SLEEP QUALITY AND MOOD REGULATION STRATEGIES AMONG AUSTRALIAN YOUNG ADULTS

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Abstract
Disturbed sleep is a common health complaint among the general population, yet the role that sleep plays in regard to mental and physical health is generally not well understood. The aim of the current research is to explore sleep quality, sleep disturbances and associated correlates of emotional and physical health among 327 young Australian adults aged between 18 and 27 years. A mixed methods design consisting of both variable and person-oriented approaches revealed that a unique pattern of sleep variables significantly predicted depression, anxiety, stress, alcohol use and illicit substance use, indicating that different sleep variables predicted different mental health symptoms. Once health related and mood regulating related variables were entered into the regression model, sleep related variables accounted for a significantly lower proportion of the variance in depression, anxiety, stress and alcohol use. Results from the cluster analysis showed three distinct profiles of sleep disturbances as reported by young adults. These profiles reflected the extent to which young adults experienced each of the four types of sleep disturbances including, insomnia, hypersomnia, parasomnias and sleep apnoea. The Non-Disturbed Sleepers reported better quality sleep and fewer disturbances to sleep, better health in terms of their physical functioning, as well as lower depression, anxiety and stress scores compared to the other clusters. The Insomniacs were named due to their more frequent insomnia symptoms, whereas the Problem Sleepers reported a variety of sleep disturbances, including more frequent symptoms of hypersomnia, sleep apnoea and parasomnias. These two groups also reported greater depression, anxiety and stress than the Non-Disturbed Sleepers, yet did not significantly differ from each other. The two disturbed sleeper groups differed from each other in that the Problem Sleepers also reported more frequent use of physiological distraction and stress management to regulate a negative mood than any of the other groups. In addition, the Problem Sleepers reported significantly greater use of illicit substances than the Insomniacs and Non-Disturbed Sleepers clusters. Findings in the present sample suggest that sleep may serve as an indicator of how a young adult is functioning overall. An implication of the current findings is that further recognition of sleep as a psychological resource may increase the attention paid to sleep quality and sleep disturbances among young adults, thereby facilitating a holistic approach to mental health care in clinical practice.
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To my friend, Davina Howell, thank you for being you, the friend I needed. We’ve made memories fit for a scrapbook.
Declaration

I declare that this thesis does not incorporate without acknowledgement any material previously submitted for a degree in any university, or other educational institution; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text. I further declare that the ethical principles and procedures specified in the document on human research and experimentation issued by the Psychology Department of Swinburne University have been adhered to (see Appendix A).

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Signed:
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Chapter 1: Introduction and Overview of the Thesis

Interest regarding the role of sleep in physical and mental health has led to a proliferation of sleep research (LeBlanc et al., 2007; Mayers, Grabau, Campbell, & Baldwin, 2009; Mume, 2010; Parker, Malhi, Hadzi-Pavlovic, & Parker, 2006; Roane & Taylor, 2008; Roth, 2009; Taylor et al., 2005; Turek, 2005; Vandeputte & De Weerd, 2003; Wong, Brower, & Zucker, 2009). While this interest has been particularly prominent over the past decade, interest in the role of sleep was evident more than four centuries ago when William Shakespeare made reference to the role of sleep throughout several of his plays. Shakespeare romanticised the role of sleep in Macbeth, Cymbeline, Henry IV, and A Midsummer Night’s Dream (“The complete works of William Shakespeare”, 1993)

Shakespeare used a metaphor for sleep as “sore labour’s bath…Balm of hurt minds...” (Shakespeare, trans. 1993, 2.2.3) implying that sleep may serve a protective function for both physical and mental health, with this idea currently emphasised by the vast body of literature which suggests sleep plays an important role in regard to mental and physical health (e.g. Kandel, Schwartz, & Jessel, 2000; LeBlanc et al., 2007; Lee & Douglass, 2010; Mayers et al., 2009; Mume, 2010; Parker et al., 2006; Roane & Taylor, 2008; Siegel, 2005; Vandeputte & De Weerd, 2003; Wong et al., 2009). However, despite the vast amount of research attention dedicated toward understanding the precise function of sleep, the reasons why humans need sleep remain largely theoretical, with limited empirical evidence to support the proposed functions of sleep (Kandel et al., 2000; Siegal, 2005).

Throughout the literature to date, the proposed functions of sleep include: energy conservation; restoration; memory consolidation; immune system functioning; and emotional regulation (Imeri & Opp, 2009; Kandel et al., 2000; Siegal, 2005). It is these proposed functions which distinguish an important role for sleep in maintaining healthy functioning and emotional well-being (Kandel et al.2000; Lee & Douglass,
Consequently, examining the relationship between impaired sleep quality, sleep disturbances and the proposed functions of sleep, is a vital area of research to add to the understanding of the way in which sleep loss can impact upon various aspects of health.

Before examining the potential role of sleep in healthy functioning and emotional well-being, it is important to outline the physiological characterisation of sleep. By broad definition, sleep comprises two stages: Rapid Eye Movement (REM) and Non-Rapid Eye Movement (NREM; also called slow wave sleep; Kandel et al., 2000). REM sleep is comparative to wakefulness in terms of brain activity because neural activity increases, brain temperature and metabolic rate increase, however muscle tone is lost (Kandel et al., 2000). Whereas in NREM sleep, metabolic rate, temperature and neuronal activity decrease, yet muscle tone and reflexes are preserved (Kandel et al., 2000). In NREM sleep, four distinct sleep stages are principally identified using electroencephalography (EEG), which is the technique of recording the brain’s spontaneous electrical activity (Carskadon & Rechtschaffen, 2005). Stage 1 is characterised by alpha wave activity and slow eye movements. Stage 2 is distinctly identified by the presence of sleep spindles and K-complexes, which are unique, irregular EEG patterns (Andreassi, 2000). Stage 3 and 4 are characterised by the presence of delta wave activity, which is high-voltage and slow wave EEG activity (Carskadon & Rechtschaffen, 2005). The different stages of sleep and the distinct physiological characteristics associated with each stage have been used to inform research design which is then used to investigate the effect of sleep loss and the function of sleep, as evidenced in selective sleep deprivation studies.

