be effective in reducing more severe levels of clinical insomnia.

The majority of participants experienced an improvement in symptoms of insomnia. In total, 88% of participants experienced a reduction in insomnia severity following treatment, and for 13% of these participants, this was of a marked clinically significant magnitude, with 28% demonstrating a moderate clinical improvement. Specifically, 13% of the sample moved from a clinically problematic level of insomnia severity to fall under the clinical cut-off following treatment. This is lower than the 87% reported by Ong and colleagues (2008), yet as previously discussed, the differences in the proportion of participants who met the criteria for clinically significant changes may have been influenced by the higher baseline insomnia severity in the current study, i.e., in order to reach clinically significant change, the reduction in insomnia severity needed to be of a greater magnitude in this research, compared to previous research.
Ong and colleagues (2008) reported a large effect size of $d = -1.32$, which is comparable to the large effect size found in this research ($\eta^2 = .64$, 95% CI [.42, .74]). These effect sizes are larger than those found by other research; for example, Cincotta and colleagues (2011) reported a modest effect size of $d = 0.38$. Overall, analysis of this study using the primary outcome measure, the ISI, indicates moderate support for treatment efficacy, despite a more heterogeneous sample than the original pilot study by Ong and colleagues (2008).

10.4.2 Secondary Outcome Measures

10.4.2.1 PSQI

Participants’ sleep quality improved over time, with significant linear and quadratic trends evident, both with large effect sizes. Post hoc comparisons indicated that sleep quality improved significantly between baseline and post-treatment. There was also a significant improvement between baseline and follow-up. These findings follow a similar trend as those found for insomnia severity, with an immediate treatment effect following treatment that was maintained during the follow-up period. Previous studies have used the PSQI to evaluate sleep quality, with consistent reporting of improvements. For example, there was a significant improvement in sleep quality after an eight week MBSR intervention, which was maintained at three month and six month follow-up (Carlson & Garland, 2005). Another study found a decrease from $M = 5$ (which is the clinical cut-off) to $M = 3$ in a group of anxiety sufferers (Yook et al., 2008). Interestingly, there were significant changes in the same five component scores as were shown in the current research.
A total of 96% of participants in the study showed improvements in their sleep quality, and 12% of the sample showed clinically significant improvement (moving from above to below the clinical cut-off). Contrary to expectation, 4% of participants showed regressions in their sleep quality scores between baseline and follow-up. However, no participants moved from below to above the clinical-cut off. On average, participants’ sleep quality improved significantly. However, this change was only clinically significant for one in five of the participants in the study.

Given that the clinical improvement of the PSQI was of a similar magnitude to that of the ISI, it is interesting to note that there was a strong negative correlation between the change scores of these two variables, suggesting that greater improvements in one of these variables was commonly associated with smaller improvements on the other. There is no clear explanation for this, however, it may suggest that the PSQI and the ISI are capturing different symptoms, and that changes in insomnia symptoms are not always associated with changes in sleep quality, and that improvements in sleep quality are not always associated with changes in insomnia severity.

10.4.3 Sleep Diaries

10.4.3.1 Sleep Onset Latency (SOL)

Analysis of variance indicated there was a significant decrease in sleep onset latency over time, with an associated moderate to large effect size. Post hoc comparisons indicated that this significant quadratic trend was due to a steep drop in SOL between baseline and post-treatment, followed by a less dramatic reduction between post-treatment and follow-up. Post hoc comparisons found a significant difference between SOL at baseline (44.75 minutes) and SOL at
follow-up (27.06 minutes). There was a 12.5 minute reduction in SOL following treatment, and SOL then reduced further to equal an average of 18 minutes by the three month follow-up. Given that SOL durations of longer than 30 minutes are considered to be problematic, this mean reduction is considered to be a clinically significant reduction, because the mean follow-up SOL no longer met the criteria for a diagnosis of insomnia.

Several mindfulness-based intervention studies have found significant reductions in SOL (Bootzin & Stevens, 2005; Heidenreich et al., 2006). In the pilot study using the same MBT-I protocol as the present research, there was a significant 19 minute reduction in SOL (Ong et al., 2008b). Other studies have found similar results, also with a significant 19 minute reduction in SOL found (Bootzin & Stevens, 2005), along with a modest four minute reduction found in another study (Heidenreich et al., 2006). This finding supports the hypothesis that this treatment protocol can be replicated in a sample with less stringent inclusion and exclusion criteria.

In a recent meta-analytic study, there was a comparison of a range of SOL outcomes as a response to CBT-I (Trauer et al., 2015). A comparison between these findings and the results from the research described in this thesis indicates that SOL in response to MBT-I falls within the range of outcome scores that are seen after intervention with CBT-I (2.85 – 29.50 minutes). This suggests that this treatment may be non-inferior to CBT-I with regard to SOL.

10.4.3.2 Wake After Sleep Onset (WASO)

Results from the analysis of variance detected an overall change in WASO, which was associated with a large effect size. Trend analysis indicated that these changes fit both a linear and a quadratic model, both with large effect sizes. There was a significant reduction in WASO
between baseline (63.33 minutes) and follow-up (36.72 minutes). After treatment, the average participant was spending almost 32 fewer minutes awake during the night. These findings were consistent with the preceding pilot study, which resulted in a reduction of WASO of almost 24 minutes (Ong et al., 2008b). The range of findings of WASO from a meta-analysis of CBT-I revealed a range of -9.10 minutes to -73.60 minutes (Trauer et al., 2015). The findings from the current study fall within this range, indicating that MBT-I may be non-inferior to CBT-I with regard to the impact on WASO.

As discussed in Chapter 1, the process of filtering cognitive activity is often ineffective in those with hyperarousal, leading to environmental awareness at night. A large reduction in WASO supports the notion that MBT-I may be able to improve sleep stability, which may in turn increase the quality of sleep and lead a reduction in daytime symptoms.

10.4.3.3 Sleep Efficiency

Sleep efficiency increased significantly from 72.8% at baseline to 80.04% at post-treatment and 80.54% at follow-up. Analyses detected significant linear and quadratic trends, reflecting a pattern of improvement over the intervention period and maintenance of sleep efficiency over the follow-up period. At post-treatment and follow-up, participants were asleep for 80% of the time that they were in bed. This finding is consistent with previous findings. Generally, treatment approaches that did not include behavioural components, such as consolidation and stimulus control, have not found significant changes in sleep efficacy. On the other hand, studies involving behavioural components have found improvements in the proportion of time spent in bed asleep. For example, the pilot study by Ong and colleagues
(2008) resulted in a sleep efficiency improvement of approximately 9%, which is almost identical to the current study.

The study described in the present research involved a cohort of participants who scored higher on baseline sleep efficiency, which allows for a useful comparison. This finding adds to the support for the use of this treatment protocol in a more diverse sample of people with insomnia who may have more severe symptoms of insomnia. A meta-analysis investigating CBT-I displayed a range of improvements to SE from 5.06% to 13.51% (Trauer et al., 2015). The findings of this study (7.21%) are within this range, and therefore MBT-I appears comparable with CBT-I with respect to its impact on SE.

**10.4.3.4 Total Sleep Time (TST)**

The analyses conducted in the current study indicated that there was no change in TST throughout the course of treatment. This finding was consistent with some previous studies (e.g., Ong et al., 2008; Yook et al., 2008), but was not consistent with others (e.g., Bootzin & Stevens, 2005; Britton et al., 2010). CBT-I has been shown to improve TST between 5.06 minutes and 14.90 minutes (Trauer et al., 2015). This indicates that MBT-I may not be as useful as CBT-I with respect to improving TST. However, it is debatable whether an overall increase of 15 minutes of sleep would equate to a clinically meaningful improvement. As discussed in Chapter 7, the amount of sleep may not lead to improvement in functioning. This may be because some people’s sleep need may be low, and therefore their associated symptoms may be more closely related to their reactions to poor sleep. This is supported by the present findings. There were significant improvements in insomnia severity, sleep quality, other subjective sleep factors such
as SOL and WASO, along with subjective and objective changes in functioning and worry about sleep, despite the non-significant finding in TST.

Another consideration is that the intervention around sleep consolidation is delivered in Week 3 of this program, whereas it is usually delivered earlier in CBT-I interventions. Consolidation may lead to an initial decrease in TST, followed by an increase. To summarise, the lack of change detected in TST following treatment is consistent with some of the previous research on mindfulness-based interventions for insomnia. It is important to consider that, despite the common focus on the number of hours sleep, TST is only one component of sleep. Improvement in insomnia severity and daytime functioning may occur via avenues other than increases in TST.

10.4.3.5 Number of Awakenings (NWAK)

NWAK reduced significantly over time. The trend was linear, with an associated effect size in the large range. NWAK reduced from an average of 2.25 awakenings to an average of 1.76 (−.49) times per night at follow-up. This finding is consistent with previous studies that have integrated behaviour therapy with mindfulness interventions for sleep (Bootzin & Stevens, 2005; Ong et al., 2008b). Bootzin and Stevens (2005) reported a reduction in NWAK of .88 times per night, and Ong and colleagues reported a reduction of .99 awakenings per night. Some studies did not report NWAK as an outcome measure (Britton et al., 2012; Gross et al., 2011). For example, a study, by Britton and colleagues (2012) provided a comparison between subjective sleep diaries and PSG changes for MBCT versus a control group. Given the specificity of EEG, it would have been interesting to for Britton and colleagues to have reported on the number of
awakenings and on any changes following treatment, particularly given the background theory relative to arousal and sleep stability.

10.4.4 Actigraphy

The majority of studies before 2010 that focused on mindfulness-based treatment for insomnia did not include actigraphy as an outcome measure. Studies that utilised actigraphy include larger samples sizes, and are published later than the research described in this thesis. Results from several studies using mindfulness-based therapy for insomnia have failed to detect any change in objective measures of sleep using actigraphy (Cincotta et al., 2011; Garland et al., 2014). However, a more recent randomised controlled trial detected a significant decrease in total wake time (TWT) and TST following an eight week MBT-I course with the use of actigraphy; other sleep parameters, such as WASO or SE, remained unchanged (Ong et al., 2014). The four objective sleep parameters collected in this study all changed significantly, and will now be discussed individually. It is important to note that actigraphic data were collected during the baseline period and throughout the study, however, it was not collected at follow-up. Therefore, analyses for the actigraphy measures did not include trend analyses.

10.4.4.1 Sleep Efficiency (SE)

Data from actigraphs indicated a significant moderate to large improvement in SE between baseline and post-treatment with mean SE increasing from 74.82% to 79.29%. Participants spent roughly 4.5% more time asleep in bed during the last week of treatment compared with the average SE during period of time before treatment. This is a very similar post-treatment sleep efficiency to that which was recorded subjectively (80.4%), however, this
finding is not consistent with the lack of change in sleep efficiency as measured by actigraphy that has been reported in the literature. For example, Ong and colleagues (2014) did not find a difference in SE in a randomised controlled trial comparing MBCT and MBSR with CBT-I. Cincotta and colleagues (2011) and Garland and colleagues (2014) also reported no change in SE following mindfulness-based treatment for insomnia. Given that the MBT-I treatment manual used by Ong and colleagues (2014) was very similar to that used in the current study, the discrepancy in these findings is interesting. It is possible that this was due to the difference in the subject population, and the overall higher level of insomnia severity of the current sample.

10.4.4.2 Sleep Onset Latency (SOL)

There was a large, significant change in SOL detected by actigraphy. Participants’ SOL reduced from an average of 14.52 minutes to 7.15 minutes. In the final week of treatment, participants fell asleep in roughly half the time they took prior to treatment. This finding is consistent with reductions in subjective SOL which reduced from 44.75 minutes to 32.34 minutes, although this data indicates a change that smaller in magnitude. This finding is inconsistent with the lack of significant findings from previous studies that have reported SOL derived from actigraphy (Cincotta et al., 2011; Garland et al., 2014; Ong et al., 2014).

10.4.4.3 Wake After Sleep Onset (WASO)

A large significant change in objective measurement of WASO was found. On average, participants reduced from 97.99 minutes of wakefulness after sleep onset to 73.14 minutes. It should be noted that the specificity of WASO, as measured by actigraphy, is uncertain for higher scores (WASO >30 minutes/night), as it tends to overestimate (Marino et al., 2013). However,
the results of the study indicated that, on average, participants were awake in bed for roughly 25 minutes less following sleep onset. This is consistent with objective measures of WASO which also reduced by close to 30 minutes. This finding is consistent with one study that found modest changes in WASO \((d = 0.3)\) following MBSR (Garland et al., 2014), but was not consistent with the lack of difference reported by others (Cincotta et al., 2011; Garland et al., 2014; Ong et al., 2014).

**10.4.4.4 Total Sleep Time (TST)**

TST also changed significantly over the course of treatment, with a large effect size, however, this was in the opposite direction than that hypothesised. Average TST reduced from 6.08 hours per night to 5.37 hours per night. Some similar studies found no difference in TST (Ong et al., 2008b; Yook et al., 2008), whereas two other studies, focusing on adolescents with substance abuse issues, demonstrated increases in TST in two separate studies using MBCT (Bootzin & Stevens, 2005; Britton et al., 2010a). The findings of the study described in this thesis are interesting, particularly in the context of improvements in other objective and subjective sleep parameters, including an increase in subjective TST between baseline and follow-up. It is important to consider the validity of actigraphy in the detection of TST in insomnia patients. Validation studies have found that actigraphy generally overestimates sleep in those with insomnia, with the inflation ranging from 14 minutes to over 60 minutes (Lichstein et al., 2006). However, this is likely to have influenced all scores (baseline and follow-up), and is unlikely to contribute to these findings, suggesting that the detected TST reduction may be accurate. The pattern of TST results is consistent with subjective measurements of TST, which
revealed a slight reduction in TST post-treatment, followed by an increase in TST at follow-up that was higher than baseline TST. During the final week of treatment, participants were in their third week of sleep consolidation, during which they were spending less time in bed. Regardless of this decrease, all other measures of sleep showed significant reductions including overall insomnia symptoms and sleep quality. This suggests that TST may not be a central sleep outcome for insomnia treatment.

10.4.5 **Subjective Versus Objective Sleep Data**

Overall, the subjective and objective data obtained through the study were congruent. There were reductions in both objective and subjective WASO and SO, and increases in SE. Reductions were also observed in objective and subjective TST measures, although this did not reach significance in post hoc comparisons of subjective TST. Both TST and SE measures were similar in objective and subjective recordings. For example, the baseline recording of TST varied by only 0.09 hours between the objective and subjective measures. However, there were discrepancies in the other two variables. Participants rated their SOL as being between 21 and 30 minutes more than the time detected by the actigraphs, and actigraphy detected roughly 30 more minutes per night of WASO than was observed by participants. These differences were seen at both time points.

This discrepancy may be explained by differences in the subjective and objective classification of these variables. Actigraphy algorithms may identify light sleep with brief awakenings, therefore leading to lower SOL and higher WASO than subjective experience, whereas participants may perceive they are still awake, resulting in higher SOL and lower
WASO. This phenomenon has been described as an ‘artefact of sleep onset definition’ in an important paper that presents several possible hypotheses for the cause of sleep state misperception such as that seen in the lack of congruence between objective and subjective SOL (Harvey & Tang, 2012). Studies supporting this hypothesis have used PSG rather than actigraphy, however, the concept may also apply to actigraphy (Harvey & Tang, 2012). In the context that both SOL and WASO reduce significantly, the discrepancy between objective and subjective measures has little influence over the interpretation of the overall results. Overall, there is some discrepancy between objective and subjective sleep, particularly the interpretation of light sleep, however, the use of actigraphy provides further support for the changes in sleep, particularly given that it is common for those with insomnia to suffer with sleep state misperception.

10.4.6 Sleepiness and Fatigue

There was a short-term reduction in fatigue with an associated large effect size. This change was not maintained at follow-up. The high attrition between post-treatment and follow-up may have led to a lack of power to detect significant findings at follow-up. There were no changes noted in sleepiness as measured by the ESS, and fatigue as measured by the POMS was also non-significant. This is inconsistent with earlier research, which utilised the POMS fatigue subscale to measure fatigue and found a significant difference in this following an MBSR program (Carlson & Garland, 2005). That study, however, focused on sleep in cancer patients. In that case, fatigue may have been related to other health or stress factors, and it cannot be assumed that the change in fatigue was linked to the change in sleep. It is also not surprising that
there was no change in ESS in the current study, as it is common for insomnia participants to experience chronic tiredness but not sleepiness. Overall, there was partial support for the hypothesis that participants would feel less fatigued during the day following intervention with MBT-I. This notion, however, requires further investigation.

10.4.7 Sleep Values and Hypotheses

Overall, there was support for the hypothesis that an MBT-I protocol can successfully be delivered to a naturalistic sample. There were improvements in the majority of subjective and objective indicators of sleep. As expected, there were significant reductions in ISI, WASO, SOL and NWAK, along with improvements in SE and PSQI. Changes in a number of these variables were of clinical significance.

10.4.8 Sleep-related Cognition

It was hypothesised that processes known to impair sleep, such as preoccupation with sleep and sleep-related monitoring, would reduce between baseline and post-treatment. Anxiety and preoccupation about sleep, as measured by the APSQ, reduced significantly between baseline and post-treatment, with a large effect size associated with this change. There was no change between baseline and follow-up, indicating that this change was maintained in the three months after treatment. Sleep-related monitoring reduced significantly between baseline and post-treatment, however, this change was not maintained at follow-up.

No studies have yet assessed changes in sleep-related monitoring or anxiety and preoccupation with sleep as outcome measures in mindfulness-based trials. However, the pilot study using the same MBT-I protocol as the study described in this thesis found significant
reductions in sleep-related effort and dysfunctional beliefs about sleep (Ong et al., 2008b).

Together, this information builds a picture that MBT-I may have benefits in targeting cognitive components of sleep disturbance. This may be due to the emphasis on components of mindfulness theory, such as non-striving, acceptance and non-judgement. These principles, along with meditation training, may allow participants to observe themselves from a metacognitive perspective, and consciously let go of preoccupation and monitoring. Alternatively, meditation practice may help to build skills to refocus attention on the present, when thoughts drift to worries about sleep or monitoring of internal and external environmental cues for sleep-related threats. However, this notion was not supported by the lack of change in mindfulness scores. This may be related to the inherent difficulties in measuring mindfulness. Overall, these results warrant further investigation into the benefit of mindfulness on the cognitive model of insomnia.

10.4.9 Arousal

Overactivation of the sympathetic nervous system can precipitate or perpetuate insomnia (Bonnet & Arand, 2010). Given this, it was hypothesised that pre-sleep arousal would reduce following treatment. Pre-sleep arousal was measured using the PSAS, which produces two component scores: cognitive arousal and somatic arousal. Results from the study indicated that there was a significant change in cognitive arousal, while somatic arousal remained unchanged across the three time points. Post hoc comparisons revealed that cognitive arousal reduced significantly with a moderate to large treatment effect; scores reduced from 23.38 to 18.89 following treatment. Cognitive arousal scores at follow-up (19.14) were similar to those post-
treatment, resulting in a quadratic trend and a non-significant difference between baseline and follow-up.

The findings of two previous studies that have investigated the change in arousal in association with mindfulness-based treatment for sleep both found significant changes in both cognitive and somatic arousal (Cincotta et al., 2011; Ong et al., 2008b). Both of these studies utilised a pre-post design. Comparing results for cognitive arousal from the current study with those just mentioned, the effect size for cognitive arousal in the present study was larger than that reported by Cincotta and colleagues (2011), as scores in the present study reduced from a similar baseline score to a lower post-treatment score. The present study’s findings were more similar to those of Ong and colleagues (2008b) with regard to the magnitude of change. Finally, a randomised controlled trial comparing MBSR and MBT-I found overall levels of arousal (combined cognitive and somatic) reduced significantly and were maintained at three month follow-up with a moderate to large long-term treatment effect.

The sample used in the current study had lower baseline levels of arousal than the sample of people with insomnia presented in the development of the PSAS, which may have influenced the results. Specifically, the present sample was 4 points lower in somatic arousal, and 3 points lower in cognitive arousal at baseline, than the sample of people with insomnia whom were used in the development study for the PSAS (Nicassio et al., 1985). In the present sample, a reduction of 4.45 points on scores of cognitive arousal indicated a significant finding, however, a slight regression of 0.29 points at follow-up led to a non-significant finding, although this may have been influenced by the high degree of attrition at follow-up. Taken together, this information
suggests that there may not have been sufficient power at follow-up to detect a significant change.

Although the current study failed to replicate the previous findings of a significant reduction in somatic arousal between baseline and post-treatment, this was nevertheless interesting in the context of the literature. Given that the current study found significant changes in most sleep-related outcome measures, it may suggest that cognitive arousal is of more interest than somatic arousal in the resolution of symptoms of insomnia. This finding warrants closer attention and will be discussed further in reference to correlational analyses.

To summarise, there was partial support for the hypotheses that arousal would reduce following treatment. Findings suggested that there was a significant, short-term reduction in cognitive arousal that was not maintained. However, a type II error cannot be ruled out due to the reduction in power and the lower levels of baseline arousal in this sample compared with the sample in the pilot study by Ong and colleagues (2008). Further contributions from this study suggest that cognitive arousal may be more important than somatic arousal, particularly in the context of the significant improvements in objective and subjective sleep measures found in this study.

10.4.10 Mindfulness

Mindfulness was measured using the FFMQ (Baer et al., 2006; Baer et al., 2008). It was expected that mindfulness would improve between baseline and post-treatment, which was not supported by the data. The trend analyses for mindfulness were not significant. This was consistent with previous research (Ong et al., 2008b). Given the central significance of
mindfulness to this thesis, and the need to investigate more specific elements of mindfulness, post hoc analyses were still run in order to compare across the three time periods all five factors of mindfulness measured by the FFMQ. The only facet that changed significantly was ‘non-reactivity to inner experience’, which improved significantly between baseline and follow-up. There was some indication that participants showed modest improvement in their ability to let go of reactions to their inner experiences. This is a central focus of the MBT-I protocol, and is considered theoretically valuable to the improvement of insomnia symptoms.

The capacity to let go of inner experiences may reduce the tendency to react to daytime symptoms with safety behaviours, and may also assist in the reduction of cognitive arousal by allowing for the letting go of thoughts and urges to strive for sleep (Ong et al., 2012). It may assist people to exit the problematic loops described in Chapter 4 (stress-lethargy, anxiety-fear, and panic-control) by introducing a mindful response to difficult emotions and physical sensations. It may also assist people to improve their management of stress, which could potentially reduce SNS activity and arousal (Lamarche & Ogilvie, 1997; Ong et al., 2012) and reduce sleep interfering processes (Lundh, 2005).

However, it is also possible that difficulties that arise in measuring mindfulness influenced the findings of this study, and that participants may actually have become more mindful than the FFMQ was able to detect. Measurement of mindfulness is inherently problematic. To be aware of mindlessness, one needs a degree of insight and awareness. Therefore, someone who is low in mindfulness is likely to overrate their degree of it. A person who has recently been exposed to the principles of mindfulness, and has not been practicing
meditation for a long time, may become more aware of mindlessness and therefore may score lower on self-reported mindfulness. Although there was no evidence of an overall difference in mindfulness across the three time points, a type II error cannot be ruled out. A larger sample may be required to detect smaller changes in mindfulness, while the improvement in non-reactivity to inner experience is an interesting and valuable finding that warrants further investigation.

10.4.11 **Anxiety and depression**

Anxiety and depression were evaluated using the HADS. There was a significant reduction in depression only. Depression scores reduced from 5.07 to 3.63 between baseline and post-treatment, however, scores regressed to 5.08 at follow-up. The overall effect of time was significant and was associated with a quadratic trend, with a moderate effect size. The results suggest that treatment was not associated with any change in anxiety and was associated with a short-term reduction in scores of depression. This is partially consistent with previous research, which demonstrates significant decreases in both anxiety and depression following MBCT in a group of anxiety sufferers with insomnia (Yook et al., 2008).

The clinical significance of these findings was evaluated. First, no participant developed clinically significant anxiety or depression during the course of treatment. However, in the case of both anxiety and depression, some participants reported higher levels of anxiety or depression following treatment, although the majority reported a reduction. Three participants experienced a clinically significant reduction in anxiety and two participants demonstrated a clinically significant reduction in depression. Only limited studies investigating mindfulness-based therapy for insomnia have reported on anxiety and depression symptoms (Yook et al., 2008). This is
surprising, given the high degree of overlap between symptoms of anxiety and depression and the common comorbidity of both diagnoses with insomnia.

A final consideration in this regard is that mindfulness may bring awareness and attention to symptoms of anxiety and depression, which participants may not have been aware of prior to treatment. If this is the case, it may reflect an important, and empowering, change for these participants. For example, becoming aware of lower mood states in particular environments, such as the workplace, may lead to the potential of creating meaningful life changes and altering mindless trajectories.

10.4.12 Mood

There was no change in total mood disturbance between baseline and post-intervention, nor were any of the six measured mood factors significantly different. Out of the 13 participants available for pre-post analysis, two participants’ total mood disturbance reduced to below clinical cut-offs. Eight out of 13 participants improved, while four participants noted higher levels of mood disturbance which remained below the clinical threshold. These results are consistent with the findings of Ong et al (2008), which indicate there were no changes in positive or negative affect following an MBT-I intervention. However, Gross and colleagues (2009) did detect an improvement in mood following an eight week MBSR intervention. It may be that the broader focus of MBSR led to more changes in mood, compared with MBT-I which is directed more towards sleep and was in the current study also two sessions shorter. It must be remembered that the POMS was only completed by a sub-group of the total participant group
(i.e., the first two groups through the study). The resulting smaller sample size may have reduced the power to a level that was not sufficient to detect small changes in mood.

10.4.13 Quality of Life

Quality of life was measured with the Rand SF-36. Of the seven component scores, only one (energy) displayed a significant change over time. The change was associated with a moderate to large effect size. Post hoc comparisons indicated that there was a significant increase in energy following treatment. Mean scores indicated these changes were maintained, however, due to a lack of power at follow-up, comparisons between baseline and follow-up were non-significant. These scores are consistent with the improvements in fatigue discussed earlier.

The only similar study to investigate quality of life was a recent randomised controlled trial that compared MBSR and eszopiclone (Gross et al., 2011). This study used the SF-12, which yields two summary scores (mental and physical), but neither of these changed significantly in either condition (Gross et al., 2011). The difference in results between the study described in this thesis and that of Gross and colleagues (2011) is possibly due to differences between MBSR and MBT-I, most importantly the addition of behaviour therapy in MBT-I. Given that the SF-12 is a shortened version of the SF-36, these results cannot be directly compared. However, this significant finding is an important outcome to support the use of MBT-I in insomnia, as lack of energy can be a debilitating symptom. Further research is required to investigate the clinical significance of this finding.
10.5 Intercorrelations

The primary aim of this research was to identify if MBT-I is effective as treatment for insomnia, and if there is any indication of what type of participant it works for. There were a number of questions that were proposed, which will be discussed in separate sections. These questions were investigated by conducting bivariate correlations among change scores, or by examining relationships between identified predictor variables and change scores.

10.5.1 Were Changes in Mindfulness or Pre-Sleep Arousal Associated with Reductions in Insomnia Severity?

Contrary to expectations, there was no relationship detected between overall change scores of pre-sleep arousal and insomnia severity. While a reduction in pre-sleep arousal may have been associated with improvements in insomnia severity in some participants, this relationship was not able to explain the overall treatment response. Exploring the relationships among change scores of pre-sleep arousal and change scores of all sleep outcome variables revealed a moderate positive correlation between change in somatic pre-sleep arousal and change in objective WASO. People who had greater reductions in somatic pre-sleep arousal were more likely to reduce the amount of minutes spent awake after sleep onset. However, given the number of correlations, this may be an incidental finding.

There was no relationship between overall change scores of mindfulness and change in insomnia severity. However, this finding may be influenced by the inherent difficulties in measuring mindfulness as discussed in Chapter 5. It may also have been influenced by the average level of mindfulness in the sample, in that if the sample were higher than average on
overall mindfulness, this may have led to a smaller degree of change which the research design was not adequately powered to detect. However, at the time of analysis, there were no available norms for the FFMQ. Further correlational investigations found a moderate positive correlation between changes in mindfulness and changes in number of awakenings. This suggests that people who improved in mindfulness were more likely to show reductions in nocturnal awakenings. This fits with theoretical concepts and past findings which support the notion that meditation may reduce stress (Sharma & Rush, 2014), decrease sympathetic activity (Krygier et al., 2013; Lazar et al., 2000; Takahashi et al., 2005; Tang et al., 2009), alter brainwaves (Cahn & Polich, 2006; Simpkins & Simpkins, 2012), and therefore potentially improve sleep stability. Although the direction of this relationship is unclear, this finding is particularly interesting and warrants further investigation. Future studies could use a measure of sleep stability, such as CAP, to evaluate changes to sleep stability.

10.5.2 What Sleep Variables Were Associated with Larger Changes in Insomnia Severity?

There was a strong negative correlation found between changes in insomnia severity and change in sleep quality. Negative correlations were also found between change scores on insomnia severity and anxiety, preoccupation with sleep, objective TST, and WASO. There is no clear explanation for these findings, except for the negative relationship with change in TST, which was expected. Changes in insomnia severity were positively correlated with changes in subjective sleep efficiency. This finding matches with the intended outcome of sleep consolidation and the background behavioural model of insomnia. People who have sleep
problems often react by increasing their time spent in bed, which can lead to an increase in wakefulness at night and a longer sleep onset. Reducing the amount of time in bed can improve sleep efficiency, and this was related to greater improvements in insomnia severity in the current sample.

10.5.3 What Other Outcome Scores Were Associated with Changes in Insomnia Severity?

Interestingly, changes in insomnia severity were only related to changes in one outcome score, energy, as measured by the SF-36. This relationship was in a positive direction and was found to be of moderate strength. This indicates that those with decreases in insomnia severity were more likely to experience improvements in energy. Changes in sleepiness, as measured by the ESS, were positively correlated with overall reductions in total mood disturbance (as assessed by the POMS) and anxiety (as assessed by the HADS). People who revealed improvements in sleepiness were more likely to report improvements in total mood disturbance and anxiety. Depression, on the other hand, was related to changes in the two outcome scales designed to identify problematic cognitive patterns associated with sleep: anxiety and preoccupation with sleep (strong positive relationship) and sleep-related monitoring (moderate positive relationship).

People who showed reductions in depressive symptoms were more likely to exhibit reductions in anxiety and preoccupation with sleep, and sleep-related monitoring. This reflects the complex nature of anxiety, depression and insomnia. These findings suggest there may be two different pathways of change. First, improving emotional regulation in people with high
anxiety or mood disturbance may lead to a reduction in sleepiness. Second, reducing preoccupation with sleep and sleep-related monitoring, may lead to lower depression scores. These suggestions are purely speculative, as this research is correlational by nature, and therefore a causal relationship cannot be assumed. Nevertheless, this warrants further consideration in future studies investigating MBT-I in naturalistic samples.

10.5.4 Could Personality Predict Who May Show Greater Improvements from MBT-I?

There was one significant correlation found between changes in insomnia severity and the identified predictors (including personality and pre-treatment levels of mindfulness, anxiety and depression and insomnia severity). Conscientiousness was negatively correlated with changes in insomnia severity, with a moderate strength detected. Those who reported being high on conscientiousness were generally efficient and organised, as opposed to being easy-going and disorderly. These people may show self-discipline and aim for achievement. In extreme situations they may be ‘workaholics’, ‘perfectionists’ and compulsive in behaviour (McCrae & Costa, 2003). Although conscientious individuals could be more likely to comply with instructions and complete meditations and homework, these same individuals may have difficulty in applying concepts required to improve sleep, such as non-striving and letting-go, due to their drive to succeed. Furthermore, they may also have more difficulty in disengaging from cognitive processing, which could potential lead to a continuation of the ‘attention-intention-effort’ pathway (Espie et al., 2006). They might also hold higher standards for their sleep, perhaps leading to a tendency to remain dissatisfied it.
There were several other relationships between personality and other sleep outcome measures. Neuroticism was negatively related to changes in subjective WASO, extroversion was positively correlated with changes in subjective SOL, and openness was negatively correlated changes in subjective TST and positively correlated to changes in objective TST. To make sense of these findings, it is important to consider how these personality traits may influence behaviour, cognitive functioning, and perception.

People who scored high on neuroticism were less likely to experience reductions in subjective WASO. Neurotic individuals tend to be moody, insecure, anxious and self-conscious, and they tend to undergo more frequent experiences of negative affect. A neurotic individual is highly susceptible to psychological distress. Consistent emotional distress during the day may lead to greater sleep instability. Chapter 2 of this dissertation includes a discussion on the brain and sleep, specifically addressing the interactions between the VLPO and the ARAS. Studies have shown that damage or weakness in either side of this complex brain circuitry may lead to difficulties with the ‘sleep switch’. It is possible that the continuous emotional turbulence experienced by neurotic individuals interferes with the process of suppressing wakefulness, which makes sense in the context of evolutionary psychology.

The brain of a person who is insecure and anxious is likely to interpret the sleeping environment as being potentially unsafe. This may lead to more external stimuli being filtered into consciousness, thus interfering with sleep. A potential way of exploring this further would be to use a measure of sleep stability and compare individuals who score highly on neuroticism
with individuals whose scores are lower. This may be investigated in future studies with measures of arousal such as CAP (Parrino, Ferri, Bruni, & Terzano, 2012).

Looking at this finding from a different perspective, there are two reasons why an individual who is high on neuroticism might perceive that their wakefulness at night is higher than it actually is. These explanations are consistent with the findings of this study, because the results suggest that high neuroticism is related only to subjective, and not objective, WASO change scores. First, individuals high on neuroticism may exaggerate their complaints of sleep disturbance. This is supported by a number of studies that have shown that those high on neuroticism were more likely to have elevated F scores (infrequency), and higher F and K scores (honesty of test responses/not faking good or bad) on the Minnesota Multiphasic Personality Inventory (MMPI). Harvey and Tang (2012) provide a review on sleep state misperception. Second, sleep misperception may be a manifestation of more general psychological distress. Correlational research has found a number of different relationships in which individuals with insomnia score higher on measures of neuroticism, hypochondriasis, conversion-hysteria, and psychasthenia (indicating the presence of trait anxiety). Furthermore, patients with depression appear more prone to sleep misperception (Harvey & Tang, 2012).

Another interesting finding from the current study was that there was a positive correlation between neuroticism and change scores on total mood disturbance as assessed by the POMS. People who were higher on neuroticism were more likely to show greater improvements in total mood disturbance, which fits with the finding that meditation improves emotional regulation (Hoelzel et al., 2011b; Lazar et al., 2005). Despite the negative correlation with
WASO and neuroticism, there is evidence that the MBT-I program may provide individuals who are high on neuroticism with the skills to begin to reduce total mood disturbance. It is possible that this may take some time to influence sleep. The negative correlation between neuroticism and WASO is an interesting finding that warrants closer examination. Further studies could use a measure of CAP to investigate the levels of sleep instability in those who score highly on neuroticism. Equally, the discrepancy between objective and subjective WASO scores may be examined to investigate if there is a greater discrepancy in those who score high on neuroticism.

Extroversion was positively correlated with SOL change scores. Extraverts tend to be social, outgoing, talkative and assertive (Barrick et al., 2001). Extraversion is also related to a desire for activity, excitement and stimulation (McCrae & Costa, 2003). It is possible that the MBT-I program educated extroverts on the concept of ‘slowing down’, which may have allowed them to create a greater wind-down plan. On the other hand, extroverts may have been better able to spend less time in bed, leading to greater success with the behavioural component of the program. To investigate these ideas, further research could investigate the relationship with these specific behaviour changes (e.g., length of wind-down time, amount of time spent in front of screens such as TV, and compliance with consolidation instructions) to identify if extroverts made significantly greater changes in these areas, and if these changes were associated with improvements in sleep onset.