One theorised function of sleep which has received attention in the literature is that of facilitating emotional regulation. Research findings from neurobiological studies provide evidence to support the theory that sleep serves as a mechanism to dampen negative affect and shorten its duration (Davidson, 2001; Romcy-Pereira & Pavlides, 2004; Walker & Van der Helm, 2009).
Specifically, Romcy-Pereira and Pavlides (2004) conducted neuroimaging studies on mice to investigate the effect of sleep deprivation on the maintenance of hippocampal and medial prefrontal cortex long-term potentiation (LTP), which are areas of the brain implicated in memory and emotion function (Romcy-Pereira & Pavlides, 2004). The authors compared three groups of mice which were assigned to one of three conditions. The first group of mice were deprived of REM sleep, the second group of mice were completely sleep deprived of both REM and NREM sleep and the third group of mice were not sleep deprived.

The findings indicate that among mice in the REM sleep deprivation condition, late phase LTP was reduced in the dentate gyrus yet was prolonged in the medial prefrontal cortex (Romcy-Pereira & Pavlides, 2004). Prolonged LTP in the medial prefrontal cortex is consistent with a reduction in amygdala function, which has been proposed to be associated with the consolidation of memories for emotionally arousing events (Kilpatrick & Cahill, 2003), the dampening of negative affect and shortening of its duration in individuals who appear to be more resilient to emotional distress (Davidson, 2001). Thus, whilst the findings from brains of mice must not be interpreted as “a blueprint for understanding the mammalian brain” (Feldman Barrett et al., 2007, p.302), they do provide tentative evidence that areas of the brain which are implicated in the enhancement or impairment of consolidating memories for emotionally arousing events, may be disrupted when sleep is deprived (Kilpatrick & Cahill, 2003).

Theoretical support for the role of sleep in emotional regulation is provided by Walker and Van der Helm (2009) who hypothesised that sleep deprivation may interfere with the biological processes that regulate emotional experiences. Specifically, Walker and Van der Helm (2009) propose that REM sleep facilitates the memory of emotional experiences by depotentiating the autonomic arousal associated with the memory, thereby reducing the level of emotion that was acquired at the time the memory occurred. In other words, if REM does not occur, the level of affect associated within autobiographical memory networks will not dissipate, resulting in a persistent state of anxiety or negative affect (Walker & Van der Helm, 2009).

Cognitive neuroscience and psychobiology research findings have implicated sleep deprivation as an important contributor toward the regulation of, and reactivity to,
emotional stimuli and the use of adaptive coping styles (e.g. Sadeh, Keinan, & Daon, 2004; Walker & Van der Helm, 2009). A study was conducted by Sadeh, Keinan, and Daon (2004) who investigated the relationship between coping style, sleep duration and stress among a sample of 36 undergraduate psychology students aged between 22 and 32 years. The authors measured coping style across a ‘high stress’ week and a ‘low stress’ week and compared the students stress ratings, sleep duration and use of coping strategies.

The findings indicated that students who reported more frequent use of emotion focused coping, which was defined as regulating emotional responses to a stressful event, experienced a reduction in average sleep duration of 23 minutes from the low stress week to the high stress week. Students also reported poorer sleep quality during the high stress week compared to the low stress week. In contrast, students who reported low emotion focused coping scores, experienced an increase in sleep duration of 33 minutes from the low stress week to the high stress week and reported better sleep quality in the high stress week compared with the low stress week. Interestingly the use of problem focused coping, which was defined as managing or altering the problem causing the distress, was associated with longer sleep duration, regardless of whether the week was low or high stress. Thus, coping style may moderate the relationship between sleep and stress.

The authors explained their findings as being indicative of an underlying bio-behavioural mechanism, whereby individuals who respond to stressful events using emotion focused coping may experience greater anxiety and arousal which in turn may interfere with sleep. It may also be the case that in response to certain stressors the use of emotion focused coping is ineffective at managing stress and may compromise sleep, which may then perpetuate increased anxiety, stress and arousal, maintaining a cycle of heightened stress and impaired sleep.

There are also research findings which suggest that those with sleep problems may employ ineffective coping strategies that are dysfunctional and thereby act to maintain the sleep disturbance (LeBlanc et al., 2007; Morin, Rodrigue, & Ivers, 2003). For example, a study was conducted by Le Blanc et al. (2007) who found that in a sample of 67 adults, individuals reporting complaints of insomnia were found to
perceive greater levels of stress in their lives and a tendency to use emotion-oriented coping more so than good sleepers, despite both groups reporting an equivalent number of minor stressful events (LeBlanc et al., 2007). Thus, individuals with insomnia symptoms were more likely to perceive the impact of stressful events as greater than those without insomnia symptoms (Le Blanc et al., 2007).

Similar to the research findings of Sadeh, Keinan, and Daon (2004), Le Blanc et al.’s (2007) findings suggest that coping plays a mediating role between sleep quality and stress which highlights the need for sleep disorder treatment programs to incorporate an educational component which teaches emotion regulation and coping skills. Furthermore, the findings of Le Blanc et al.’s (2007) research indicate that those reporting sleep disturbances are more likely to use coping skills which are intended to reduce emotional distress and also report greater arousal at bed time than those without sleep difficulties. Therefore, it is possible that emotion focused coping may be ineffective at providing a buffer from stress for people with sleep disturbances, potentially maintaining a hyper aroused state which may interfere with the ability to fall asleep.

The aforementioned findings of previous research build a case to suggest that sleep deprivation and poor sleep quality may impair effective emotional regulation and that in addition, ineffective coping strategies impair sleep quality, which could lead to increased risk of emotional distress (Alfano et al., 2009; Sadeh, Keinan, & Daon, 2004; Walker & Van der Helm, 2009). The findings of Sadeh et al. (2004) and Le Blanc et al. (2007) indicate that the use of coping strategies play a modulatory or mediating role in the relationship between sleep and stress, which suggests that coping and mood regulation needs to be accounted for when examining the relationship between sleep-related variables and psychological symptoms such as stress. Further exploration of the relationship between sleep quality, sleep disturbances, the use of mood regulation strategies and emotional distress is warranted, particularly among the young adult cohort, a group identified as being at a higher risk of developing mood and anxiety disorders in comparison to any other age cohort in Australia (Australian Bureau of Statistics [ABS], 1997; 2007). Further exploration of young adults sleep health seems particularly important given current concern regarding a potential decline in sleep
duration over the past three decades, which may reflect a decline in sleep quality given that sleep duration is frequently measured as a component of sleep quality (Buysse et al., 1988).

Specifically, over the last century, a decline in sleep duration has become apparent (Bixler, 2009), particularly among children and adolescents (Matricciani, Olds, & Petkov, 2012). This decline in sleep duration has been partly attributed to increasing work demands and access to technology, which has sparked debate regarding whether people are getting enough sleep (National Sleep Foundation, 2013). Indeed, the modern lifestyle may have an impact on sleep at a societal level. Pickering (2006) has argued that in modern society, which is commonly referred to as the “24/7” society due to the expansion of technology and economic growth, sleep is becoming increasingly forsaken to meet lifestyle demands.