Openness was negatively correlated with changes in subjective TST and positively correlated to changes in objective TST. Openness to experience describes traits of curiosity, imagination, broad-mindedness and unconventionality (Barrick et al., 2001). These findings
suggest that people who were high on openness were more likely to exhibit higher degrees of change in objective TST, and less likely to exhibit change in subjective TST. ‘Change’ in this situation, however, is not as straightforward to interpret as it has been for other sleep variables, because objective results indicated that TST decreased rather than increased, which was contrary to expectations. People who are high on openness may have been more likely to comply with consolidation instructions, which may have led to them being more likely to reduce on objective TST. It is not clear why there was the opposite finding with subjective experience of TST.

Age was positively correlated with changes in subjective WASO, indicating that older participants showed greater reductions in the amount of time they perceived they were awake at night after the first onset of sleep. Sleep changes over the course of the lifespan, with consistent reports of increases in WASO and sleep latency, and percentage of stage one and stage two sleep in older populations. Decreases in REM sleep percentage are also associated with age. It is possible that WASO of older adults was greater at baseline, leading to greater change scores after the intervention. This finding suggests older adults are more likely to benefit from treatment with respect to reductions in WASO, making it particularly relevant in terms of referral suggestions for MBT-I. On this basis, clinicians may consider older adults with high WASO as suitable candidates for MBT-I.

10.5.5 Other Correlations of Interest

Pre-treatment depression scores were positively correlated with change in pre-sleep cognitive arousal and with changes in anxiety. Higher levels of baseline depression were associated with more pronounced reductions in cognitive arousal anxiety. Higher levels of
baseline depression were negatively correlated with two aspects of the SF-36 (physical role limitation and pain), indicating that people who scored higher on depression were less likely to experience improvements in pain and physical role limitations.

Pre-treatment mindfulness was negatively correlated with two outcome measures: POMS total mood disturbance and FFMQ change score. People who were high on mindfulness at baseline were less likely to show changes in mood and mindfulness, whereas people who were low on mindfulness at baseline were more likely to show improvements in mood and mindfulness. Mindfulness and mood was not found to change significantly over time, but interestingly, there were changes in overall insomnia severity, which indicates that there is still benefit from MBT-I for individuals who do not show notable changes in self-reported mindfulness. This may be for a variety of reasons for this; for example, there may be a neurological and physiological benefit to sleep derived from meditation, even if overall mindfulness is high.

Alternatively, it is possible that the behavioural aspects of the intervention may account more for the changes in sleep. However, there are indications that meditation has the potential to reduce stress by increasing theta power, which is associated with relaxed attention (Cahn & Polich, 2006; Simpkins & Simpkins, 2012), decreasing sympathetic tone (Krygier et al., 2013; Lazar et al., 2000; Takahashi et al., 2005; Tang et al., 2009), and an improvement in the recovery of the stress response (Harinath et al., 2004). This suggests that, regardless of the level of baseline mindfulness, meditation may contribute to improvements in sleep.
10.6 Qualitative Findings

Anonymous questionnaires at follow-up were collected for approximately half of the sample. It is important to consider that there may be a self-selection bias when interpreting these qualitative findings, as those who were not satisfied with the outcomes of the intervention may have not taken the time to return their questionnaires. However, from the questionnaires that were collected, there was a very positive response to treatment, despite a range of outcomes in subjective sleep. No participant reported dissatisfaction with the treatment and participants endorsed the treatment program strongly; noting, for example, “I would highly recommend this treatment to others”.

Many participants found there was a positive impact of meditation on sleep. However, other participants noted that meditation was more useful for managing the symptoms of poor sleep. One participant reported that: “It put it in perspective and unconsciously I seem to have relaxed about the whole issue”. This reflects a general theme seen in the responses. The only common finding that signifies that amending the protocol may be warranted is that participants generally struggled to maintain their meditation practice, and cited issues such as “difficulties finding the time to meditate” as reasons for this. Changes to the program may involve dedicating more time to support establishing the practice, and perhaps including some follow-up telephone calls from the convenor.

Overall, the qualitative findings provided more detailed support for the efficacy of MBT-I. Although not all participants experienced clinically significant findings with regard to quantitative outcomes, all participants who responded at follow-up felt positive about their
experience and their comments regarding the benefit of mindfulness appeared to extend beyond the focus of sleep outcomes.

10.7 Limitations of the Study

10.7.1 Generalisability

The generalisability of the study was limited due to several factors. The first category of considerations is with respect to the sample. Recruitment was largely through the Melbourne Sleep Disorders Centre, which is a private sleep disorders centre situated in East Melbourne, Australia. This is a private consulting suite, so referrals tend to include a greater proportion of people with private health insurance and an overall higher socio-economic status. This was reflected in the characteristics of the sample, which reported higher education and use of private healthcare insurance than the average Australian. This must be considered when interpreting these findings, as it may lead enhanced outcomes due to an increased likelihood of comprehension of the material presented. Second, participants self-selected into the group, which may have led to a sample who were more open to mindfulness-based treatment than the general population of those with insomnia. It is possible that if participants were randomly assigned to this treatment without awareness of what it was, the findings may have been different.

Another factor that may impact on the generalisability of this study is the small sample size and the 50% attrition between post-treatment and follow-up. Smaller sample sizes reduce the power to detect small effects to a level of statistical significance, thereby lowering confidence that the sample may be representative of the population of interest. Finally, although the
inclusion criteria did not rule out comorbid or secondary medical and mental health issues, this information was not collected and analysed. Therefore, no report can be made on the incidence of particular conditions and nor can it be identified whether or not this sample is representative of the population.

Another consideration with regards to generalisability is the study design. The design of the study can be described as a prospective cohort study, which is one form of a non-randomised trial. To reduce bias, two baseline time points were collected (intake and pre-treatment) which were averaged to achieve a stable overall baseline. In general, studies that do not involve a control group are more susceptible to bias. Randomised controlled trials have been found to be the ‘gold standard’ for treatment evaluation by minimising threats to internal validity and improving the ability to generalise findings to the overall population (Sibbald & Roland, 1998). The significant findings in this study could have been due to a number of factors besides the program. For example, it is not possible to rule out the Hawthorne effect (McCarney et al., 2007), which is improvement simply because the participants were aware they were being monitored as part of a trial. The most appropriate design for this study would have been a randomised controlled trial. However, due to unforeseen circumstances this was not possible. The addition of a second baseline period strengthened the reliability of the results, because any difference from the combined baseline and post-treatment was less likely to be due to expectations of treatment leading to an improvement.
10.7.2 Data Collection

The majority of the variables analysed were self-report measures. For some of the variables of interest – for example, mindfulness or arousal – self-reported outcomes may not be sensitive enough to detect important changes. Assessment of mindfulness has inherent difficulties that have been discussed at length in Chapter 5. However, there are techniques that may provide more information about arousal from an objective perspective, such as physiological (e.g., cortisol or heart rate variability) and neurological changes (e.g., CAP). However, the inclusion of actigraphy and data from a sleep diary, along with the subjective outcomes, adds a valuable contribution to the literature.

There was a proportion of missing data from consistent errors in actigraphy recordings. Follow-up conversations with the distributor of the actigraphs identified that there may have been an error in the batch of actigraphs from which the purchases were made, as the rate of error was significantly higher than expected. Although these errors were random, and there were attempts to make the best use of the available data by organising it in a linear mixed modelling format, the issue of missing data is still an important one to consider. It should be noted, however, that no systematic differences were identified in the actigraphic data between participants who completed the trial and those who didn’t.

10.8 Clinical Implications

This current study provides further support for the use of MBT-I, given that the sample in this case is more representative of the type of person who may self-refer for insomnia treatment
than the sample used in the original pilot study (Ong et al., 2008b). Results suggest that MBT-I led to clinically meaningful changes in all sleep measures apart from TST, and the magnitude of these changes was comparable to those yielded by a meta-analytic study investigating the treatment outcomes of CBT-I (Trauer et al., 2015).

Correlational findings introduced some interesting ideas that may guide clinicians with respect to referrals to MBT-I. Findings suggested that: participants who were high on neuroticism were more likely to show smaller changes in insomnia severity; individuals higher on neuroticism were less likely to experience reductions in WASO; individuals high on neuroticism were more likely to show greater improvements in total mood disturbance; those who were high on extroversion were more likely to experience reductions in SOL; older adults were more likely to experience greater changes in WASO than younger adults; and higher baseline insomnia severity was correlated with larger reductions in SOL. Depending on the presenting problem, clinicians may consider personality and age when considering a referral. For example, if a clinician encounters an individual who is highly neurotic, it may be anticipated that following MBT-I intervention, WASO could be less likely to change than other sleep outcomes for this particular person. However, the same individual may be more likely to experience improvements in mood disturbance that may be clinically relevant to their overall functioning. Similarly, those with high scores on insomnia severity, highly extroverted individuals with long SOL times, and older adults with high levels of WASO seem to be particularly good candidates for treatment using MBT-I. Given the design of the study, this research is not able to provide information regarding the difference between MBT-I and CBT-I; however, there is more recent
research that has indicated that MBT-I is as effective as CBT-I (Ong et al., 2014). Clinicians can consider both MBT-I and CBI-I as options for treating insomnia.

**10.9 Theoretical Implications**

The correlational findings also suggested some interesting ideas that may guide further research, as a number of interesting relationships were found. These relationships include: somatic arousal and WASO (positive); mindfulness and number of awakenings (positive); mood disturbance and sleepiness (positive), and anxiety and sleepiness (positive); anxiety and preoccupation with sleep and depression (positive), and sleep-related monitoring and depression (positive); pain and physical role limitations with depression (both positive); and baseline mindfulness with mood (negative) and mindfulness (negative). Pre-sleep arousal was not found to be related to sleep or mindfulness, contrary to hypotheses. This suggests that MBT-I may not improve sleep by reducing arousal, or, the measure of pre-sleep arousal may not be an adequate assessment of arousal. Given the increasing focus on hyperarousal within models of insomnia, this topic warrants further research. Overall, there appears to be several different pathways that have led to improvement with different outcome measures, although the study design does not allow for these to be evaluated with any degree of certainty.

Given the nature of the research design reported here, meaningful suggestions regarding causal pathways or alternative mechanisms would be beyond the scope of this thesis. However, future research could focus on using more sophisticated data analyses with larger samples, such as path analysis or structural equation modelling, to allow for more specific model testing. This
study also introduced the concept of personality as relevant to treatment outcome and builds on previous research by including a naturalistic sample. Together, these factors add to the current body of research in this area by providing some preliminary relationships that may be examined further with more sophisticated procedures (Gunzler, Chen, Wu, & Zhang, 2013). As there was an overall meaningful change in insomnia severity, understanding these pathways further may help to enhance the overall program, or perhaps enable the program to be tailored to patients with different types of presenting problems.

This research is the first to replicate MBT-I in a naturalistic sample with the use of subjective and objective outcome measures. This replication of the pilot study provides relevant and useful clinical outcomes that strengthen our understanding of MBT-I. The findings suggest that MBT-I can be successfully delivered to a sample of people with insomnia, without screening for potential confounding variables such as depression or anxiety, or by using strict criteria for psychophysiological insomnia.

10.10 Conclusion

Insomnia is a serious problem that negatively impacts the quality of life of sufferers. CBT-I, the most widely used non-pharmacological treatment for insomnia has been found to be effective in the treatment of insomnia, however there is scope to improve treatment options for insomnia. The development of an alternative treatment is likely to be of benefit. There is substantial evidence that mindfulness-based therapies may offer a unique avenue to improve sleep by reducing hyperarousal and through training individuals to respond differently to
thoughts and emotions that can impede the natural sleep process. MBT-I is a treatment combining MBSR with behaviour therapy for insomnia. This research is the first to replicate MBT-I in a naturalistic sample with the use of subjective and objective outcome measures.

The aim of this research was to evaluate the efficacy of MBT-I in a naturalistic Australian sample. It was hypothesised that participants would score lower on insomnia severity, and higher on objective and subjective sleep quality at post-treatment and follow-up when compared with baseline. This hypothesis was supported, with many significant improvements across a variety of subjective and objective sleep variables. For example, there were significant reductions in insomnia severity, sleep disturbance, sleep onset latency, wake after sleep onset and improvements in sleep efficiency found in both objective and subjective data. The outcomes of the research also supported the hypothesis that there would be reductions in cognitive processes known to impair sleep; this was demonstrated by significant reductions in sleep-related monitoring and anxiety and preoccupation about sleep. This study was the first to investigate changes in sleep-related monitoring and anxiety and preoccupation with sleep. Finally, there was some evidence to support the hypothesis that mindfulness hyperarousal may reduce arousal levels. Cognitive arousal reduced significantly between baseline and post-treatment, however these changes were not maintained at follow-up. However, contrary to expectations, there was no relationship detected between overall change scores of pre-sleep arousal and insomnia severity. This reduction in hyperarousal was not able to explain the overall treatment response. There was also no relationship between changes in mindfulness, and changes in insomnia severity, however this finding may be impacted by the inherent difficulties in measuring mindfulness. Overall,
there is support for the efficacy of MBT-I, however more research is required to understand the mechanisms by which it works.

This replication of the pilot study provides relevant and useful clinical outcomes that strengthen our understanding of MBT-I. The findings suggest that MBT-I can be successfully delivered to a sample of people with insomnia, without screening for potential confounding variables such as depression or anxiety, or by using strict criteria for psychophysiological insomnia.
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12 Appendix

12.1 Telephone Screening Form

TELEPHONE SCREENING FORM

Date of Telephone Call: ________________________
Source of Subject: ____________________________

I would like to give you a brief overview of the study. This study is looking at the benefits of a group mindfulness and cognitive behaviour therapy to treat insomnia. The research involves a three-month commitment from you.

You will be asked to attend the Melbourne Sleep Disorder Centre to meet with one of our study doctors to determine if this treatment is right for you. Based on this meeting you may be invited to take part in the study. Eligible participants will be asked to keep a daily sleep diary, wear a watch to monitor their sleep-wake patterns and do some short questionnaires asking about their sleep quality and any depression or anxiety symptoms they may have.
Eligible participants will attend one two-hour group session per week for six weeks at the Melbourne Sleep Disorders Centre, and perform home practice five times per week at home. Classes will be limited to eight people. Then for the next three months participants will be encouraged to continue this home practice routine. Participants will be asked to complete a daily sleep diary so we are able to monitor their progress.

At the beginning of the study and before and after your first session participants will be asked to complete a set of questionnaires.

I will need to ask you some questions to determine whether this study is right for you.

Are you interested in proceeding with this screening?

YES  NO

If NO, why not?

___________________________________________________
Name: _______________________________________________________________

Phone number_________________________________________________________

Address______________________________________________________________

____________________________________________________________________

What is your date of birth? _____/_____/_____ How old are you now? _____ years

Have you been diagnosed with insomnia? Date __/__/____

YES  NO

Are you currently being treated for insomnia? ☐  ☐

IF YES what treatment? ________________________________

Is there any particular reason for your poor sleep? YES  NO

☐  ☐

How many nights do you have difficulty sleeping per week?

____________________________________________________________________

How long have you been experiencing sleep difficulties? _____________

Do you have difficulty

Getting to sleep ☐

Staying asleep ☐

Early morning awakenings ☐
Have you been diagnosed with another sleep disorder?  

YES  NO

☐  ☐

IF YES what was it?  

__________________________________

Date of diagnosis?  

__________________________________

Severity if known  

__________________________________

Is it currently treated?  

__________________________________

What is the treatment?  

__________________________________

Do you have, or have you ever been diagnosed with any psychiatric or psychological illness (including depression or anxiety)?  

YES  NO

☐  ☐

Current treatment:  

__________________________________

Past treatment:  

__________________________________

Have you been diagnosed with alcohol abuse or dependence?  

YES  NO

☐  ☐
How many cups of caffeinated drinks do you consume per day?

________________________________________________________

Are you a shift worker? YES NO

☐ ☐

Do you have any other chronic disease which is out of control or has changed rapidly in the last six months? YES NO

☐ ☐

If YES, give details: ______________________________________________________

_____________________________________________________________________

_____________________________________________________________________

Are you currently participating in any other research studies? YES NO

☐ ☐
Would you like to receive some more information about the study? We can send you out some written information, and then talk to you about it again once you have had a chance to read through it.

If you have any questions or concerns about the study before we contact you again, please call Allie Peters on (03) 9663 1993. Thank you very much.
12.2 Demographic Questionnaire

Participant Demographic Information

Name:

**Is your gender**

- Male □
- Female □

**What is your marital status?**

- Single, never married □
- Married □
- Separated/Divorced □
- Live with partner □
- Widowed □
- Prefer not to say □
- Other ______________

**Is your primary language:**

- English □
- Other ___________________________
What is the highest educational level you have completed?

Less than high school □ Some high school □
Completed high school □ Trade School/TAFE □
University undergraduate □ University postgraduate □

Please describe your employment status

Employed in the work force full-time □ Employed in the work force part-time □
Not in the work force □

Please describe your household income

Between 0 and 25,000 □ Between 75,000 and 100,000 □
Between 25,000 and 50,000 □ Over 100,000 □
Between 50,000 and 75,000 □ Prefer not to say □

Please describe your current housing:

Rented House/Apartment □ Own House/Apartment □
Retirement Living □ Other _____________________
**What is your housing situation?**

- Live alone
- Live with partner
- Live with children
- Live with other relatives
- Live with non-relatives
- Other

**Do you have private health insurance?**

- Yes
- No

**Do you smoke?**

- Yes
- No

If yes, how many per day? ___________

**Do you drink alcohol?**

- Yes
- No

If yes, how many standard drinks per week? ___________

**Do you drink coffee or other caffeinated beverages?**

- Yes
- No

If yes, how many drinks per week? ___________

**Do you use recreational drugs?**

- Yes
- No

If yes, describe weekly amount? ___________
Have you ever accessed psychological treatment?
Yes □ No □
If yes, how many sessions have you attended? ____________

Have you ever had cognitive behaviour therapy?
Yes □ No □
If yes, how many sessions have you attended? ____________

Had you heard about mindfulness prior to contacting us about this treatment?
Yes □ No □

Have you ever engaged in mindfulness meditation?
Yes □ No □
If yes, how many sessions have you attended? ____________

How long have you experienced sleeping difficulties for? (Please indicate the number of months or years.) _____Months _____Years

Do any other family members report sleep difficulties?
Yes □ No □
12.3 Treatment Manual

2010

Ms Allie Peters
Principal Investigator, PhD Candidate

Professor Ken Greenwood
Primary Supervisor

Assistant Professor Jason Ong
Secondary Supervisor

Dr Moira Junge
Secondary Supervisor

Dr David Cunnington
Principal Physician
Summary of Sessions

**Session 1: Introduction and overview of program**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Time</th>
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<tbody>
<tr>
<td>1. Provide overview of the program rules, and participant expectations</td>
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<tr>
<td>2. Introductions</td>
<td>20</td>
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<tr>
<td>3. Introduce mindfulness</td>
<td>10</td>
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<tr>
<td>4. Eating meditation and inquiry</td>
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<tr>
<td>5. Sitting with breath meditation and inquiry</td>
<td>30</td>
</tr>
<tr>
<td>6. Model of insomnia</td>
<td>15</td>
</tr>
<tr>
<td>7. Homework and farewell</td>
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**Session 2: Stepping out of automatic pilot**

<table>
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<th>Activity</th>
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<tr>
<td>2. Discussion about body scan</td>
<td>10</td>
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<tr>
<td>3. Walking meditation</td>
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</tr>
<tr>
<td>4. Discussion about walking meditation</td>
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<tr>
<td>5. Establishing practice</td>
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</tr>
<tr>
<td>6. Awareness and insomnia</td>
<td>25</td>
</tr>
<tr>
<td>7. Sleep hygiene (revision)</td>
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<tr>
<td>8. Homework and farewell</td>
<td>05</td>
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</tbody>
</table>

**Session 3: Acceptance**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Time</th>
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</thead>
<tbody>
<tr>
<td>1. Mindful movement (yoga) and inquiry</td>
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</table>
2. Sleep consolidation program  40
3. Acceptance and letting go  20
4. Poem  10
5. Homework and farewell  05

Session 4: Working with sleeplessness at night

1. Half-way point discussion  15
2. Stimulus control  20
3. Adjustment to sleep window  10
4. Territory of insomnia  30
5. Sitting meditation with emotions  20
6. Discussion  20
7. Homework and farewell  05

Session 5: Nurturing relationships with the self and sleep

1. Discussion  10
2. Three-minute breathing space and discussion  25
3. Meditation with choiceless awareness and discussion  20
4. Relationship with sleep  30
5. Nurturing/depleting exercise  30
6. Homework and farewell  05

Session 6: Eating, breathing, and sleeping mindfulness: Living the full catastrophe
1. Informal mindfulness mediation and group discussions  40
2. Breathing meditation inquiry and discussion  20
3. Overview of progress (group time)  10
4. Review and long-term goal setting  10
5. Action plan for insomnia  15
6. Closing ceremony (wisdom circle)  25
Session 1: Introduction and overview of program

Introduction to the Program

Key Points: Provide participants with ground rules and expectations of the program. Introduce instructors and group members.

Overview [5 minutes]
This program brings together elements of a program using mindfulness meditation practice with behavioural strategies for insomnia into an integrated program designed to help people who suffer from insomnia. Our program will meet every __________ (day) from ________ (time) for 6 weeks at MSDC. In between the sessions, we will be asking you to practice the skills that are taught during the program. This will consist of setting aside time to practice the meditations, following certain instructions about night-time and daytime behaviours, and changing the way you approach sleeping and waking stress. Although it might sound overwhelming or difficult to participate, many people who have had the same reservations but decided to participate in programs similar to this one have found ways to fit the program into their busy lives and were ultimately rewarded with significant benefits. Also, if you are sceptical or disagree with some of things that are taught in this class, I encourage you to suspend judgment and stay open to the possibility that you might benefit from the program. Many people who were initially sceptical of programs similar to this one have also found that they were able to benefit considerably. So take heart! The journey is not without effort but I believe you will find the work to be worthwhile.

Pass out resources for class (Full Catastrophe Living and Meditation CDs) to each participant and explain that this book can serve as a reference for the meditation practices and provides examples of how mindfulness can be applied to our daily lives. Also explain that certain chapters will be assigned as homework. Refer to the homework page.

Ground Rules and Expectations [5 minutes]
As with any program, it is important to establish “ground rules” to help understand the expectations of this program and questions can be answered. So, let’s talk about how this program works.

1. Confidentiality – Discussions are an important part of this group program and we encourage everyone to share their experiences during these discussions. Thus, creating an environment that people feel safe and open to share with group members is very important to facilitate these discussions. Therefore, we ask that everything said during the classes is kept confidential. Please take a moment to look around the room and acknowledge to one another that this privacy will be respected throughout this program.

2. Giving advice to other members – Another important issue related to the discussions is whether or not group members should give advice to one another. Although this is very tempting and can be helpful at times, I would like to emphasise that this program is not intended to be a support group for insomnia. This program aims to teach mindfulness skills including mindful listening, non-judging, and being present without trying to engage in problem solving. Please try to keep these principles alive during our discussions. It is okay, and even encouraged, to share your experiences and insights during discussions.
3. Diaries and questionnaires – As participants in a research study, you are aware that we would like to learn as much as possible from each of you so that we can answer important scientific questions. In this program, you will be given weekly diaries and questionnaires during the program and also during follow-up points after the conclusion of the class. It is very important that you do your very best to complete all of the diaries and questionnaires so that we can have the best chance of answering the study questions. Ask if there are other questions about the program, requirements, or expectations.

4. Who will be in the group? – Main group leader, assistant leaders, and silent observers.

Group Member Introductions [20 minutes]

Now I would like to take some time to introduce ourselves so that we can get to know each other. Please tell us: 1) your name, 2) what brought you to this program (including previous experience with meditation or insomnia treatments, sleep problems), 3) what you hope to get out of this program. I will get us started.

Go around the room and have each member give an introduction.

One common theme is that you are all here because you are experiencing sleep problems and want help for this problem. At this time, I ask that you set aside any goals or intentions of trying to improve your sleep. This might sound odd but it is an important first step in the mindful approach we are taking. I ask that you pause for a moment and let go of this goal and just allow things to happen during the program without trying to strive towards an end. Then, we can see where things stand at the end of the program.

Introduction to Mindfulness Meditation [10 minutes]

**Key Point:** Introduce the concept of mindfulness and initiate meditation practice.

What is mindfulness meditation?

The concept of mindfulness comes from Eastern philosophical and religious traditions. Recently, it has been integrated into Western medicine and psychology as a technique to help reduce stress and live healthier more adaptive lives. It should be emphasised that even though mindfulness is rooted in Buddhism, this program is not associated with any religion and people with different religious backgrounds have found that it can complement their existing beliefs. The word mindfulness literally means to “see with discernment” or to see clearly, which is a concept that has universal applications. Although there are many definitions of mindfulness, a simple definition of mindfulness is bringing awareness and attention to the present moment. By paying attention in the present moment we begin to see clearly or become more “awakened”. This might seem curious because you are here to seek help for your sleep problem. However, we will talk about how becoming more awake in your life might actually help you sleep better. To expand our definition of mindfulness, there are several guiding principles to being mindful. These principles are: 1) Non-judging, 2) Patience, 3) Beginner’s Mind, 4) Trust, 5) Non-striving, 6) Acceptance, and 7) Letting go. These principles or qualities are the core of adopting a mindful approach to each moment. You might think of these principles as guidelines for living in a mindful way.
Briefly describe each principle and emphasise that whatever participants are feeling or thinking is okay. Also encourage participants to bring these principles to life in here as well as their daily lives.

Now that we have talked about what mindfulness is, let’s spend a moment defining meditation and talking about mindfulness meditations. First, let’s define meditation. I like to think of meditation as an activity or a process of transformation that embodies attention, awareness, understanding, and compassion. Although we often think of meditation as sitting in a lotus position with our eyes closed, this is only one form of meditation. In fact, it is possible to meditate when eating, lying down, or walking. Furthermore, there are many “informal” ways to meditate such as mindfully riding a bike or mindfully talking to a colleague. So I ask you to open your mind to all of these different forms of activities as meditation. In the approach taken in this program, mindfulness is based in meditation. The practice of meditation provides an opportunity to cultivate the principles of mindfulness we discussed earlier. Such practice allows for a deeper sense of being mindful and the benefits of being mindful (such as relaxation) arise directly from this practice. Therefore, it is important to develop and maintain a consistent meditation practice. Some of you may have heard of or had experience with other forms of meditation such as transcendental meditation or Zen meditation. These approaches are slightly different than the mindful approach taken here. For example, transcendental meditation emphasises concentration of attention on an object or word. In contrast, mindfulness meditation emphasises awareness. Rather than thinking, it is about being with whatever you are experiencing in the present moment in a non-judgmental manner. Again, we ask that you try this approach and then see how it works for you.

Finally, I would like to explain some misconceptions about mindfulness and mindfulness meditation. Mindfulness meditation is NOT: 1) positive thinking; 2) simply another relaxation technique; 3) going into a trance; 4) clearing your mind or making it go blank; 5) a special activity for highly trained, unique people; or 6) trying to achieve a special state of mind. Mindfulness meditation is about becoming more awake in YOUR life, something everyone can do!

Now that we have talked about mindfulness meditation, let’s begin to experience mindfulness meditation.

Meditation Practice and Inquiry [60 minutes]

Mindful Eating [20 minutes] (Kabat-Zinn, 1990)

Key points: The raisin exercise is introduced as an example of how to eat mindfully and it can demonstrate how we are often unaware of what is going on in normal every day activities. It can also demonstrate how changes can take place by simply slowing down and paying attention to these activities. This exercise also provides an example of how mindfulness practice can extend beyond a formal sitting meditation. The following exercise is completed in about 20 minutes to serve as an example of a mindfulness meditation. The steps are described below:

1. Participants are given 2-3 raisins.
2. The therapist leads the group in eating each raisin in a “mindful” way. This includes using all the senses, become completely aware of everything we are doing, and being fully present with the eating experience.
3. Participants are given the opportunity to practice being fully attentive to an activity in a non-judgmental manner.
4. This exercise is processed and contrasted with the normal eating experience.
Furthermore, it is offered as an example of how mindfulness works (i.e. to “demystify” the concept).

**Inquiry and Discussion of Mindful Eating [10 minutes]**

1. What did you notice?
2. How is this different than the way you normally eat?
3. How do you think eating mindfully will help you with insomnia?

**Sitting with Breath Meditation [20 minutes]**

**Key points:** Provide participants with guidance on bringing attention to the breath. This serves as the anchor for grounding oneself in the present moment.
- Discuss diaphragmatic breathing and lead group through a 20-minute breathing meditation (see Sitting with breath Meditation Exercise in FCL) followed by a discussion of this exercise.

**Inquiry and Discussion of Sitting Meditation [10 minutes]**

- Issues to consider for discussion:
  a. Breathing can be automatic or controlled. This can lead to a discussion on the cognitive and physiological relaxation effects of breathing.
  b. What was it like to simply pay attention to your breathing?
  - active, intention, note variations in breathing
  - not trying to change or control anything
  - try not to think about it, just feel it!
  - can do this at anytime during the day (e.g. work, home, etc.)
  - can also practice mindfulness on any activity (e.g. talking, eating, driving)
  - NO WRONG WAY TO MEDITATE, AS LONG AS YOU ARE PAYING ATTENTION IN A NON-JUDGMENTAL WAY
  - DO NOT LINK PRACTICE TO OUTCOMES! THIS IS A NON-STRIVING ACTIVITY

For homework, ask participants to practice the sitting with breath meditation for at least 15 minutes per session, at least 6 times this coming week. Discuss issues related to finding a time and place to practice.

**A Model of Insomnia [15 minutes]**

**Key point:** Introduce the model of insomnia that will be used in this program.

*Now let's spend some time talking about sleep, stress, and insomnia. One of the most widely accepted models of insomnia is what I like to call the “three-P model” of insomnia. The three P's stand for predisposing, precipitating, and perpetuating factors. Predisposing factors are the elements that we “bring to the table”, such as genetic or biological make up, personality or psychological makeup. For example, a person might have a biological predisposition to insomnia. Usually, we do not have control over these factors. The second P is the precipitating factor. These factors usually involve an event or series of events that disrupts our sleep or sleep-wake pattern. For example, it could be spending a week in the hospital, traveling across many time zones, going through a divorce, or losing a job. These might be thought of as “triggers” of insomnia. These precipitating factors are also often uncontrollable and usually dissipate over time. Finally, the perpetuating factors are the worries about sleep and sleep loss, compensatory behaviours (e.g. taking medication, going to bed earlier) and the effort put into trying to regain sleep. For people who have chronic insomnia, this factor seems to be the “fuel” that drives the*
cycle of insomnia. In contrast to the other factors, we often have more control of these factors, although it might not seem to be the case on a nightly basis. This program works primarily with these perpetuating factors.

Traditionally, treatments for insomnia have attempted to reduce or eliminate the perpetuating factors by focusing on the nighttime symptoms. For example, sleep medication or instructions for bedtime behaviours are usually intended to regulate sleep-related behaviors or improve sleep-promoting behaviours. However, a common denominator with the perpetuating factors is the physical and psychological distress that arises when sleep is regularly disrupted. This distress is often present at night and also during the day so that insomnia becomes a “24-hour problem”, not just a problem that occurs at night. In fact, some people with insomnia have described their bed as “an enemy” or the bedtime as a “battlefield” and if they lost this “battle” they have to pay the consequences the next day. As I mentioned earlier, one of the paradoxical aspects of this program is that we hope to teach you how to become more awake through mindfulness. There is research evidence that similar mindfulness-based interventions have led to decreased psychological distress. We think this approach can be helpful in working with the perpetuating factors and getting people out of the cycle of chronic insomnia.

In this program, we take an integrative approach to insomnia by helping you work more effectively with distress and regulate sleep-related behaviours. In addition to the mindfulness meditations, we will be asking you to record information related to your sleep-wake patterns. This information will be used in later sessions as part of the instructions for developing your own sleep program and setting up an action plan for insomnia. It is important that you keep track of this information. Later, when we give these instructions, it will be important to practice them at home, just as you will be practicing the meditations at home. Some of these instructions might not make sense at first, so we ask you to be open to following them without judgment and then evaluate your level of improvement at the end of the program. Hopefully, you are beginning to see how the principles of mindfulness are consistently applied throughout this program. In many ways, this program will encourage you to change your relationship with sleep so that the bed is no longer an enemy, but a friend, and the night-time is no longer a battlefield, but a time for comfort and rest.

Homework for session 1
A. Sleep and meditation diaries
B. Eat at least one meal or snack mindfully
C. Practice sitting with breath meditation for 15 minutes, at least 6 days during week (online)
D. Read Full Catastrophe Living, Chapter 2 (Foundation of Mindfulness Practice), Chapter 3 (The Power of Breathing) and Chapter 4 (Sitting Meditation)
E. After reading chapters in FCL, read Handout 1 for next week.
Session 2: Stepping out of Automatic Pilot

1. Body Scan Meditation [20 minutes] (Kabat-Zinn, 1990)

**Key Point:** The body scan meditation is an important exercise for teaching how to intentionally bring awareness to a particular body area, noting sensations without trying to alter or change anything, and then letting go and bringing attention to another part of the body. This exercise also emphasizes the point of stepping out of automatic pilot (i.e., being unaware of habitual physical or emotional reactive patterns).

The body scan meditation helps us to connect with our bodies and become more aware of each part of our body, including certain areas to which we do not normally pay attention. It also helps participants learn to keep their attention focused over a sustained period of time, and to learn mental flexibility by redirecting attention to different areas of the body when attention has wandered elsewhere. Attention regulation is foundational in mindfulness practice. Without the ability to sustain attention, it is impossible to focus on present moment experience. Participants sometimes experience their attention as a purification or detoxification process of releasing habitual holding patterns. Therefore, the body scan is introduced as an exercise in awareness, in which participants direct their attention toward whatever they are experiencing in the body. Participants are reminded through this exercise to hold a gentle, non-judgmental moment-to-moment awareness.

In addition to physical awareness, the body scan also serves to develop awareness of emotions and can lead to a sense of calmness. It provides an opportunity to practice bringing a gentle, curious awareness to sensations in the body as they arise in the present moment. A greater awareness of the body is important in learning how to deal more effectively with emotions. Specific sensations such as tightness in the chest or tension in the shoulders may at times signal the presence of strong feelings of which we are not fully aware. Feedback on how the body feels is an integral part of learning how to better manage emotions and stress.

One note of caution: Although the body scan provides an opportunity to enter into a deep state of physical and mental relaxation, instructors should make it clear that we do not recommend using this practice to help fall asleep, at least not at this time. Remember, we are not trying to “meditate you to sleep” but instead to use this exercise to cultivate awareness. While the body scan might eventually help you fall asleep, it is important to practice this during the daytime first, as you are practicing how to cultivate this awareness. We will talk later about how you can use this exercise at night.

Instructions for the body scan:

1. Begin by having all participants lie on the ground or recline in a chair.
2. Each participant is guided through a sequence of informal breathing meditation, followed by diaphragmatic breathing.
3. The therapist then leads participants to bring attention to each part of the body, beginning with the left foot. Participants are then asked to become aware of that part of the body, noting all of the sensations without judgment, and then explore what it is like to feel the breath move to that part of the body.
4. The therapist moves to the next part of the body and repeats the instructions. Each time, the therapist reminds the participants to bring attention without judgment. If the attention wanders, participants are encouraged to note that their mind has wandered and to gently bring attention back to the part of the body being scanned. This is in contrast to forcing attention or clearing the mind.
5. Movement begins in the left leg, up through the leg, followed by the right foot, and then up the back, up the torso, to each arm, and finally ending at the head.