The cost of forsaken sleep is demonstrated at a societal level by loss of workplace productivity, impaired cognitive and psychomotor performance among employees, absenteeism, disability, hospitalisation, ambulatory care, motor vehicle accidents, depression, substance use and increased medical costs (Dorrian, Lamond, & Dawson, 2000; Hossain & Shapiro, 2002; Lamond et al., 2007). The risk of impaired occupational and driving performance due to fatigue appears to increase among individuals with an untreated sleep disorder as well as occupational groups which tend to have extended and unpredictable shift hours such as train drivers, nurses and miners, (Dorrian et al., 2006; Dorrian, Hussey, & Dawson, 2007; Ferguson et al., 2011; Vakulin et al., 2009). These findings highlight safety concerns in modern society whereby sleep deprivation is potentially becoming commonplace.

Whilst sleep is a behaviour that primarily serves biological functions such as energy conservation and restoration, memory consolidation, immune system functioning and emotional regulation, it is [also] largely shaped by culture (Williams, Coveney, & Gabe, 2013). For example, it is argued that the advances in technology and globalisation which have become more apparent in Australia with the arrival of the 21st century (McMahon, 2006), have encroached upon time once reserved for sleep, which is reflected in the declining sleep duration trend over the past century (Bixler, 2009; Williams et al., 2013). The idea that modern Western society is “chronically sleep
deprived” (Williams et al., 2013, p.41) has been explored as a function of changing trends in sleep duration. For example, An American National Sleep Poll conducted in 2006 demonstrated that over a six year period, longer sleep duration decreased whereas shorter sleep duration increased. The poll indicated that the number of adults reporting that they get more than eight hours sleep a night decreased from 35% in 1998, to 26% in 2005. However, the number of people who reported getting less than six hours of sleep per night increased slightly from 12% in 1998 to 16% in 2005. The reasons given as to why people were sleeping less included spending more time on work related tasks that needed to be done as well as using the internet and watching television. Consistent with the National Sleep Foundations (2013) findings, the National Centre for Health Statistics (2004) reported that the percentage of Americans across all age groups reporting less than six hours sleep per night, increased from 1985 to 2004.

This trend of declining sleep duration is not limited to the United States, with research in Finland and France indicating findings which are consistent with a decline in sleep duration over the last five decades. A longitudinal study in Finland reported that over a 33 year period from 1972 to 2005, sleep duration decreased by 18 minutes and sleep complaints relating to insomnia symptoms (Kronholm et al., 2008). Similarly, a study among French young adults found short sleep duration to be highly prevalent (Leger et al., 2010). Short sleep is typically defined as less than six hours of sleep per night and long sleep as more than nine hours per night (APA, 2000).

In contrast to this pattern of sleep duration decline in the U.S, France and Finland, a recent study examining the prevalence of short and long sleep duration in 10 countries found that six countries reported an increase in the prevalence of long sleep duration, with Australia among those reporting an increase in long sleep duration (Bin, Marshall, & Glozier, 2012). Bin et al. (2012) examined the change in prevalence of short and long sleep duration across 10 industrialised countries from 1960s to 2000s. The findings revealed that the prevalence of short sleep duration had increased in Italy and Norway and decreased in Sweden, United Kingdom and United States. Further, the prevalence of long sleep duration had increased in Australia, Finland, Sweden and the United States and decreased in Italy and Canada. Therefore, mixed findings regarding the pattern of sleep duration across different countries suggests that sleep duration and
potentially other aspects of sleep quality differ across geographical region, indicating that an examination of the sleep quality reported by Australian young adults specifically, is warranted.

It is possible that inconsistencies in methodology contribute to these disparities in the pattern of sleep duration in Australia, with some studies relying on proxy reports, others on self-reports and some studies using a combination of both proxy and self-report data, to determine sleep duration estimates. Thus, standardised measures of sleep duration are needed to ensure valid comparisons can be made cross culturally and longitudinally. In addition, further research investigating other indicators of sleep quality is needed to determine whether sleep satisfaction has declined over the past century. Despite methodological disparities, the inconsistent findings challenge the idea that modern society and increased access to technology is impacting upon sleep duration. Alternatively, these inconsistent findings may be partially explained by differences in the age of participants, with researchers which have examined sleep duration trends among young people in Australia, as well as worldwide, consistently identifying a decline in sleep duration and an increase in sleep disturbances (Dollman et al., 2007; Gradisar, Gardner, & Dohnt, 2011). Thus, examining sleep duration trends amongst specific age cohorts may provide more consistent findings regarding the pattern of sleep duration.

Whilst research findings from Bin et al. (2012) identified Australia as a country where there is a larger proportion of people reporting they are sleeping longer compared to several decades ago, data from several other Australian studies suggest that sleep duration has been declining among young people (Dollman et al., 2007; Glozier et al., 2010; Olds, Maher, Blunden, & Matricciani, 2010). In one study, researchers collected data among one cohort of 10 to 15 year old Australian school children in 1985 and compared that data to other collected data among the same age cohort in 2004. It was revealed that sleep duration had decreased by 28 minutes for girls and 33 minutes for boys (Dollman et al., 2007). The decline in sleep duration was more apparent for boys from low socioeconomic backgrounds, 44 minutes, in comparison with boys from high socioeconomic backgrounds, 23 minutes. Thus sleep quality may differ across geographical region as well as socioeconomic status.
Furthermore, previous research on the prevalence, incidence and chronicity of short sleep duration among American adolescents between 11 and 17 years of age, indicates high prevalence figures among this age cohort (Roberts, Roberts, & Xing, 2011). For example, among 4,175 adolescents interviewed in research by Roberts, Roberts, and Duong (2008), one in five reported having six hours or less sleep almost every week night over the past month, whereas one in 10 reported this much sleep on both weeknights and weekends. There were also an additional 17 percent of adolescents who reported getting six hours or less sleep per night one year later, indicating a substantial incidence. In terms of the chronicity of short sleep, over half who reported short sleep on weeknights at the first interview, also reported it one year later. In addition, two-thirds of the adolescents who reported short sleep on both weeknights and weekends initially also reported restricted sleep after one year. Thus, indicating the chronic nature of short sleep duration. Being older in age, female and experiencing school stress were identified risk factors which predicted the chronicity of short sleep duration. Whereas, the incidence of restricted sleep was predicted by being older in age and having school work which meant less time to sleep. This research did not find that psychological or somatic health factors acted as contributors to adolescents short sleep duration. This may indicate that short sleep duration is not necessarily associated with psychological symptoms and health factors and can occur independently.