Inquiry and Discussion of Body Scan Practice [10 minutes]
1. Did you notice anything different about your body?
2. Did anyone fall asleep?
3. How do you think the body scan will help you to work with insomnia?
4. Homework this week: Body scan using CD (30 min each session for at least 6 days).

3. Walking Meditation [20 minutes]
**Key Point:** Introduce walking meditation as a means of mindful movement.
Walking, like breathing tends to be an automatic activity. However, bringing conscious attention to it can be a powerful mindfulness mediation. This meditation builds upon the meditations taught thus far to include physical movement in addition to the breathing and body scan practice.
1. If weather permits, the walking meditation can be done outside.
2. Instruct participants to pay close attention to the process of walking, slowing down all of the steps.
3. Ask participants to pay close attention to their balance and note what happens when their mind has wandered.
4. Walking meditation is a reminder that we can generalize meditation exercises to various aspects of our daily lives without adding to the time constraints of our busy schedules.
   - lead participants through tranquillity walking and insight walking

4 and 5. Inquiry and Discussion of Walking Meditation and Establishing Practice [15 minutes]
- Following meditation, discuss what they noticed during this meditation.
- Discuss issues related to beginning a meditation practice during the last week.
  1. What issues came up in your practice?
  2. Anything that was a challenge? How can you overcome these challenges to establish a regular practice?
  3. Any changes noticed?
- Address questions about diaries: If participants complain about sleep diary making them more anxious about sleep, remind them about the principle of non-judging. Encourage them to use the diaries as a way to work on monitoring sleep without judgment or trying to fix things.

Awareness and Insomnia [25 minutes]

**Key Point:** Provide participants with a rationale for the connection between developing awareness through mindfulness meditation and its potential impact on insomnia. This is another chance to emphasise how habitual reactions to sleep and sleeplessness contribute to the problem of insomnia. Emphasise the difference between sleepiness and fatigue.

*Our brain is an extremely efficient organ at processing information. It organizes, manages, and retrieves information in an amazing way. Unfortunately, sometimes we “program” it so well that we begin to operate on “automatic pilot.” You may notice this automatic pilot when you are driving and cannot recall the last few minutes or pass your exit. You might also notice this automatic pilot when you react to a stimulus, such as yelling at someone who has cut you off on the road. For people who suffer from insomnia, there is often a tendency to react automatically to poor sleep. Having a night of poor sleep*
might automatically put you in a bad mood or lead you to question whether your performance that day could have been better if you had slept better. Tiredness and fatigue seem to take over and we might automatically blame this on poor sleep. Before long, you might find yourself in this cycle of not being able to sleep, yet being tired and wanting sleep to happen, while going through the motions in life. In fact, many people who seek treatment for insomnia describe themselves as being in this “fog” or half-asleep/half-awake state.

We have talked about how the intention of mindfulness is to awaken and see clearly. That is why we focus on cultivating awareness as the first step in this process. As you have seen, we have been working on bringing an intentional awareness to your lives through the mindful eating exercise, paying attention to our breathing, and throughout the body scan. These exercises help you to become aware of automatic reactions and to note these thoughts, feelings, and sensations as just that – all the while, taking an observing, non-judging stance. In the context of insomnia developing awareness is very important because it serves as the platform for taking mindful action to work with insomnia (which will be discussed later). First, you must re-train yourselves to bring awareness to the moments in our lives. Bringing awareness to your body and state of mind can help you to distinguish between feeling tired and sleepy, which is difficult for some people who are in a cycle of insomnia. As we will talk about later, the sensation of sleepiness is an important one to be aware of because it is related to the probability of falling asleep and to your natural biological rhythms. Tiredness on the other hand relates to a lack of energy and is often associated with negative emotions. Therefore, awareness might help you to see more clearly if your body is sleepy and therefore needs more sleep, if it is tired and needs more rest and rejuvenation, or if the negative emotion reflects a greater need to take care of your mental health. Sleeplessness can be a signal that something other than sleep need is going on and you should bring your attention to investigate what that might be. Finally, you might also notice that your mind is quite resilient and sometimes you can do nothing and the mind and body will self-regulate and rejuvenate. In each of these ways, the important first step is to work on developing mindful awareness to help prepare for action and change our relationship with sleep.

Group Discussion (small groups)

Sleep Hygiene [5 minutes]

**Key Point:** Discuss sleep hygiene as a way to notice any behaviours or activities that might be incompatible with sleep. Bring awareness to the things that we do (or don’t do) to facilitate sleep.

In providing sleep instructions, a good place to start is by going over the rules for good sleep hygiene. Much like good dental hygiene is a way to clean your teeth in order to reduce the risk of having cavities, sleep hygiene is a way to “clean your sleep-related behaviours” in order to reduce the risk of having trouble falling or staying asleep. Note that we refer to reducing risk of poor sleep not to immediately improving your sleep. Many of these will sound familiar and you might have even tried these. If you have, we encourage you to either continue following these rules or to try it again, regardless of the outcome for that night. You have seen how the meditations are done without effort or striving towards a goal. In that same spirit, we ask that you simply follow these instructions without the expectation that it will lead to immediate improvement in your sleep. At the end of the program, we can talk about how effectively things worked. We would also like for you to become more aware of what activities you do as you prepare to sleep and also what activities you tend to avoid. Remember, we are continuing to bring awareness to our lives!
Discuss the application of these instructions, previous attempts, and problems encountered. Also, reinforce the importance of consistently following these instructions. Finally, note that these instructions are only part of the program, so even if you have already done these or do not see improvement, please be patient. Encourage participants to use beginner's mind every night and to become aware of their sleep hygiene.

**Remember to bring sleep diaries in next week!**

A. Sleep and meditation diaries  
B. Read FCL Chapter 5 (Body Scan) and 7 (Walking Meditation)  
C. Practice body scan three times and walking meditation three times (6 days practice of 30 minutes)  
D. Follow Sleep Hygiene Instructions throughout this week.
Session 3: Acceptance

Meditation Practice and Inquiry [40 minutes]

1. Mindful Movement [30 minutes]

**Key Point:** Introduce yoga/light stretching as a mindful movement practice. It is an extension of the body scan practice and can be helpful for people who are restless.

We can have a lot of trouble with the body in various ways. It ages over the years, it starts to look different, and it doesn’t seem to be able to do what it used to do. Therefore, it is essential that you spend time taking care of it. It is important to rediscover your body on a daily basis and not take it for granted. Your entire body, including bones, muscles, and organs, all need stimulation for regulating, revitalising, and working more effectively. The quality of your body deeply affects the entire quality of your life. So tune into your own body for a while. Listen to your own body, be gentle, caring, and mindful. Tune into the movement of the body, the rhythmic breathing.

Yoga is a very powerful way to cultivate balance in our body. It is another form of meditation to remind ourselves of the importance of bringing awareness into the body moment to moment. By noticing how the body moves, yoga can help you work with tension and relaxation. For example, you might notice that the body can be relaxed amidst the tension and strain of holding a posture. You might also notice that moving into pain with awareness facilitates expanding your limits.

Instructions for mindful movement (also see Appendix):
A. Guide the class slowly through a sequence of postures, with appropriate teaching comments interspersed as required.
B. Encourage people to be conservative and to listen carefully to their own bodies. Emphasis is on mindfulness and approaching one’s limits with gentleness.
- avoid any postures they feel would cause injury or a setback, or to experiment very cautiously when in doubt. Pay particular attention to people with chronic problems with the lower back, neck, and chronic pain in general.
C. Verbal guidance needs to be explicit and accurate so that people know what you are actually asking them to do without having to look at you all the time.

**Inquiry and Discussion for Mindful Movement [10 minutes]**
1. Did you notice anything different or new about your body?
2. Was it difficult to remain focused on the poses?
3. How do you think Yoga might help you work with insomnia?

Instructions for Sleep Consolidation Program [40 minutes]

**Key Point:** Provide rationale for sleep consolidation and make the connection to awareness of sleepiness and wakefulness.

Introduction and Rationale
Often when we feel that we are not getting enough sleep we make efforts to try to get sleep to come back. We might try going to bed earlier or staying in bed after the alarm clock goes off. Although these attempts might seem logical at the time, these behaviours tend to be automatic reactions and are usually counterproductive. In fact, there is scientific evidence indicating that when we expand the time we spend in bed beyond what our brain is used to, we inadvertently provide more opportunity to have insomnia. Therefore, instead of spending more time in bed, one of the most powerful strategies to improve sleep continuity is to spend less time in bed. You might be thinking that this strategy will lead to even less sleep, which is the opposite of what you are trying to accomplish. Initially, this might happen. However, you stand a better chance to get consolidated sleep, which most people report as feeling better than fragmented sleep. Thus we will first establish a pattern of good quality, consolidated, sleep and then it will become rather easy to slowly expand the amount of sleep. So quality first, then quantity! This strategy is consistent with the mindful approach adopted by this program and the spirit of setting aside your goals, retaining a non-judgmental stance, and letting go of the desperation to have sleep come back.

Before we provide specific instructions for this strategy, it is important to keep in mind a few key points. First, it is very important to be consistent with these instructions. As you have seen with the meditations and the sleep hygiene instructions, consistency is a key in making behaviour changes. This is especially true to keep in mind when you want to go to bed earlier or set the alarm clock later. Consistency also makes it easier to stop thinking about what you can do to improve your sleep, but instead to spend more time paying attention to the natural cues for determining when you feel sleepy and awake. Second, you might experience some daytime sleepiness or fatigue during this process. For most people, this is temporary and is probably not more than what you are currently experiencing. Later we will discuss some strategies for handling these symptoms. Finally, keep in mind that we might ask you to spend less time in bed initially, but eventually as you have less unwanted wakefulness in bed, you will be able to slowly expand your time in bed and still get good quality sleep. We are not asking you to keep this schedule for the rest of your life!

So the first step is to establish a regular wake-up time. This means that no matter how many hours you slept or how sleepy you feel, you should get up at the same time every morning. It is best to choose a wake-up time that is reasonable for you and fits your work/home schedule. Once you have selected this wake-up time, we ask that you maintain this for the next week, including days you can afford sleeping in. If you have problems or questions, we can discuss it next time.

Use Handout 3 as a guide to help explain the instructions and answer questions about establishing a regular wake time.

The second step is to figure out how many hours to spend in bed. To determine the initial Time in Bed (TIB) prescription, the average total sleep time (TST) reported by the patient on his/her current sleep diary is calculated. Looking at your sleep diaries, calculate the average TST for this past week. Subsequently, an initial TIB prescription is determined using the formula: TIB = average TST + 30 minutes. Adding 30 minutes to the average TST allows for sleep onset latency and normal, brief nocturnal arousals.

Use handout 3 to determine TIB prescription. Once you have your TIB prescription, you now have a “sleep window” that is anchored by your wake time in the morning and a recommended bedtime at night. If this timing does not seem reasonable,
adjustments can be made to your wake-up time but not the TIB. Remember that keeping this tight TIB can help you become aware of your own sleepiness, allowing your sleep system to work in your favour. Keep in mind that awareness of sleepiness should be your cue for going to bed, not the time on the clock! Focus on the internal cues and not the external cues.

**Use Handout 3 to determine the beginning of the sleep window.**
Review sleep consolidation instructions if necessary and see if there are any questions. Then break into dyads to allow participants to discuss setting their own TIB schedules. Come back and discuss each person’s TIB schedule.

Notes for Determining TIB prescriptions
It is important to help each participant choose a wake-up time and earliest bed time that is reasonable and has a good chance to succeed. In doing so, have the participant consider both "ends" of the night. He or she may initially decide that 7:00 AM is a desirable wake-up time. However, if the initial TIB prescription is 6 hours, this wake-up time would result in an earliest bedtime of 1:00 AM. Upon discovering this fact, the participant may wish to select an earlier wake-up time so that bedtime can be earlier during the night. The instructor might want to do this during the large group discussion or go around the room and help each dyad. Also note that compliance with the TIB prescription will usually be best when the participant takes an active role in selecting bed and wake-up times.

Acceptance and Letting Go [20 minutes]

**Key Point:** Emphasise the principles of acceptance and letting go and the relevance to working with the territory of insomnia.

So far, we have talked about the importance of paying attention to our minds and bodies, intentionally bringing awareness to thoughts, feelings, and sensations. In the context of insomnia, we have also talked about how rediscovering the sensation of sleepiness is important to determine when we are ready for bed and that when sleepiness is not there, it is better to get out of bed and do a soothing activity. But what happens when these things do not seem to be working and we still find ourselves awake at night or thinking during the daytime about poor sleep?

During these times, the principles of acceptance and letting go can serve as reminders of how to respond in a mindful way. First, let’s talk about letting go. We have been practicing this principle throughout the program. For example, in the body scan we bring attention to each area of the body and then let go of that area, bringing our attention to the next body area. This is essentially a practice of bringing attention to an area and then intentionally allowing our attention to move to another area without judging or becoming engaged in problem solving of that area. Another example is in paying attention to the breath. With each exhalation, we practice breathing out and letting go of that breath. As we have mentioned before, sleep naturally unfolds when we allow ourselves to let go of conscious activities. This means letting go of the day to prepare for rest, including the problems and pleasures that occur. Has anyone noticed any changes with your ability to let go of thoughts, feelings, or bodily sensations?

Discuss any observations about ability to let go.
The principle of acceptance is another important aspect involved in working mindfully with the territory of insomnia. Although it might seem reasonable to expect that we should be achieving our ideal sleep needs, we often fall short of this because of the conditions of modern society. As you might have noticed, our brain is quite a resilient organ and it still works, even if we have been sleeping very little. Accepting that sleep may not happen exactly when we want it to or for as long as we would like is a key component to working with the territory of insomnia. At night, it can serve as a reminder to get out of bed when our minds or bodies are not yet ready for sleep. During the day, it helps to reduce the distress that might otherwise be an automatic reaction to little sleep. In one of our previous studies at the Stanford Sleep Clinic, we found that insomnia patients who completed a cognitive-behaviour therapy group for insomnia reported that learning to accept their current sleep state and accepting that sleep cannot be forced were among the most helpful components of treatment (Manber, Hydes, & Kuo, 2004).

There is also research evidence that acceptance is helpful for people who experience chronic anxiety and worry. It has been found that what seems to “fuel” anxiety is non-acceptance, putting things off, or avoidance of the problem. It seems that worry serves the purpose of “giving the mind something to do” so it does not have to face the problem. A worried response to a stressful challenge tends to make people more rigid in their reactions to stress. In fact, one of the most effective strategies for helping people with phobias and serious anxiety issues is exposure to the stimulus. For example, an individual with a phobia of bridges can benefit from gradual exposure to being on a bridge (e.g. start with picture of bridge, then small bridge, then large bridge) whereas avoiding bridges generally reinforces the anxious response. Recent research is examining how acceptance can help people develop more skilful means of working with unpleasant experiences, especially with their emotional reactions. In particular, it seems that by cultivating acceptance, we can step out of the automatic reactions (i.e. automatic pilot) and increase the range of responses with greater awareness. What do people with insomnia avoid?

One question that frequently comes up is whether or not acceptance is like a passive way of “giving up” or resignation that one has no control over the problem. It is actually quite the opposite! Rather than giving up, you are making a conscious decision to accept or embrace what is happening. You are choosing to actively respond by allowing or letting the feeling or experience be rather than automatically avoiding, fixing, or changing the unpleasant feeling. By doing so, you might even find that the experience changes – that the negative emotions really were not as bad as you thought. Or, you might find that an alternative solution is possible when previously you thought there was no way out. The key point is that it is not always helpful to try to fix or solve things. Acceptance provides another way to relate to the problem. It often leads to a deeper understanding of the problem and allows creative solutions to emerge.

Read the poem “The Guest House” by Rumi.

The Guest House

This being human is a guest house.
Every morning a new arrival.

A joy, a depression, a meanness,
some momentary awareness comes
as an unexpected visitor.

Welcome and entertain them all!
Even if they're a crowd of sorrows,  
who violently sweep your house  
empty of its furniture,  
still, treat each guest honourably.  
He may be clearing you out  
for some new delight.

The dark thought, the shame, the malice,  
meet them at the door laughing,  
and invite them in.

Be grateful for whoever comes,  
because each has been sent  
as a guide from beyond.

~ Rumi ~

Ask people for their reactions to the poem and how it relates to acceptance and letting go. Discuss if anyone has noticed any changes about acceptance of their sleep or daytime issues?

Discuss the wandering mind if this has not come up yet.

Description of Lenny and the shoe.

Homework for session 3:  
A. Sleep and meditation diaries  
B. Read FCL Chapter 6  
C. Practice two active (walking, yoga) and four passive (sitting with breath, sitting with sound, body scan) meditations of 30 minutes each, at least 6 days per week.  
D. Follow sleep consolidation program this week.
Session 4: The Territory of Insomnia

1 Discussion: Review of program at half-way point [15 minutes]
1. What are you experiencing? Have you noticed any changes?
2. Ask whether people are willing to recommit to the practice fully for the next half (new beginning). Let go of expectations for the second half based on your experience of first half of the course. Just practice and take each moment as a new beginning, a fresh opportunity to be fully engaged, fully alive.
3. Making adjustment to sleep window (see Handout 4)
   - review handout 4 if necessary
4. Discuss issues related to sleep program (can do in small groups, in which case follow with a full group discussion)
   - barriers for compliance and troubleshoot difficulties
   - reinforce rationale if necessary.
   - Provide support and encouragement for compliance with recommendations

2. Stimulus Control Instructions [20 minutes]

Key Point: Provide rationale and instructions for stimulus control. Emphasise the connections with the on-going practice of awareness of sleepiness and wakefulness.