In contrast to this, Glozier et al. (2010) found that self-reported short sleep duration was positively associated with prevalent and persistent psychological distress, regardless of distress severity, among twenty thousand Australian young adults aged between 17 and 24 years. The findings also indicated that short sleep duration was an independent risk factor for the persistence of psychological distress one year later, which suggests that short sleep duration may act as a precipitant to the onset of psychological symptoms among young adults. In addition, sleep disturbances have been found to increase the risk of developing subsequent mental health difficulties among young people, however research on sleep disturbances among young adults remains limited in Australia (Short et al., 2013a).

Attention to the exploration of sleep disturbances amongst young adults is evident in research from a variety of countries such as the U.S, Brazil, France, Turkey,
Spain, China, and Japan (e.g. Breslau, Roth, Rosenthal, & Andreski, 1996; Fernandez-Mendoza et al., 2009; Gaultney, 2010; Harada, Tanoue, & Takeuchi, 2006; Leger et al., 2011; Millman, 2005; Patel et al., 2008; Roane & Taylor, 2008; Roberts, Roberts, & Xing, 2011; Sogut, Yilmaz, Dinc, & Yuksel, 2009; Wong et al., 2013). While several Australian studies have examined sleep disturbances among young adults, the focus has largely been on women (Bruck & Astbury, 2012; Soltani et al., 2012), insomnia (Smith & Trinder, 2001), or short sleep duration (Glozier et al., 2010; Short et al., 2013b) and has neglected to examine a range of sleep disturbances. Despite international research evidence which suggests that sleep disturbances are a prevalent health complaint amongst young adults (Gradisar, Gardner, & Dohnt, 2011; Wong et al., 2013), there is an absence of Australian research dedicated to examining a wider range of sleep disturbances amongst young adults.

The importance of examining the sleep health of young people is argued by Gradisar, Gardner, and Dohnt (2011), who conducted a meta-analysis of 41 worldwide sleep surveys published between 1999 and 2010 to investigate sleep health among adolescents. The findings of the meta-analysis indicated that worldwide, a delay of two hours existed between adolescents’ bed times and wake up times during the week compared to the weekend. In addition, sleep onset insomnia symptoms were commonly reported across the 41 surveys. Gradisar et al. (2011) argue that the sleep phase delay of two hours and the sleep onset insomnia symptoms reported among adolescents is indicative of Delayed Sleep Phase Disorder, and this is likely to be underestimated in prevalence studies. The findings also indicated that older adolescents were going to bed later and obtaining less sleep than younger adolescents, which may indicate that the risk of poor sleep health increases from adolescence to young adulthood. Furthermore, sleep patterns differed across cultural region with Asian adolescents reporting later bed times than North American and European adolescents. Asian adolescents also reported greater daytime sleepiness than adolescents from any other cultural region. Only one large scale study was found from the Australasian region, which therefore meant it was unable to be included in statistical comparisons with other regions due to low statistical power (Gradisar et al., 2011). This is indicative of the limited research which has examined the quality of sleep and experience of sleep disturbances amongst Australian young adults.
in modern society. Thus, further research dedicated to exploring individual differences amongst Australian young adults and their sleep quality is warranted.

Furthermore, prevalence figures of the risk of developing sleep disorders have been investigated among American college students (Gaultney, 2010). Among 1,845 first year psychology students at an American university, 27% reported experiencing sleep disordered symptoms. Students who reported no sleep disorder were performing better academically as per their grade point average, compared to students who reported at least one sleep disorder. The author suggested it is possible that the relationship between poorer academic performance and poor sleep may be related indirectly by reduced motivation, compromised health or depressed mood. Therefore, symptoms of sleep disturbance may indirectly affect academic performance by impacting upon mood, health and motivation.

Despite the high prevalence of mental health disorders among the young adult cohort in Australia (ABS; 1997; 2007), there is limited research looking at the sleep quality of young adults and its relationship with mental and physical health. The importance of examining sleep quality in relation to mental health symptoms is demonstrated by the data from an array of epidemiological research which supports a view that the association between insomnia and depression is bi-directional, and that either a causal relationship or common causalities, underlie both disorders (Staner, 2010). The idea that the association between insomnia and bi-directional implies that sleep disorders may represent a prodromal period or risk factor, for the development of mental health disorders (Fong & Wing, 2007). Similarly, non-clinical data demonstrates a positive association between sleep disturbances and the onset of mental health symptoms in the general population (Ford & Kamerow, 1989; Ohayon, 1997; Taylor et al., 2005). Therefore, developing the current understanding of the relationship between sleep disturbances and mood disturbances among young adults may provide an avenue for treatment intervention and prevention.

In order to develop an accurate understanding of the relationship between sleep and mood disturbances, other variables related to sleep and mood must be considered. Previous research by Taylor et al. (2011) who conducted an examination of the relationship between insomnia symptoms and mental health symptoms found that self-
report physical health measures accounted for a considerable portion of the variance in the relationship. Furthermore, research findings reveal that mental illnesses, such as affective and anxiety disorders occur at higher rates among individuals with physical health conditions, compared to individuals reporting no physical health problems (Sareen, Cox, Clara, & Asmundson, 2005; Teeson et al., 2011). Therefore, accounting for self-reported physical health is crucial to developing further understanding of the complex relationship between sleep and mental health.

There is a gap in the literature regarding the relationship between sleep, self-rated health and pain amongst young adults, despite research findings which have established that sleep plays an important role in pain management (Affleck et al., 1996; Chiu et al., 2005; Graham & Streitel, 2010; Imeri & Opp, 2009; Millman, 2005) and when impaired, may hold negative health consequences. Research findings suggest that individuals obtaining too much sleep, which is defined as more than nine hours per night on average, or too little, which is defined as less than six hours per night, as well as sleep disturbances, have increased health risks including obesity (Magee, Huang, Iverson, Caputi, 2009) cardiovascular disease (Bixler, 2009; Magee et al., 2011), heart disease (Kakizaki et al., 2012), increased risk of mortality (Gallicchio & Kalesan, 2008) and overall poor self-rated health (Imeri & Opp, 2009). However, the immune system responds to infection and illness by promoting sleep, thereby conserving energy and facilitating recovery (Imeri & Opp, 2009). Therefore, changes in sleep duration may be a consequence of pre-existing health conditions, rather than a precursor to negative health outcomes. This highlights the need to review longitudinal research in order to elucidate the nature of the relationship between sleep duration and increased health risks. Exploring the quality of young adults sleep and its relationship with self-reported health and symptoms of pain in the current study will therefore add to existing knowledge regarding the mental and physical health of young adults.

Previous researchers which have examined the co-occurrence of sleep disorders and mental health disorders have relied on the use of classifications such as the Diagnostic and Statistical Manual of Mental Disorders (APA, 2000) and the International Classification of Sleep Disorders (AASM, 2001) to guide the assessment of sleep and mental health disorders (Ohayon & Reynolds III, 2009). A long standing
issue in the literature regarding the classification of mental health disorders is whether a
categorical approach is the most effective way to conceptualise the broad spectrum of
mental health symptomatology. An alternative approach to the current classification
model is increasingly being argued for, with a dimensional model of classification
among those that have been proposed (Clark, Watson, & Reynolds, 1995; Wilfley,
Bishop, Wilson, & Agras, 2007; Wonderlich et al., 2007).

Specifically, it has been argued that the use of a sub-typing scheme may provide
a more accurate representation of psychopathology and emulate the experience of
mental health disorders in individuals (Clark et al., 1995; Wilfley, Bishop, Wilson, &
Agras, 2007; Wonderlich et al., 2007). This idea is reflected in the sleep research
context, whereby Ohayon, Riemann, Morin & Reynolds III (2012) used a hierarchical
classification tree procedure to distinguish between different categories of insomnia in
the general population. Findings indicated distinctions between those who reported
insomnia complaints, symptoms and syndromes. Ohayon et al. (2012) defined a
symptom as “a clinical fact recognised by the clinician based on answers to a
questionnaire or an examination” (p.56) which provides support for the notion that sleep
disturbances exist along the continuum of sleep disorders and are prevalent in the
general population. Ohayon et al.’s (2012) definition of an insomnia symptom is
synonymous with the definition of subthreshold sleep disorders. Sub threshold sleep
disorders are defined as an insufficient number or duration of sleep disturbed symptoms
to meet criteria for a diagnosis (Clark et al., 1995).

Limited research has been conducted to investigate the dimensional nature of
sleep disturbances and whether symptoms of sleep disturbances are associated with
symptoms of depression and anxiety among young adults in Australia. The use of a
person-oriented approach to explore different profiles within the young adult cohort is
of importance given the large degree of heterogeneity evident in the experience of sleep
disturbances (Ohayon et al., 2012), mental health symptoms (Clark et al., 1995) and
mood regulation strategies among young adults (Eisenbarth, 2012; Tandon, Dariotis,
Tucker, & Sonenstein, 2013; Thayer, Newman, & McClain, 1994). Therefore, the aim
of the current research was to address this gap by exploring the relationship between
sleep quality, sleep disturbances and self-reported mental and physical health amongst
Australian young adults. To date, limited research has explored sleep quality and sleep disturbances among young adults in the Australian context. The young adult cohort is recognised as a high priority population for research on sleep disturbances (Gradisar, Gardner, & Dohnt, 2011; Wong et al., 2013) and has a high prevalence of mental health problems among this cluster (Jorm & Butterworth, 2006; McCloughen, Foster, Huws-Thomas, & Delgado, 2012; Yap, Reavely, & Jorm, 2011; 2013). For these reasons there is a need to examine the relationship between sleep disturbances and mental health symptoms.

Sleep disturbances have been found to act as a mechanism in the development of mental health problems and therefore may play a role in the development of mental health symptoms among young adults. The aim of the current study was to explore sleep disturbances among Australian young adults and their impact on self-reported mood regulation, substance use, as well as emotional and physical health symptoms. A further aim was to distinguish distinct profiles of young adults who differed based on their experience of sleep disturbances. This was an important focus of the current thesis, as there is limited empirical research in the sleep literature which has used a person-oriented approach to understand the complex, mixed symptom presentation of sleep disturbances on a dimensional scale. This second aim sought to identify whether young adults experiencing different dimensions of sleep disturbances also experienced unique emotional and physical health correlates.

Overview of the thesis. This thesis is presented in eight chapters. Chapter 2 through to Chapter 5 provides a review of the theoretical and empirical literature pertaining to the relationship between sleep and mood. Chapter 6 and Chapter 7 detail the methodology and statistical analyses of the current empirical study. Finally, Chapter 8 provides a discussion and integration of the findings.

In Chapter 2, the potential functions of sleep such as energy conservation, memory consolidation, immune-system functioning, and emotional regulation are briefly discussed. Following from a brief discussion on the functions of sleep, a description of “normal” sleep is provided to facilitate the distinction between sleep disturbances and disorders. The focus of the remainder of Chapter 2 is on defining sleep
disorders and highlighting sleep disturbances as existing along the continuum of sleep disorders. An overview of the most prevalent sleep disorders is provided, defining insomnia, hypersomnia, sleep apnoea and parasomnias and their prevalence in Australia. Limitations of the current classification system for sleep disorder diagnoses are also discussed. This chapter provides a rationale for exploring sleep disturbances amongst a young adult cohort.

The focus of Chapter 3 is on the conceptualisation of sleep as a psychological resource and its potential function in mood regulation. A review of mood regulation models is provided which focuses on researchers who have developed taxonomies of strategies, or behaviours, that may be used to modulate affect. The importance of examining mood regulation amongst young adults is emphasised, given that this particular developmental period of life is a time when individuals are developing resources and strategies for emotional regulation and stress management (Arnett, 2000; Graham & Streitel, 2010).

In Chapter 4, the literature on sleep disturbances and sleep duration among young adults is reviewed. Given that young Australian adults are a group identified as being at high risk for the onset of mental health difficulties (Australian Bureau of Statistics, 1997; 2007), an extensive discussion of the relationship between sleep and mood disturbances is discussed. Sleep disturbances are commonly associated with psychiatric disorders and poor health, with studies supporting a positive association between sleep disorders and greater perceived depression (Fong & Wing, 2007; Ford & Kamerow, 1989; Le Blanc et al., 2006), anxiety (Fong & Wing, 2007; Ford & Kamerow, 1989; Le Blanc et al., 2006; Parker et al., 2006), and substance use (Roane & Taylor, 2008). In particular, sleep disturbances such as insomnia and hypersomnia have been associated with increased risk of depression, anxiety, and substance use (Ford & Kamerow, 1989; Le Blanc et al., 2006; Parker et al., 2006; Roane & Taylor, 2008). Despite these findings, there is limited research looking at the sleep quality of Australian young adults and its relationship with the high prevalence of mental health problems among this cohort. Thus, further research is warranted to explore the
relationship between sleep quality, sleep disturbances and mental health disorders amongst young adults.