Begin by asking if there are any questions about sleep consolidation program. Provide support and encouragement for participants to keep up their sleep program. Discuss how to make adjustments to sleep window (see Handout 4)

- Emphasise the natural night to night variability in sleep and that therefore adjustments should be made on a weekly basis rather than a night-to-night basis. Also discuss the idea that sleep needs are not universal. There is no magic in the often quoted 8 hours of sleep. Bring up the idea that a slow gradual extension of the time allowed in bed, combined with increased awareness can help us find out what our own sleep needs are.

Last week, we discussed how spending less time in bed can be helpful to decrease unwanted wakefulness in bed. There is another set of instructions that are compatible with the sleep consolidation instructions called stimulus control, which I would like to talk about today.

The basic theory behind the stimulus control instructions is to re-associate the bed to be a place where you feel sleepy, safe, and comfortable allowing sleep to happen. These instructions come from behavioural theories of conditioned responses to a certain stimulus. You might remember that Pavlov was able to condition his dogs to have a certain response (salivation) when he presented a stimulus (bell ringing) first in the presence of meat, and then without the meat present. Using similar principles, when you go through a period of disturbed sleep, the bed (and bedroom) is no longer associated with the cues that promote sleep. Instead, the bed becomes a place of anxiety, uncertainty, and arousal that are not conducive to sleep.

Fortunately, we can change this! You can begin to recondition yourself by following a few instructions. First, if you are in bed and find that you do not feel sleepy, then it is best to get out of bed, move to
another area of the home and do a quiet, soothing activity until you regain the sensation of sleepiness. Viewed from the mindfulness perspective when you become aware that you are not sleepy, instead of striving for a state of sleep, be fully awake. Notice what thoughts and physical sensations are present when you are lying sleepless in bed. Are you sleepy? Are you fatigued? Rather than thinking of this as an unpleasant time, you might think of this as a wonderful opportunity to practice your meditation, something you might not have during the day.

**Instructors should refer to Handout 5 to guide them in delivering the instructions for stimulus control.**

After answering questions about stimulus control, break into small groups to allow participants to discuss how they will implement these recommendations and what obstacles they think will arise. Come back to discuss in large group.

Issues that might arise in discussion about stimulus control:

1. What activities to do outside of bed?
   - should be soothing, pleasant; examples of
     - reading comics, knitting, playing game, listening to music, drawing or painting
     - avoid unpleasant or activating activities
     - might be helpful to have blanket ready if it is cold
     - remember, the idea is to cultivate soothing, calm sensations rather than striving for sleep to happen
     - have participants write their activities into Handout 5

   - **emphasise that awareness of mental and physical states can help to distinguish between sleepiness and fatigue. Thus, there is a reliance on internal cues to decide how to respond rather than external cues, which tend to be reactive.**

3. Overall Review of Progress with Sleep Program [10 minutes] (can be done in small groups)
   A. Discuss progress and successful implementation of recommendations
     - revisit how to make adjustments to TIB if necessary
   B. Discuss barriers for compliance and troubleshoot difficulties
   C. Answer questions about sleep program, reinforce rationale if necessary.
   D. Provide support and encouragement for compliance with recommendations

Territory of Insomnia [20 minutes] (adapted from Segal et al., 2003)

**Key Point:** Encourage participants to recognize that insomnia is more than just a problem of not sleeping at night.

*Typically, in research and in clinical treatments for insomnia, the focus is on the night time symptoms. For example, treatments are aimed at reducing the time it takes to fall asleep or reducing the amount of time awake in the middle of the night. Medications are aimed at trying to make you more sedated. The message seems to be that solving the night time problems will make everything else better. Although we have talked about strategies for working with these problems, we have also asked for you to do much more in this program. Now that you have been through four weeks of the program, let’s revisit this question of why mindfulness meditation might be helpful for working with insomnia. Does anyone have any thoughts about this question at this point?*
One of the reasons behind developing such an extensive program for helping people with insomnia is that there is growing evidence that insomnia is much more than just a problem at night. Research has consistently found that insomnia is associated with negative emotions and elevated arousal (both psychological and physiological). However, it is not clear if these symptoms improve with treatment since most studies do not measure this or do not report this. As many of you have noted, the problems at night also blend in with the problems of daytime functioning. Soon, not sleeping leads to distress about not sleeping, which further exacerbates the problem. This is what I call the “territory of insomnia”.

Pass out criteria for psychophysiological insomnia and discuss.

As you would expect, the criteria for insomnia details the night time symptoms (e.g., difficulty falling asleep) but there is only brief mentioning of distress or emotional factors. In other words, it only covers part of the “territory of insomnia”. In this program, we try to unveil the entire territory of insomnia, meaning both the night time symptoms and the emotional reactions to sleep disturbance. If we can see insomnia in this way, then we realize that work needs to be done on the night time symptoms, but we also need to work on how to deal with our reactions to the sleep disturbances. From this perspective, recognizing the “territory of insomnia” (the entire package of insomnia symptoms) can help us make changes or relate differently to the problem. By becoming more awakened to the territory of insomnia, we can take skilful action that will allow us to step outside of the entire territory, not just one aspect of it (the night time part).

Discussion of Territory of Insomnia [10 minutes]

Break into small groups to discuss reactions to this view of the territory of insomnia, especially with regards to what has been learned thus far in the program.

Questions to consider:
1. What is your territory of insomnia (e.g., what domains in your life are affected by not sleeping)?
2. How might you approach this territory in a mindful way?

Follow with a full group discussion.
- Bring together the idea that chronic insomnia is a disorder or syndrome that is more than just nighttime symptoms.

Sitting Meditation – Emotions or Bodily Sensations [20 minutes]

Key point: Invite participants to bring in a difficult thought, emotion, or body sensation to work with during this meditation. Acknowledge that it might be difficult to sit for longer periods of time.

Inquiry and Discussion [20 minutes]

Things to consider for discussion/inquiry:
1. How was the experience of bringing in a difficulty to work with during the meditation?
   - explore issues around acceptance, letting go
2. Do we always have to move away from a negative experience?
   - this provides an opportunity to work with things that appear negative (e.g., pain, anxiety).
3. How might accepting difficulty be helpful for working with insomnia?
4. Discuss issues of reacting versus responding.
5. Connect mindfulness with perception/appraisal in the critical moment, and with the arising of reactive emotions.
6. Remind participants to pay attention to stress reactions without trying to change the reactions.

Homework for session 4

A. Sleep and meditation diaries

B. Read FCL Chapter 27 Sleep and Sleep Stress

C. Read FCL Chapter 20 Responding to Stress Instead of Reacting, and your choice of Chapters 21 (Working with Symptoms: Listening to Your Body), 22 (Working with Physical Pain: Your Pain Is Not You), 23 (More on Pain) 24 (Working With Emotional Pain: Your Suffering is Not You..But There Is Much You Can Do to Heal It), 25 (Working with Fear, Panic, and Anxiety), 26 (Time and Time Stress), 28 (People Stress), 29 (Role Stress), 30 (Work Stress) 31 (Food Stress) or 32 (World Stress). These are short chapters, so you may choose to read all of them.

This is your opportunity to tailor your practice to meet your individual needs given your current life stress.

Practice your choice of meditations of 30 minutes each, at least 6 days per week.

D. Follow adjusted sleep consolidation program and stimulus control this week.
Session 5: Nurturing Relationships with Self and Sleep

Inquiry and Discussion [10 minutes]
1. Discuss progress and reinforce successful implementation of recommendations
2. Remind participants of instructions for sleep extension
3. Continue to discuss barriers for compliance and troubleshoot difficulties.
4. Continue to provide support and encourage participants who have been successful with their program to share their success with others.

Three-Minute Breathing Space [15 minutes] (Segal et al., 2003)
**Key Point:** Provide participants with a short meditation that can be used to cope with stress by stepping out of automatic pilot and bringing attention to the present moment.

Since it might not be practical to do a 30-minute sitting meditation when we encounter stressful events during the day, there is a shorter activity that can be helpful for grounding yourself in the present moment and preparing yourself to take mindful action. This is called a 3-minute breathing space and it was developed by Zindel Segal and colleagues as part of their mindfulness-based cognitive therapy program. This is a powerful exercise that can be useful for working with automatic negative thoughts that arise from insomnia or stress.

Lead group through 3-minute breathing space exercise:
1. Recognize and acknowledge one’s experience at the present moment.
2. Bringing attention to the breath
3. Expand attention to include a sense of the breath and the body as a whole

Emphasise that this is not used as an “escape hatch” but rather to ground oneself in the present moment so that one can then respond in a mindful way rather than in a habitual, automatic way.

Small Group Discussions about the usefulness of this exercise, develop a list of examples for larger group discussion. [10 minutes]

Sitting Meditation with Choiceless Awareness [20 minutes]
**Key Point:** Invite whatever arises in the mind and body to become the focus of attention. This meditation can be lead with less guidance, allowing more silence.

How is your relationship with sleep? [20 minutes]
**Key Point:** Revisit the sleep relationship, one of the major themes of this program. Discuss changes that have been noticed while undergoing this program.
At the beginning of this intervention, we spoke of changing your relationship with sleep (and sleeplessness). This incorporates the different principles we have discussed:
a. non-judging, (sleeplessness is not a bad thing); non-striving
b. re-learning how to approach each night with a beginner’s mind
c. letting go of the expectations of ideal sleep and recognising that sleep needs change
d. accepting sleeplessness sometimes occur when we do not want it to
- creating a “laboratory” to experiment with how to work with sleeplessness
- does not have to be something to avoid

After reading, break into small groups and discuss any changes noted in the relationship to sleep. Come back to large group and discuss.

Note how just changing the relationship with sleep can help us cope more skilfully with insomnia. Not getting ideal sleep no longer has to be a burden, enemy, or another thing on the list of things to fix. Emphasise how embodying mindfulness in daily life and taking a mindful approach to sleep can help us work with the entire territory of insomnia.

The nurturing/depleting activities exercise [20 minutes] (Segal et al., 2003)

Key Point: To look at our daily lives to bring light to what activities are nurturing and which are depleting. This will be used as a possible strategy for coping with daytime fatigue as part of the action plan.

The following instructions are given for the nurturing/depleting activities exercise:

Take a moment to think about the activities that occur on a typical day. What sorts of things do you find yourself doing? Then, on a piece of paper list all of these activities. After you have completed your list, go through each activity and write an “N” next to the activities that are “nurturing” and a “D” next to the activities that are “depleting”. You might also think of these as positive and negative activities. Finally, tally up how many N’s and D’s you have listed.

Once participants are done, have one or two participants read out loud the activities and note whether the activity was an N or D. Then ask whether they had more N’s or D’s. As part of the inquiry, ask:

1. Where is your energy going?
2. Of the N’s: How might you change things so that you can make more time to do these or become more aware of them?
3. Of the D’s: How might these be done less often?

The point of this exercise is to look at your daily lives to see what might be done to bring more nurturing activities into your daily routines. It can serve as a reminder for self-compassion and self-care. Awareness of these energy transactions can help you cope with daytime fatigue when you have had several nights of poor sleep. Feeling tired often has negative feelings attached to it so when you find yourself feeling tired, one way to work mindfully with this is to take time to do more nurturing activities. If you notice instead that the sensation is one of sleepiness, and if your schedule allows, then you might consider taking a short nap (see recommendations for daytime napping).

In the discussion it is usually noted that some of the same activities can be nurturing or depleting so that a different approach to the same activity might be considered nurturing rather than depleting. Instructors might consider discussing sleep specific examples: “trying” to nap can be depleting whereas resting or meditation for the same amount of time can be refreshing. Once again, we are working to bring mindful attention to increase the range of responses to the experience of being tired or sleepy.
Homework for session 5

A. Sleep and meditation diaries
B. Read FCL Chapter 9 (Really Doing What You’re Doing: Mindfulness In Daily Life)
C. Read FCL Chapter 34 and 35 (Keeping up the Formal and Informal Practice).
D. Your choice of meditations 30 – 45 minutes per day, 6 days each week. Attempt to do this without audio prompting. Also include 3-minute breathing, 3 times per day.
E. Follow sleep consolidation program and stimulus control this week. Make adjustments as needed.
Session 6: Eating, Breathing, and Sleeping Mindfulness: Living the Full Catastrophe

Themes:
1. Continuing mindfulness meditation (formal and informal) beyond this program
2. Setting up an action plan for future episodes of insomnia

Key Point: Invite whatever arises in the mind and body to become the focus of attention. This meditation can be lead with less guidance, allowing more silence.

- We began with the sitting/breathing meditation and end with this practice, coming full circle.
  1. Breathing Meditation – 10 minutes.

  2. Informal Mindfulness Meditation: taking moments of mindfulness in everyday life [30 minutes]

Key Point: To encourage participants to keep mindfulness qualities alive in moments throughout their lives.

Although this program has emphasised the importance of formal mindfulness meditation, it is not the only way we can bring mindfulness practice into our daily lives. In fact, many Buddhist teachers consider the formal meditation as just practice, with the “real game” being our every day lives. Now that we have worked on establishing a formal meditation practice, the next challenge is to bring the qualities of mindfulness into everyday living.

In behavioural medicine, coping with stress is often described as having two branches: problem focused coping and emotion-focused coping. Traditional cognitive-behaviour therapy usually recommends discerning whether or not the problem is solvable as the first step. If it is, then problem-focused coping should be used, where one works directly with the situation at hand by determining what actions need to be taken and what resources are available. In some situations, the problem cannot be changed or resources are not available to immediately solve the problem. In this situation, emotion-focused coping would be more appropriate. This strategy uses our inner resources to reframe our perspective and work with our feelings about the situation. Both are very effective means of coping with daily stress.

The approach taken in this mindfulness-based insomnia treatment fits well within this paradigm. Recall that in our discussions, the first step is to stop, ground yourself in the present moment, and become aware of what is going on. For example, you might want to take a breathing space (3-minute breathing). Once you step out of automatic pilot and can see the problem with clarity, free of the emotional reactions that might be habitually attached to the situation, then you can decide how to respond. Sometimes, this might lead to a determination that there are steps you can take to work with the problem. Other times, you might choose to work with your feelings or you might just let the feelings pass and see what happens. For example, imagine that you are running late for an appointment and before you can get to your
destination, a thunderstorm suddenly arrives. Depending on what is available, you might have an umbrella and choose to continue going to your destination. Or, if one is not available, you might choose to duck into a shelter and let the rain pass. Perhaps this would be a good time to be mindful of rain and simply enjoy observing the falling of rain drops. You might even find this to be a pleasant experience, as we don’t often have time in our lives to watch falling rain. You can see from this example how bringing mindfulness qualities to a situation that can commonly occur during our daily life can increase the range of responses we have to choose from. In many ways, we can use this to enrich our lives in the face of all the stress we encounter.

<Look at FCL p. 326 for more on problem-focused and emotion-focused coping>

Break into small groups. Each group/dyad is to talk about how mindfulness can be practiced informally and to provide some examples of how this might be done. Come back and discuss as a large group.

Inquiry and Discussion of Meditation Practices [15 minutes]:
1. How was the meditation practice this week without using the CDs?
2. How can you continue your meditation practice?

- The 8th week is the rest of your life – JKZ
- review of supporting materials to help with practice (tapes, CD, books, meditation groups)
- establish short and long-term goals

Discussion about what people learned in this program [10-15 minutes]
At the beginning of the program, we asked everyone to set aside their goals. Now we can revisit this.
1. Has anything changed for you since starting this program?
2. Is there anything you have learned?

Putting together an action plan for insomnia [20 minutes]

**Key Point:** Help participants develop an action plan to work with future episodes of insomnia.

*From a behavioural perspective, insomnia is a condition where we have unlearned how to fall asleep. In this program, we have been working on "re-learning" this process by taking a more mindful approach to sleep, starting with intentional awareness. We have also talked about some strategies for working with the territory of insomnia, including sleeplessness at night and the negative thoughts and feelings that tend to be automatic reactions to poor sleep. Since insomnia is a condition that tends to wax and wane, let’s now put things together so that we have an action plan in the event that you encounter an episode of insomnia in the future.*

First, lead discussion on some possible ways to work with insomnia. Have participants break into small groups or dyads to discuss their own action plans to work with the territory of insomnia. Then return to large group and discuss. Some thoughts for discussion:

The first step is to become aware of what is going on:
1. Awareness of mental and physical states – Are you sleepy? Are you fatigued?
2. Awareness of sleep-wake patterns - Keep sleep diary
3. Note what stressors are present during the day
4. Are you reacting automatically to sleep disruption?
5. Are you avoiding unwanted wakefulness by going to bed?

The second step is to make a choice of how to respond:
1. Accept and let go
2. Increase nurturing activities (especially if daytime fatigue seems to be a problem)
3. Choose to wake up at the same time
4. Choose to follow sleep restriction or stimulus control instructions without judgment
5. Choose to use 3 min breathing space to help cope with daytime stress
6. Choose to take a nap if sensations of sleepiness are overwhelming

Note that these are done with awareness and intention rather than automatic reactions in an effort to regain sleep
- let wise mind help you cope when sleep does not seem ideal (may figure out that ideal sleep is different than initial perception)

Has each participant completed Handout 7? Once each participant has an action plan, it is important to discuss how to implement action plan. Some suggestions include:
1. Write letter to self with action plan
2. Give to instructor, who will mail it to participant in 1 month.

Closing Ceremony [25 minutes]

**Key Point:** Provide a sense of closure to the program and encouragement for participants to continue in their own journey.

Wisdom Circle - Have participants form a closing circle. Each person goes around and shares anything he or she would like before the close of the program. The instructor might begin by sharing first. For example, some instructors share a feeling of deep gratitude for the participants’ openness and willingness to engage and work hard. Also, some share an appreciation for the opportunity to share such a profoundly healing and beautiful practice with all of the group members.

If participants are unsure about what to share, encourage them to think back to their original goals: What did you want/hope for? What did you get out of this program, if anything? Why did you stay? What did you learn? What are your biggest obstacles to growth and healing? What strategies might work to not get stuck?

End with acknowledgement of work and effort. Consider giving participants something to take with them to remember this experience. Examples include a poem or certificate.