The aims and hypotheses of the current study are detailed in Chapter 5, followed by a description of the methodology and design used to explore these aims in Chapter 6. The use of a cross-sectional, mixed methods design is outlined in Chapter 7, whereby both variable and person-oriented approaches are used to analyse the data. The analyses which comprise the variable-oriented approach include a total of nine hierarchical regressions and the analyses which comprise the person-oriented approach include a cluster analysis and a series of MANOVAs exploring differences between the clusters. The rationale for using a variable-oriented approach in the current study was to explore the value of sleep variables in predicting self-reported depression, anxiety and stress symptoms using hierarchical regression analyses. A further aim of using this approach was to investigate whether the addition of physical health related variables and mood regulating strategies improved the prediction of depression, anxiety, stress, and substance use, beyond that predicted by sleep-related variables. Physical health and mood regulation variables were included in the model in order to control for the effects of these variables, given their noted relationship with depression (Kovacs, Joormann, & Gotlib, 2008; Sanna et al., 2013; Teeson et al., 2011), anxiety (Sanna et al., 2013; Sareen, Cox, Clara, & Asmundson, 2005; Teeson et al., 2011), stress (Raposa et al., 2013) and substance use (Crome, 2004).

In contrast, the aim of the person-oriented approach was to explore if there are common patterns of sleep disturbances reported by individuals that are more likely to be associated with negative mental and physical health symptoms. As such, a cluster analysis was conducted to explore the data and develop sleep profiles. Finally, an integration and discussion of the findings is provided in Chapter 8. Specifically, in Chapter 8 a discussion of the findings of the variable-oriented and person-oriented approaches in the context of previous research is provided. The broader implications of these findings are considered for their relevant application to mental health practice. Furthermore, the limitations of the current study are discussed and implications of the
findings are provided. Finally, the thesis concludes by summarising the contribution of the current thesis to the existing mental health literature on young adults in Australia.

Chapter 2: An Overview of Sleep and Sleep Disorders

"Sleep that knits up the ravelled sleave of care
The death of each day's life, sore labour's bath
Balm of hurt minds, great nature's second course,
Chief nourisher in life's feast." (Shakespeare, trans. 1993, 2.2.3)

Sleep has long been associated with healthy functioning in humans, however, the functions of sleep remain largely unexplained (Kandel, Schwartz, & Jessel, 2000; Siegal, 2005). While the functions of sleep are unconfirmed in the literature, the physiological changes that occur during sleep are well understood (Barkoukis, Matheson, Ferber, & Doghramji, 2012; Kandel et al., 2000; Smith, Comella, & Hogl, 2008). Physiologically, sleep is characterised by four criteria: reduced motor activity, decreased response to stimulation, certain postures and easy reversibility of the sleep state to an awake state (Kandel et al., 2000; Siegel, 2005). The contrasting physiological characteristics of NREM and REM sleep have led to the development and support of numerous theories regarding the functions of sleep. The different proposed functions of sleep and the way in which they relate to the differing physiological characteristics of NREM and REM sleep will be outlined below. At present, the prominent theories on the function of sleep include energy conservation, restoration, memory consolidation, immune system functioning and emotional regulation (Siegal, 2005; Walker & Van der Helm, 2009).

The first proposed function of sleep, which is derived from an evolutionary perspective, is that sleep serves a survival mechanism (Kandel et al., 2000; Siegal, 2005). From an evolutionary perspective, night time increases the vulnerability of diurnal mammals to predation and in order to compensate for this increased vulnerability, sleep is a process which minimises noticeability to predators and thus
enables survival (Siegel, 2005). However, this evolutionary proposition does not explain why the body will try to recover sleep when it is deprived of it (Siegel, 2005). Sustained sleep deprivation results in accumulated sleep debt, which can impair daytime performance (Siegel, 2005). This suggests that for optimal daytime functioning, lost sleep needs to be made up for (Siegel, 2005).

The second proposed function of sleep is the conservation of metabolic energy (Kandel et al., 2000; Siegal, 2005). For example, as small animals have great demands for thermoregulation yet low energy reserves; sleep enables them to conserve energy resources (Kandel et al., 2000). The third function associated with sleep, in particular REM sleep, is that of learning and memory processes (Kandel et al., 2000). Specifically, Romcy-Pereira and Pavlides (2004) have demonstrated through neuroimaging studies on mice that been deprived of REM sleep that the process of synaptic plasticity, which is crucial to learning and memory, is reduced in the hippocampus although was prolonged in the medial prefrontal cortex. Romcy-Pereira and Pavlides (2004) suggest that their findings are indicative of distinct memory processing which occurs during REM sleep. In addition, sharp wave pattern activity in the brain during NREM sleep, called sleep spindles, is associated with memory transfer and storage, suggesting that it is not only REM sleep that is implicated in memory processes (Gais, Molle, Helms, & Born, 2002). Gais, Molle, Helms, and Born (2002) investigated EEG data among 16 participants aged between 18 and 30 years during their sleep after completing both a learning and non-learning task of equal cognitive strain. The EEG data indicated that the density of sleep spindles were increased in stage 2 sleep following the learning task as compared with the non-learning task. These findings suggest that brain activity which occurs during a stage in NREM sleep may be associated with learning. However, research examining the effect of sleep deprivation on learning and memory has not consistently supported this proposed function of sleep (Kandel et al., 2000). Another proposed function of sleep is to maintain optimal immune system functioning (Imeri & Opp, 2009). Research by Palmblad, Petrini, Wasserman, and Akerstedt (1979) found that sleep deprivation stimulates increased energy production to tolerate the stress on the body, thereby potentially compromises other immune functions such as defence against infection. Furthermore, sleep loss has
been associated with an increased vulnerability to disease (Imeri & Opp, 2009). Imeri and Opp (2009) propose that infection increases the concentration of cytokines and neurotransmitters which are involved in regulating sleep, which therefore increases the need for sleep. Thus, changes to the regulation of sleep in response to infection indicate that the body responds to infection by promoting sleep in an attempt to promote recovery (Imeri & Opp, 2009). Slow wave sleep has also been linked to blood pressure regulation, with research findings demonstrating slow wave sleep deprivation resulted in the attenuation of the sleep-related decrease in blood pressure (Sayk et al., 2011).

In addition to the theorised impact of sleep deprivation on physical health via the immune system, empirical research findings build a case to suggest that sleep is important for mental health (Kandel et al., 2000; Lee & Douglass, 2010) An array of neurobiological research has found evidence to support the theory that sleep serves to dampen negative affect and shorten its duration (Davidson, 2001; Romcy-Pereira & Pavlides, 2004; Walker & Van der Helm, 2009). Yoo et al. (2007) proposed that sleep serves to “reset the correct brain reactivity to next day-emotional challenges” (p.2), highlighting sleep’s potential role in regulating negative emotional activity.

As outlined above, the proposed functions of sleep indicate that sleep has an important role in maintaining healthy functioning and emotional well-being (Kandel, Schwartz, & Jessel, 2000; Lee & Douglass, 2010; LeBlanc et al., 2007; Mayers et al., 2009; Mume, 2010; Parker et al., 2006; Roane & Taylor, 2008; Siegel, 2005; Vandeputte & De Weerd, 2003; Wong, Brower, & Zucker, 2009). Specifically, the diverse functions of sleep that have been outlined potentially include; energy conservation and restoration, memory consolidation, immune system functioning, and emotional regulation (Imeri & Opp, 2009; Kandel et al., 2000; Lee & Douglass, 2010; Siegel, 2005). Thus, sleep plays an important role in maintaining a healthy life. The following section will provide a discussion of the definition of normal sleep and the changes to sleep across development. This discussion is important as it provides a point of comparison, distinguishing normal sleep from disturbed sleep before describing sleep abnormalities.
2.1 How to Define Normal Sleep

Sleep physiology changes throughout development and differs between individuals (Smith, et al., 2008). Therefore, a definition of normal sleep should take into account age, genetics and environmental factors (Smith et al., 2008). In view of this, The National Sleep Foundation provides a guideline outlining how many hours of sleep are needed per night, based on age. Newborns are estimated to need between 12 and 18 hours of sleep per day, compared to adults who are estimated to need between seven and nine hours per day (National Sleep Foundation, 2013). However, these figures are average estimates and do not take into account the entire range of individual differences and the changes across development and ageing (Yuen & Kashida, 2007). The nature of sleep changes with age and these normal changes mean that older people tend to have less REM sleep, greater sleep fragmentation and greater amount of light stage sleep compared to younger people (Smith et al., 2008; Yuen & Kashida, 2007). Sleep architecture for adolescents differs in that they tend to have less slow wave sleep, increased stage 2 sleep and the latency to the onset of first episode REM sleep is reduced (Millman, 2005). Circadian rhythms, which influence timing of sleep and waking activity in response to light and other environmental factors, also change across the lifespan and are markedly different among adolescents in comparison to older adults. Adolescents and young adults commonly demonstrate a phase-delayed sleep wake cycle, whereby they experience symptoms of sleep onset insomnia, difficulty waking and subsequent excessive daytime sleepiness. The delayed sleep phase is attributed to a combination of intrinsic factors such as hormonal changes as well as extrinsic factors such as lifestyle changes (Millman, 2005). Consistent with the changes to sleep across ageing, the prevalence of sleep disorders tends to increase with age, yet sleep disorders are not considered a normal consequence of ageing (National Sleep Foundation, 2013; Monjan, 2007). Thus, sleep disorders can affect individuals at any point across the developmental life span and can occur in conjunction with physical health conditions as well as mental health disorders.

Sleep disorders are defined as problems with the amount of sleep, timing of sleep, satisfaction of sleep as well as behaviours during sleep, which can be complicated by behavioural conditioning (APA, 2000). Sleep disorders affect night-time sleep as
well as day time function, resulting in decreased alertness, drowsiness and sleepiness, poor concentration and memory, irritability and accidents (Lader, Cardinali, & Perumal, 2006). Sleep disorders can be classed as transient, short-term or chronic and can be primary or secondary disorders (Lader et al., 2006). The course of sleep disorders can fluctuate from transient to chronic and can interact with other disorders of health. This poses a difficulty for diagnostic stability and classification as it becomes difficult to categorise symptoms of sleep disorders that do not meet the full criteria for a diagnosis, which in a broader context holds implications for treatment guidelines.

The complexity of diagnosing sleep disorders is reflected in the question, “what are the differences between complaint, symptom, syndrome, and disorder in sleep disorders?” (Ohayon et al., 2012, p.56). Ohayon, Riemann, Morin, and Reynolds III (2012) distinguished between sleep complaints, symptoms and syndromes by outlining that “a complaint refers to a patient reporting a problem bothering him [sic] or producing a handicap, a symptom is a clinical fact recognized by the clinician based on answers to a questionnaire or an examination, a syndrome is a regrouping of symptoms and/or complaints in terms of criteria that can have an intensity, a duration, a frequency, an evolution, and a specificity linked with age, gender, or other categories” (p.56). This clarification facilitates a definition for subthreshold sleep disorders and suggests that sleep disorders exist along a continuum of sleep disturbed symptoms that are graded in severity. However, this is not how sleep disorders are currently classified according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) and International Classification of Sleep Disorders (ICSD; American Academy of Sleep Medicine [AASM], 2001). The following section will outline the current classification of sleep disorders, with a particular focus on the classification system used by the DSM-IV-TR (2000) and AASM (2001). (DSM-IV-TR; American Psychiatric Association [APA], 2000) given these classification manuals are predominantly used throughout the sleep literature (Doghramji, 2006; Edinger et al., 2000; Ohayon, 1997; Breslau, Roth, Rosenthal, & Andreski, 1996; 1997).
2.2 Classification of Sleep Disorders

Sleep disorders are recognised as complex to diagnose given their fluctuating course, symptom continuum and high comorbidity with a range of other mental and physical health disorders (LeBlanc et al., 2007; Mayers et al., 2009; Mume, 2010; Parker, Malhi, Hadzi-Pavlovic, & Parker, 2006; Roane & Taylor, 2008; Vandeputte & De Weerd, 2003; Wong, Brower, & Zucker, 2009). To guide clinicians through the complex task of diagnosis, there are several publications that provide international classification guidelines for the classification of sleep disorders. This section will focus on two international classification manuals; the ICSD (AASM, 2001) and the DSM-IV-TR; (APA, 2000) given both have been widely utilised in the sleep literature. According to the ICSD (AASM, 2001) there are seven major classification groups of sleep disorders and within each classification groups the ICSD distinguishes between sleep disorders of an idiopathic nature that are assumed to have biological causation and those that are thought to be related to psychological and physiological factors. These classification groups consist of; Behavioural or Environmental Sleep Disorders, Psychiatric Sleep Disorders, Respiratory-related Sleep Disorders, Neurologic Disorders, Circadian-Rhythm Sleep Disorders, Developmental or Psychiatric Sleep Disorders and Other Sleep-related Medical Disorders.