Provide information regarding study follow-up and answer questions [5 minutes]
- follow-up questionnaires
- pass out post-intervention diaries
“On life's journey faith is nourishment, virtuous deeds are a shelter, wisdom is the light by day and right mindfulness is the protection by night. If a man lives a pure life, nothing can destroy him.”

~ Hindu Prince Gautama Siddharta
12.4 Handouts

Handout 1: Applying Mindfulness Principles to Sleep

In the spirit of cultivating mindfulness, this program will help guide your personal inquiry into your own sleep needs and the optimal state of mind for initiation of sleep (at the beginning or middle of the night). In doing so, you want to bring attention to changing your relationship to sleep rather than to the amount of sleep you get each night. As you begin to change this relationship, you might notice an improvement in the quality of your sleep. Later, you will slowly increase the amount of sleep you get. This approach requires discipline and consistency but follows the principles of mindfulness discussed in this program. These principles can also be applied to sleep:

**Beginner’s Mind:** Remember that each night is a new night. Be open and try something different! What you have been doing to this point is probably not working well.

**Non-striving:** Sleep is a process that cannot be forced but instead, should be allowed to unfold. Putting more effort into sleeping longer or better is counterproductive.

**Letting go:** Attachment to sleep or your ideal sleep needs usually leads to worry about the consequences of sleeplessness. This is counterproductive and inconsistent with the natural process of letting go of the day to allow sleep to come.

**Non-judging:** It is easy to automatically judge the state of being awake as negative and aversive, especially if you do not sleep well for several nights. However, this negative energy can interfere with the process of sleep. One’s relationship to sleep can be a fruitful subject of meditation.

**Acceptance:** Recognizing and accepting your current state is an important first step in choosing how to respond. If you can accept that you are not in a state of sleepiness and sleep is not likely to come soon, why not get out of bed? Many people who have trouble sleeping avoid getting out of bed. Unfortunately, spending long periods of time awake in bed might condition you to being awake in bed.

**Trust:** Trust your sleep system and let it work for you! Trust that your mind and body can self-regulate and self-correct for sleep loss. Knowing that short consolidated sleep often feels more satisfying than longer fragmented sleep can help you develop trust in your sleep system. Also, sleep debt can promote good sleep as long as it is not associated with increased effort to sleep.

**Patience:** Be patient! It is unlikely that both the quality and quantity of your sleep will be optimal right away.

These are just some ways that the mindfulness principles are related to sleep. You might
discover other connections between these principles and the process of going to sleep or falling back asleep. We encourage you to explore this for yourself and share your experience throughout this program.
Handout 2: Sleep Hygiene Recommendations

Adapted from Manber & Kuo (2004)

There are several factors that impact sleep.

• Caffeine is a stimulant that may disrupt normal sleep. It is relatively long acting and its effects may last for several hours after you consume it. There is large individual differences in the rate of metabolism of caffeine and therefore, in the length of time during which it might still be impacting you. The half-life of caffeine has been reported as 4–5 hours when modest amounts have been consumed, and it is even longer after higher levels of intake. The half-life is a measure of the period over which the concentration of caffeine or its active metabolites take to fall to half its original concentration in the blood. Therefore, we recommend that you limit your caffeine intake to the equivalent of no more than 3 cups of coffee per day and that you not consume caffeine in the late afternoon or evening hours.

• Alcoholic beverages tend to be relaxing and to induce drowsiness. Some people drink alcohol to facilitate the process of falling asleep. However, as the effects of alcohol diminish sleep becomes fragmented and restless and subsequently it is far less refreshing than normal. We therefore discourage the practice of consuming alcohol too close to bedtime. For most people, a glass of wine with dinner is not likely to have a negative impact on sleep. However, for some very sensitive individuals’ elimination of alcohol altogether has yielded significant improvement in sleep. We therefore recommend that you limit your intake of alcohol in the evening and we strongly discourage you from using alcohol as a sleep aid.

• Eating close to bedtime. It is generally not a good idea to eat heavy meals too close to bedtime or to eat anything if you wake up in the middle of the night. Your digestive system slows down during sleep and foods that have not been completely digested may cause digestive discomfort that might disturb sleep at the beginning of the night. For the same reason it is not a good idea to eat in the middle of the night.

• Sleep Environment. Your sleep environment needs to be quiet, dark, and safe and its temperature should not be extreme. Noise and light (even dim light) may interrupt or shorten your sleep. One good way to filter out unwanted noise is to sleep with a “white noise” in the background. This can be achieved by any one of the following: running a fan, air filter, or using a specially designed “white noise” generating device.

• Physical Fitness. In the long run, improving your fitness level is likely to improve the overall quality of your sleep. Individuals who are physically fit have been found to be better sleepers than those who are not physically fit. If you are not in this condition, you should not expect to see a one-to-one correspondence between your exercise and your sleep. It is recommended that you continue with your current or planned exercise routine but it is best to complete your exercise at least 3 hours before bedtime to avoid impacting the onset of your sleep.
Handout 3: Integrating Mindfulness Principles into the Sleep Program:

Sleep Consolidation

The first recommendation for consolidating your sleep is that you limit the amount of time you stay in bed. You should begin by allowing yourself to be in bed just slightly more than the amount of actual sleep time that you estimate you are currently getting. Although this may sound very drastic, it will quickly help reduce fragmentation of your sleep and make it more consolidated. It can also help you develop a greater awareness of the sensation of sleepiness. Once your sleep is consolidated, you will gradually increase the time you allow yourself to be in bed.

**Step 1: Keep a consistent wake-up time.** The best way to anchor your biological clock is to adhere to your fixed wake-up time and stick to it every day regardless of how much sleep you actually get on any given night. Get out of bed no later than 15 minutes after your wake up time. Anchoring your wake-up time is essential for optimal sleep. This practice will help you develop a more stable sleep pattern and will strengthen the natural cues from your internal biological clock that regulates your sleep-wake cycle. An irregular wake up time can weaken the signal from your biological clock that regulates optimal time for your sleep. In fact, you can create the type of sleep problem that occurs in jetlag by varying your wake-up time from day to day. If you stick to a fixed wake-up time you will gradually notice that you become sleepy at roughly the same time most nights, which will eventually allow you to go to bed earlier, get more sleep, and satisfy your sleep need.

**Step 2: Establish a window for sleep.** Now that you have established a fixed wake-up time, the next step is to figure out how many hours to spend in bed. Looking at your sleep diaries, calculate the average total sleep time (TST) for this past week. Subsequently, your initial time in bed (TIB) prescription is determined using the formula: TIB = average TST + 30 minutes. Adding 30 minutes to the average TST allows for sleep onset latency and normal, brief nocturnal arousals.

**Step 3: Determine a recommended bedtime.** Using the TIB calculated above, count backwards from your wake-up time. This will be your recommended bedtime. However, it is essential that you consider this recommended bedtime as your earliest allowed time to go to bed. It is not required that you go to bed at this time if you do not feel sleepy. Instead, be aware of your state of alertness at this time and allow yourself to go to bed only if you feel sleepy at this time. If you do not feel sleepy at your prescribed time wait until you do feel sleepy. By going to bed only when sleepy you increase the likelihood that you will fall asleep easily. Remember that sleep is an unfolding process. It cannot be forced. Impatience with the natural unfolding of sleep and trying to force sleep to happen are usually not effective or productive. Try practicing non-striving and letting go of the need to sleep.

**Frequently Asked Questions about the Sleep Consolidation Program**
What is the difference between sleepiness and tiredness? Many people misjudge the state of sleepiness. People often confuse the sense of being sleepy with the sense of being tired, fatigued, and the wish to rest the mind and the body. The state of being very sleepy is a state of having to almost struggle to stay awake. When you are close to that state, you are sleepy. In contrast, tiredness usually involves a lack of energy, fatigue, and perhaps some negative reaction, such as frustration or irritability towards this lack of energy. Some people describe this as a “fog”, where they are not fully awake but unable to sleep. Becoming aware of the state of your mind and body can help you respond more wisely to sleepiness and tiredness.

Should I have a pre-sleep routine or unwind before my scheduled bedtime? Creating a “buffer zone”, or quiet time, for about 30-60 minutes prior to your scheduled bedtime can help to prepare your mind for sleep and increase the chances of detecting sleepiness. This time can be spent engaging in activities that are enjoyable on their own rather activities that are taken as a means to an end. Usually, soothing activities such as knitting, reading comics, or listening to calming music can be helpful. In contrast, having a rigid routine can sometimes increase anxiety or tension, usually because the routine is used as a means to an end. The practice of non-striving will help you to shed off the day’s excitement and tensions, preparing yourself for sleep to naturally unfold.

Can I take a nap during the day? During this period of transition to better sleep, you should generally, avoid napping. Sleeping at times other than your specified time in bed, particularly for more than an hour, might weaken your sleep drive and could undermine the sleep consolidation process. **However, if you find yourself very sleepy** (see above) a brief (20-30 minute) afternoon nap 7 to 9 hours after your morning rise time can be taken to ensure your safety. If you do nap, it is best to nap at approximately the same time daily. Irregular naps may weaken the signal from your biological clock and long naps may weaken your sleep drive. As long as you maintain a consistent wake-up time and follow these recommendations for taking a short nap when needed, it is not likely to interfere with your sleep at night.

Once your sleep consolidation program has been discussed with the instructor, please write down your bedtime and wake time below to help remind you of your plan for the coming week. You might also want to write this on your sleep diary as a reminder.

My Sleep Consolidation Program
For the next week, I should **go to bed no earlier than** ________. However, if I am not sleepy at this time, I should wait until I am aware of the sensation of sleepiness is present.
For the next week, I should **wake up at** ________, regardless of how much sleep I obtained during the night.
Handout 4: Sleep Alteration Instructions
Adapted from Manber & Kuo

The initial time in bed recommendation was designed to improve your sleep quality by consolidating your sleep. The best measure of the consolidation of your sleep is your sleep efficiency. Use the following formula:

\[
\text{Sleep Efficiency} = \frac{\text{Average Time You Actually Slept}}{\text{Average Time You Spent in Bed}}
\]

A. If your average sleep efficiency is ≥ 85% and you feel that you are not getting a sufficient amount of sleep for optimal functioning during the daytime, increase your allowed Time in Bed by 15-minutes, at either end of the night. You should stay on the new schedule for at least 7 nights before making changes.

B. If your sleep efficiency is < 80%, decrease your fixed Time in Bed by 15 minutes, at either end of the night. However, you should not stay in bed less than 5.5 hours. You should stay on the new schedule for at least 7 nights before making changes.

C. If your average sleep efficiency is between 80% and 85% continue on your current schedule. When your average sleep efficiency does meet criterion A or criterion B for 7 consecutive days, you can extend or further restrict your time in bed according to the relevant rule.

Examples:

1. Over the past week, Joe reported an average total sleep time (at night) of 6 hours. Following the sleep consolidation recommendations, he spent an average of 6.5 hours in bed. Therefore, 6 hours (TST) / 6.5 hours (TIB) = 92.3%. With a 92.3% sleep efficiency, Joe is then asked if he has noticed any sensations of sleepiness (not tiredness) during the day. If so, he can increase his time in bed by 15 minutes to 6.75 hours for the next week.

2. Jane had a rough week and reported an average total sleep time of 5.5 hours over the past week, down from 6.5 hours the previous week. She spent an average of 7.0 hours in bed hoping to get more sleep. Using the formula 5.5 / 7.0 = 78.6%. With a sleep efficiency of 78.6%, Jane should decrease her time in bed to 6.75 hours for the next week.

3. Over the past week, Jim reported an average total sleep time of 5.75 hours with some good nights and some bad nights. His fixed time in bed was 7 hours during the past week, for a sleep efficiency of 82.1%. Following the recommendations above, Jim should continue to keep a fixed bed time of 7 hours for the next week.
Handout 5: Integrating Mindfulness into the Sleep Program

Stimulus Control

The instructions below come from behavioural theories of conditioned responses to a certain stimulus. When you go through a period of disturbed sleep, the bed (and bedroom) is no longer associated with the cues that promote sleep. Instead, the bed becomes a place of anxiety, uncertainty, and activation that are not conducive to sleep. The basic premise behind these instructions are that if you are in bed and find that you do not feel sleepy, then it is best to get out of the sleeping position by sitting up in bed or getting out of bed and moving to another area of the home. Once you are no longer trying to sleep, do a quiet, soothing activity until you regain the sensation of sleepiness. Viewed from the mindfulness perspective when you become aware that you are not sleepy, instead of striving for a state of sleep, be fully awake. Rather than thinking of this as an unpleasant time, you might think of this as a wonderful opportunity to practice your meditation, something you might not have during the day.

**Most importantly, stop trying harder to sleep.** This means that it is best to stay out of a sleeping position when your state of mind is not compatible with sleep. When you are out of this sleeping position, you should be fully present with whatever activity you do and avoid thinking about sleep or its absence.

**Step 1: Become aware of your state of mind and body.** As we have discussed previously, present-moment awareness is the starting point for choosing how to respond. If you notice that you are tossing and turning and sleep is not happening, pause to recognize your state of mind in the present moment. This might happen at the beginning of the night or if you happen to wake up in the middle of the night. Prolonged periods of being awake in bed usually leads to tossing and turning, becoming frustrated, or worrying about not sleeping, all of which indicates that you are striving for sleep to happen. You might even be excited about something happening in your life. All of these reactions make it more difficult to fall asleep. Also when you lie in bed awake trying to sleep, wanting and hoping to go back to sleep, you are training (conditioning) yourself to be awake in bed. Recognizing your state of mind and body helps you to determine the next step.

**Step 2: Get out of sleep mode.** Once you are aware that sleep is not likely to come soon, you can now choose what action to take. **One course of action is to acknowledge this state of wakefulness, get out of bed, and go to another room.** Getting out of bed when you are unable to sleep is often not easy. Your bed is comfortable, you might want to at least get some rest, and you might be hopeful that your continued efforts to sleep will make it happen. However, keep in mind that sleep naturally emerges when the body and the mind are calm and content. Therefore, the activities that you choose to do when you are out of bed should promote that state of mind. Things that are soothing and pleasant usually work well. Many of the same activities that were recommended for the buffer zone (see Handout 3) are also appropriate activities to do in the middle of the night. You might also consider this as an opportunity to practice mindful movement (e.g., walking meditation) or a sitting meditation. Note that if you choose to do this, you should also continue your daytime practice.
If you find that getting out of bed is too difficult or if there are physical limitations for getting out of bed at night, you can also choose to sit up in bed. This means getting yourself into an upright position so that your intention is to engage in a soothing activity (as described above) rather than trying to sleep. You might choose to practice a sitting meditation, breathing meditation, or a body scan. Again, you should not use this as a substitute for your daytime practice. If you choose to read, it is better to use dim light rather than a bright light.

Step 3: Return to a sleeping position only when sleepy. Whatever activity you choose, it is best to return to a sleeping position when you become aware that you are sleepy. When you become aware of a sensation that the mind and body are in a state of calmness, relaxation, and sleepiness, you are more likely to fall asleep faster. Be aware of the mind’s tendency to want sleep to happen rather than the sensations that naturally arise when sleep is likely to happen.

Frequently Asked Questions

How long should I wait before getting out of bed or sitting up? Generally speaking, when you become aware that sleep is not imminent you should get out of bed, and when feasible get out of the bedroom. Most people become aware of their non-sleepy state of mind fairly quickly (in less than 15 minutes). Note that we strongly discourage the use of a clock in making this decision because monitoring the clock time could lead to dwelling about not sleeping, which further increases frustration or tension, two emotional states that are not conducive to sleep. Instead, be guided by what you have already learned from your mindfulness practice in the past 3 weeks about mental states that are not conducive to sleep. Just learn to calmly observe your state of mind and let it guide you.

Do I have to follow these instructions every night? Inconsistent observance of these instructions compromise the potential benefits you stand to gain. It is through consistency that, over time, your body “unlearns” conditioned arousal.

Can I still do other activities in bed? While in bed, you should avoid doing things that you do when you are awake. Activities such as watching TV, eating, studying, or talking on the phone should not be done while you are in bed. If you frequently use your bed for activities other than sleep, you are unintentionally training yourself to stay awake in bed. If you avoid these activities while in bed, your bed will eventually become a place where it is easy to go to sleep and stay asleep. Sexual activity is the only exception to this rule. This will help make the bed a strong stimulus (or cue) for sleep. In some situations, such as dorms, or studio apartments you will need to reorganize your room to make a separation between the space you use for sleep and the spaces you use for other activities.

After discussing appropriate soothing activities, please write your choices below:

If I become aware that I am awake and not sleepy in bed, I can choose to:
## Handout 6. Nurturing and Depleting Exercise

<table>
<thead>
<tr>
<th>Nurturing Activities</th>
<th>Depleting Activities</th>
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<tr>
<td><em>E.g. A mindful morning shower</em></td>
<td><em>E.g. Travelling from home to work</em></td>
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Handout 7: An Action Plan for Working with the Territory of Insomnia

It is important to keep in mind the different aspects of this program that were found to be helpful in working with the entire territory of insomnia. Much like the theme of impermanence discussed throughout this program, sleep disturbance might return in the future. Therefore, it is helpful to have an action plan so that you can be prepared to work with insomnia if it does arrive in the future.

Please answer the questions below by listing what you learned during this program as part of your own action plan for working with the territory of insomnia.

When I notice that my sleep is disturbed, I can bring awareness to:

To work with the territory of insomnia, I can choose to respond by:
12.5 Questionnaire Battery

Name:
Date:
Time

ISI

1. Please rate the current (i.e., last 2 weeks) severity of your insomnia problem(s).

0 = None, 1 = Mild, 2 = Moderate, 3 = Severe, and 4 = Very.

a. Difficulty falling asleep: 0 1 2 3 4
b. Difficulty staying asleep: 0 1 2 3 4
c. Problem waking up too early: 0 1 2 3 4

2. How satisfied / dissatisfied are you with your current sleep pattern?

Very satisfied (0) Satisfied (1) Neutral (2) Dissatisfied (3) Very dissatisfied (4)

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

Not at all interfering (0) A little (1) Somewhat (2) Much (3) Very much interfering (4)

4. How noticeable to others do you think your sleeping problem is in terms of impairing the quality of your life?

Not at all (0) Very much noticeable (1) A little (2) Somewhat (3) Much noticeable (4)

5. How worried / distressed are you about your current sleep problem?

Not at all (0) Very much worried (1) A little (2) Somewhat (3) Much worried (4)
ESS

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

This refers to your usual way of life in recent times. Even if you have not 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:

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of Dozing</th>
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<tbody>
<tr>
<td>Sitting and reading</td>
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<td>Watching television</td>
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<tr>
<td>Sitting, inactive in a public place (e.g. theatre or a meeting)</td>
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</tbody>
</table>
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 traffic
PSQI

Instructions

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

During the past month, when have you usually gone to bed?

Usual bed time

During the past month how long (in minutes) has it usually taken you to fall asleep each night?

Number of minutes

During the past month, when have you usually gotten up in the morning?

Usual getting up time

During the past month, how many hours of actual sleep did you get at night?

Hours of sleep per night

For each of the following questions, tick the one best response. Please answer all questions.

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

a. Cannot get to sleep within 30 minutes

Not during the less than once or times 3 or more
Past month_____ once a week _____ twice a week _____ a week _____

b.  **Wake up in the middle of the night or early morning**

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

c.  **Have to get up to use the bathroom**

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

d.  **Cannot breathe comfortably**

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

e.  **Cough or snore loudly**

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

f.  **Feel too cold**

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

g.  **Feel too hot**

Not during the less than once or 3 or more times
Past month_____ once a week _____ twice a week _____ a week _____

h. Had bad dreams

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

i. Have pain

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

j. Other reasons (please describe): __________________________

_______________________________________________________________

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

Not during the less than once or 3 or more times

Past month_____ once a week _____ twice a week _____ a week _____

6. During the past month, how would you rate your sleep quality overall?

Very good ______

Fairly good ______

Fairly bad ______
Very bad

During the past month, how often have you taken medicine (prescribed or over the counter) to help you sleep?

Not during the less than once or 3 or more times

Past month once a week twice a week a week

8. During the past month, how often have you had trouble staying awake while driving, eating meals or engaging in social activities?

Not during the less than once or 3 or more times

Past month once a week twice a week a week

9. During the past month how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all

Only a very slight problem

Somewhat of a problem

A very big problem
Read each statement and circle a number from 1 to 7, based on how accurately it reflects your condition during the past week and the extent to which you agree or disagree that the statement applies to you.

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<tbody>
<tr>
<td>1. My motivation is lower when I am fatigued.</td>
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<td>2. Exercise brings on my fatigue.</td>
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<td>3. I am easily fatigued.</td>
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<td>4. Fatigue interferes with my physical functioning.</td>
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<td>5. Fatigue causes frequent problems for me.</td>
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<td>6. My fatigue prevents sustained physical functioning.</td>
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<td>7. Fatigue interferes with carrying out certain duties and responsibilities.</td>
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<td>8. Fatigue is among my three most disabling symptoms.</td>
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<td>9. Fatigue interferes with my work, family, or social life.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
**SAMI**

Below is a list of things that people sometimes do or feel when falling asleep, waking up, or during the day. For each statement please CIRCLE THE BEST RESPONSE for how much you notice these things on a TYPICAL NIGHT or a TYPICAL DAY in the past month:

<table>
<thead>
<tr>
<th>Not at all</th>
<th>a little</th>
<th>some what</th>
<th>often</th>
<th>all the time</th>
</tr>
</thead>
</table>

**AS YOU ARE TRYING TO GET TO SLEEP** (including trying to fall asleep at the beginning of the night and getting back to sleep after waking during the night) **DO YOU...**

1. Calculate the number of hours of sleep you are likely to get (i.e., the number of ‘likely’ sleeping hours when you set the Alarm clock)?
   ![Table Entry]
2. Calculate the number of hours of sleep you hope to get?
   ![Table Entry]
3. Decide what time you should get up based on what time you are going to sleep?
   ![Table Entry]
4. Notice physical sensations in your body?
   ![Table Entry]
5. notice you pulse or heartbeat?
   ![Table Entry]
6. notice your internal body reactions?
   ![Table Entry]
7. notice feelings of tension or discomfort within your body?
   ![Table Entry]
8. notice noises in the house?
   ![Table Entry]
9. notice noises outside the house?
   ![Table Entry]
10. check the clock or watch to see how long it is taking you to fall asleep?
    ![Table Entry]
11. notice how long it is taking you to fall asleep?
    ![Table Entry]
12. notice the need to go to the bathroom (i.e. the need to empty your bladder)
    ![Table Entry]

**WHEN GETTING CLOSER TO SLEEP HOW OFTEN ARE YOU AWARE OF...**

13. your body relaxing or feeling heavier?
    ![Table Entry]
14. a feeling of ‘drifting off’?
    ![Table Entry]
15. your eyes or eyelids feeling heavy?
    ![Table Entry]
16. your muscles getting weaker or relaxing?
    ![Table Entry]

**WHEN YOU WAKE UP IN THE MORNING TO WHAT EXTENT DO YOU...**

17. calculate the amount of sleep you actually got?
    ![Table Entry]
18. notice feelings of tiredness or heaviness in your body?
    ![Table Entry]
19. notice heaviness, soreness, or itchiness in your eyes?
    ![Table Entry]
20. notice your arms and/or legs feeling tired or heavy?
    ![Table Entry]
21. notice that you feel fatigued?
    ![Table Entry]
22. have feelings or sensations caused by sleep deprivation?
    ![Table Entry]

**THROUGHOUT THE DAY HOW OFTEN ARE YOU AWARE OF...**

23. your arms and/or legs feeling tired or heavy?
    ![Table Entry]
24. muscle aches, cramps, or pain?
    ![Table Entry]
25. your shoulders, neck, or back feeling tense or sore?
    ![Table Entry]
26. feelings of tension or discomfort in your body?
    ![Table Entry]
27. stiffness in your body?
    ![Table Entry]
28. thinking about how much the amount of sleep you got will affect your performance during the day?
    ![Table Entry]
29. your concentration being affected by your sleep (or lack of it)?
    ![Table Entry]
30. your memory being affected by your sleep (or lack of it)?
    ![Table Entry]
31. thinking about or assessing your energy level?
    ![Table Entry]
32. your mood being affected by your sleep (or lack of it)?
    ![Table Entry]
33. feelings of not coping?
    ![Table Entry]
APSQ

On the scales provided below, please rate each of the following statements for how true they are for you during the past month.

1. I worry about the amount of sleep I am going to get every night
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

2. I worry about how the amount of sleep I had last night is going to affect my day time performance
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

3. I worry about how the amount of sleep I get is going to afflict my health
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

4. I worry about how much the amount of sleep I get will weaken my social ability
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

5. I worry about how much the amount of sleep I get will shake my mood
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

6. I worry about my loss of control over sleep
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

7. I worry about my ability to stay awake and alert during the day
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true

8. I put great effort into trying to rectify my sleep problems
   
   1 2 3 4 5 6 7 8 9 10

   Not true      Very true
9. My failure to rectify my sleep problems troubles me a lot
   1  2  3  4  5  6  7  8  9  10

   Not true                         Very true

10. My worry about sleep is persistent
    1  2  3  4  5  6  7  8  9  10

   Not true
PSAS

Please rate how intensely you generally experience each item as you attempt to fall asleep in your own bedroom *in the past week*. Please complete the dates that you are rating below. The dates should be the same as your sleep diary.

Week of ________ to _________

<table>
<thead>
<tr>
<th></th>
<th>Not at all (1)</th>
<th>Slightly (2)</th>
<th>Moderately (3)</th>
<th>A lot (4)</th>
<th>Extremely (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heart racing, pounding or beating irregularly</td>
<td></td>
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<tr>
<td>2. A jittery, nervous feeling in your body.</td>
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<tr>
<td>3. Shortness of breath or laboured breathing.</td>
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<tr>
<td>4. A tight, tense feeling in your muscles.</td>
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<tr>
<td>5. Cold feeling in your hands, feet, or body in general.</td>
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<td>6. Have stomach upset (knot or nervous feeling in stomach, heartburn, nausea, gas, etc.)</td>
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<tr>
<td>7. Perspiration in palms of your hands or other parts of your body.</td>
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<tr>
<td>8. Dry feeling in mouth or throat.</td>
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<tr>
<td>9. Worry about falling asleep.</td>
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<tr>
<td>10. Review or ponder events of the day.</td>
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<tr>
<td>11. Depressing or anxious thoughts.</td>
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<tr>
<td>12. Worry about problems other than sleep.</td>
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<tr>
<td></td>
<td>Being mentally alert, active.</td>
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</tr>
<tr>
<td>13</td>
<td>Can’t shut off your thoughts.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>14</td>
<td>Thoughts keep running through your head.</td>
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<tr>
<td>15</td>
<td>Being distracted by sounds, noise in the environment (e.g., ticking of clock, house noises, traffic)</td>
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</tbody>
</table>
SF-36 HEALTH SURVEY

INSTRUCTIONS: This questionnaire asks for your views about your health, how you feel and how well you are able to do your usual activities. Answer every question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

1. In general, would you say your health is:

   (Ci) Excellent 1
   Very Good 2
   Good 3
   Fair 4
   Poor 5

2. Compared to one week ago, how would you rate your health in general now?

   (Ci) Much better than one week ago 1
   Somewhat better than one week ago 2
   About the same as one week ago 3
   Somewhat worse than one week ago 4
   Much worse than one week ago 5

3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?
<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>Yes, limited a lot</th>
<th>Yes, limited a little</th>
<th>No, not limited at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Vigorous <strong>activities</strong>, such as running, lifting heavy objects,</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>participating in strenuous sports.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. <strong>Moderate activities</strong>, such as moving a table, pushing a vacuum</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>cleaner or playing golf.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Lifting or carrying groceries</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. Climbing <strong>several</strong> flights of stairs</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. Climbing <strong>one</strong> flight of stairs</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. Bending, kneeling, stooping</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>g. Walking <strong>more than one kilometre</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>h. Walking <strong>half a kilometre</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>i. Walking <strong>100 metres</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>j. Bathing or dressing yourself</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

4. During the past week, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

(Circle one number on each line)

<table>
<thead>
<tr>
<th>a. Cut down on the <strong>amount of time</strong> you spent on work or other activities</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
b. Accomplished less than you would like | 1 | 2

c. Were limited in the kind of work or other activities | 1 | 2

d. Had difficulty performing the work or other activities (for example, it took extra effort) | 1 | 2

5. During the past week, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

(circle one number on each line)

<table>
<thead>
<tr>
<th></th>
<th>Y es</th>
<th>N o</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Cut down on the amount of time you spent on work or other activities</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Accomplished less than you would like</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Didn’t do work or other activities as carefully as usual</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

6. During the past week, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?

Not at all 1
Slightly 2
Moderately 3
Quite a bit 4
Extremely 5

7. How much bodily pain have you had during the past week?
8. During the past week, how much did pain interfere with your normal work (including both work outside the home and housework)?

- No bodily pain: 1
- Very mild: 2
- Mild: 3
- Moderate: 4
- Severe: 5
- Very severe: 6

9. These questions are about how you feel and how things have been with you during the past week. For each question, please give the one answer that comes closest to the way you have been feeling.

   How much of the time during the past week –

<table>
<thead>
<tr>
<th></th>
<th>All of the Time</th>
<th>Most of the Time</th>
<th>A Good Bit of the Time</th>
<th>Some of the Time</th>
<th>Little of the Time</th>
<th>None of the Time</th>
</tr>
</thead>
</table>
10. During the past week, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time ................................................................. 1

Most of the time ............................................................. 2

Some of the time ............................................................ 3

A little of the time .......................................................... 4
11. How TRUE or FALSE is each of the following statements for you?

<table>
<thead>
<tr>
<th></th>
<th>De</th>
<th>M</th>
<th>Do</th>
<th>M</th>
<th>De</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>finitely True</td>
<td>mostly True</td>
<td>n’t Know</td>
<td>mostly False</td>
<td>finitely False</td>
</tr>
<tr>
<td>a. I seem to get sick a little easier than other people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. I am as healthy as anybody I know</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. I expect my health to get worse</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. My health is excellent</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
HADS

This next questionnaire is designed to help your doctor know how you feel. Read each item and underline the reply which comes closest to how you have been feeling in the past week. Don’t take too long over your replies; your immediate reaction to each item will probably be more accurate than a long thought out response.

11.1 I feel tense and ‘wound up’:

☐ Most of the time
☐ A lot of the time
☐ From time to time, occasionally
☐ Not at all

11.2 I still enjoy the things I used to enjoy:

☐ Definitely as much
☐ Not quite so much
☐ Only a little
☐ Hardly at all
11.3 I get a sort of frightened feeling as if something awful is about to happen:

☐ Very definitely and quite badly
☐ Yes, but not too badly
☐ A little, but it doesn’t worry me
☐ Not at all

11.4 I can laugh and see the funny side of things:

☐ As much as I always could
☐ Not quite so much now
☐ Definitely not so much now
☐ Not at all

11.5 Worrying thoughts go through my mind:

☐ A great deal of the time
☐ A lot of the time
☐ From time to time but not too often
☐ Only occasionally
11.6  I feel cheerful:

☐ Not at all
☐ Not often
☐ Sometimes
☐ Most of the time

11.7  I can sit at ease and feel relaxed:

☐ Definitely
☐ Usually
☐ Not often
☐ Not at all

11.8  I feel as if I am slowed down:

☐ Nearly all the time
☐ Very often
☐ sometimes
☐ Not at all
11.9  
I get a sort of frightened feeling like ‘butterflies’ in the stomach:  

☐ Not at all  
☐ Occasionally  
☐ Quite often  
☐ Very often  

11.10 I have lost interest in my appearance:  

☐ Definitely  
☐ I don’t take as much care as I should  
☐ I may not take quite as much care  
☐ I take just as much care as ever  

11.11 I feel restless as if I have to be on the move:  

☐ Very much indeed  
☐ Quite A lot  
☐ Not very much  
☐ Not at all
11.12 I look forward with enjoyment to things:

- As much as I ever did
- Rather less than I used to
- Definitely less than I used to
- Hardly at all

11.13 I get sudden feelings of panic:

- Very often indeed
- Quite often
- Not very often
- Not at all

11.14 I can enjoy a good book or radio or TV programme:

- Often
- Sometimes
- Not often
- Very seldom
**FFMQ**

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>never or very rarely true</td>
<td>rarely true</td>
<td>sometimes true</td>
<td>often true</td>
<td>very often or always true</td>
</tr>
</tbody>
</table>

1. When I’m walking, I deliberately notice the sensations of my body moving.
2. I’m good at finding words to describe my feelings.
3. I criticize myself for having irrational or inappropriate emotions.
4. I perceive my feelings and emotions without having to react to them.
5. When I do things, my mind wanders off and I’m easily distracted.
6. When I take a shower or bath, I stay alert to the sensations of water on my body.
7. I can easily put my beliefs, opinions, and expectations into words.
8. I don’t pay attention to what I’m doing because I’m daydreaming, worrying, or otherwise distracted.
9. I watch my feelings without getting lost in them.
10. I tell myself I shouldn’t be feeling the way I’m feeling.
11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
12. It’s hard for me to find the words to describe what I’m thinking.
13. I am easily distracted.
14. I believe some of my thoughts are abnormal or bad and I shouldn’t think that way.
15. I pay attention to sensations, such as the wind in my hair or sun on my face.
16. I have trouble thinking of the right words to express how I feel about things.
17. I make judgments about whether my thoughts are good or bad.
18. I find it difficult to stay focused on what’s happening in the present.
19. When I have distressing thoughts or images, I “step back” and am aware of the thought or image without getting taken over by it.
20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
21. In difficult situations, I can pause without immediately reacting.
22. When I have a sensation in my body, it’s difficult for me to describe it because I can’t find the right words.
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>never or very rarely true</td>
<td>rarely true</td>
<td>sometimes true</td>
<td>often true</td>
<td>very often or always true</td>
</tr>
<tr>
<td>23.</td>
<td>It seems I am “running on automatic” without much awareness of what I’m doing.</td>
<td></td>
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<tr>
<td>24.</td>
<td>When I have distressing thoughts or images, I feel calm soon after.</td>
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<td>25.</td>
<td>I tell myself that I shouldn’t be thinking the way I’m thinking.</td>
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<tr>
<td>26.</td>
<td>I notice the smells and aromas of things.</td>
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<tr>
<td>27.</td>
<td>Even when I’m feeling terribly upset, I can find a way to put it into words.</td>
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<td>28.</td>
<td>I rush through activities without being really attentive to them.</td>
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<tr>
<td>29.</td>
<td>When I have distressing thoughts or images I am able just to notice them without reacting.</td>
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<tr>
<td>30.</td>
<td>I think some of my emotions are bad or inappropriate and I shouldn’t feel them.</td>
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<tr>
<td>31.</td>
<td>I notice visual elements in art or nature, such as colours, shapes, textures, or patterns of light and shadow.</td>
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<tr>
<td>32.</td>
<td>My natural tendency is to put my experiences into words.</td>
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<tr>
<td>33.</td>
<td>When I have distressing thoughts or images, I just notice them and let them go.</td>
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<tr>
<td>34.</td>
<td>I do jobs or tasks automatically without being aware of what I’m doing.</td>
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<tr>
<td>35.</td>
<td>When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.</td>
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<tr>
<td>36.</td>
<td>I pay attention to how my emotions affect my thoughts and behaviour.</td>
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<tr>
<td>37.</td>
<td>I can usually describe how I feel at the moment in considerable detail.</td>
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<tr>
<td>38.</td>
<td>I find myself doing things without paying attention.</td>
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<tr>
<td>39.</td>
<td>I disapprove of myself when I have irrational ideas.</td>
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</tbody>
</table>