In comparison to the ICSD (AASM, 2001), the DSM-IV-TR (APA, 2000) outlines four categories of sleep disorders based on their presumed aetiology. The first category; Primary Sleep Disorders; characterises sleep disorders that have a presumed endogenous cause. The three remaining categories are; Sleep Disorder related to Another Mental Disorder, Sleep Disorder related to a Medical Condition and Substance-Induced Sleep Disorder (APA, 2000). The focus of the following section will largely be based on the DSM-IV as opposed to the ICSD, given its relevance and applicability to the Australian mental health care context (Henderson, Andrews, & Hall, 2000; Rey, 2010). The DSM-IV is the diagnostic manual predominantly used by clinicians in Australian mental health care practices, therefore to facilitate the current study’s relevance to Australian mental health care the DSM-IV criteria for sleep disorders will be focused on. In addition, the diagnostic challenges which are faced using a categorical classification system will also be discussed.
2.3 Limitations of the Categorical Approach to Diagnostic Classification

The categorical approach to psychopathology has emphasised the importance of the reliability of diagnoses which has provided clinical utility and promoted ease of use among clinicians (Carson, 1991). However the validity of discrete diagnostic entities which have been developed from categorical models of psychopathology, such as the DSM-IV, has been subject to ongoing criticism (Carson, 1991; Clark, Watson, & Reynolds, 1995; Sonuga-Barke, 1998). Common criticisms include issues of heterogeneity and comorbidity within and across diagnostic categories, which challenge the validity of discrete diagnostic entities (Clark et al., 1995). Clark, Watson, and Reynolds (1995) identify two specific types of heterogeneity which question the validity and utility of the DSM’s categorical approach. The first type is within-category heterogeneity, which is represented by the multiple symptom dimensions within the DSM diagnostic criteria. The second type of heterogeneity consists of mixed symptom presentations, which do not fall neatly within the diagnostic criteria (Clark et al., 1995). Both of these types of heterogeneity are outlined as major limitations of the categorical approach as they interfere with the ability to inform treatment guidelines and predict the clinical course (Clark et al., 1995). In relation to the issue of comorbidity, empirical research provides evidence to suggest that the diagnostic entities within the DSM lack stability. This means that comorbidity is the rule rather than the exception and there is a tendency for two or more disorders to coexist as well as a lack of independence between disorders (Carson, 1991; Lecrubier, 2008). While the categorical approach is one way to group symptoms into diagnostic entities, the aforementioned criticisms suggest an alternative approach to categorical classification is needed to improve the current conceptualisation of mental health disorders. Therefore, the aim of the current study is to investigate symptoms of sleep disturbances on a dimensional scale that may not meet the current diagnostic criteria for a diagnosis according to DSM-IV-TR criteria.

In contrast to the medical model, psychopathology is assumed as existing along a continuum, whereby symptoms can fluctuate, overlap, and behaviour change is plausible (Nelson-Gray, 1991). Highlighted in this assumption is the difficulty in making stable diagnoses and monitoring the clinical course of disorders (Krystal, 2005). This is especially relevant to sleep disorders given the course can fluctuate from
transient to chronic and can interact with other disorders of health. The aforementioned criticisms of the categorical classification system utilised by the ICSD and DSM are relevant to the diagnostic entities of sleep disorders as using a categorical diagnostic approach does not accurately recognise the dimensional nature of sleep disordered symptoms or the clinical significance of subthreshold sleep-disordered symptoms.

In the research literature, significant variation in classification reliability among sleep disorders exists (Ford & Cooper-Patrick, 2001; Lee-Chiong, 2006; Walsh, 2004). This variation suggests that prevalence figures for sleep disorders may be somewhat inaccurate and that standardised measures are needed in order to obtain accurate prevalence estimates. Another challenge using the categorical classification system is that sleep disorders are difficult to define as entirely distinct clinical diagnostic entities amongst a clinical population, given their heterogeneity and high comorbidity with psychiatric disorders and other physical health conditions (Wilkinson & Shapiro, 2012). Therefore, an alternative approach to classifying sleep disorders which captures the range of symptomatology is needed. Crome (2004) has argued for a diagnostic classification which “classifies the degrees and patterns of relationships between disorders” (p. 51) with the rationale behind the argument being driven by the need to inform treatment guidelines for the increasing number of overlapping presentations of addiction and mental health disorders among youth (Crome, 2004). Crome’s (2004) idea is applicable to the diagnostic classification of sleep disorders and the need to understand the relationship between sleep disorders and common comorbidities such as physical health conditions and psychiatric disorders.

The following section will define four of the more prevalent sleep disorders in the general population namely, insomnia, hypersomnia, sleep apnoea and parasomnias (Sleep Health Australia, 2004). Given these sleep disorders are of a higher prevalence in the general population, examining subthreshold symptoms of these sleep disorders in an Australian context, will add to the research in this area and to existing knowledge regarding this important area of health.
2.4 Prevalence and Epidemiology of Sleep Disorders

Sleep disorders are estimated to affect 6% of the Australian population, with as many as 90% of Australians experiencing sleep disturbance at some point in their lives due to a range of factors (Sleep Health Australia, 2004). Prevalence data tend to indicate that whilst the prevalence of diagnosable primary sleep disorders is relatively low, the prevalence of subthreshold symptoms of sleep disturbance is quite high. This highlights that a sizeable proportion of sleep related complaints exist among a non-clinical population, supporting the importance of examining sleep disturbances among a non-clinical sample. Given the subthreshold symptoms of insomnia, hypersomnia, sleep apnoea and parasomnias are highly prevalent in the general population, examining subthreshold symptoms of these sleep disorders and their prevalence in an Australian context, will add to the research in this area and current understanding of this important aspect of health.

Prevalence estimates vary across age, gender and country and also differ between disorders such as insomnia, hypersomnia, sleep apnoea and parasomnias. The following section will define these sleep disorders and describe their diagnostic criteria, prevalence rates and demographic differences.

**Insomnia.** Insomnia is defined by difficulty initiating and/or maintaining sleep, early morning awakening or the subjective experience of non-restorative sleep (Barkoukis, Matheson, Ferber, & Doghramji, 2012). The DSM-IV-TR; (APA, 2000) criteria for a diagnosis of Primary Insomnia stipulates that the predominant complaint relates to difficulty initiating, or maintaining sleep, or experiencing restorative sleep for at least a month and that the condition causes clinically significant impairment or distress.

The prevalence rates for insomnia vary widely with estimates ranging from 9% to 50% of people reporting insomnia, due to variation in definition, assessment and methodology (Walsh, 2004). In many surveys, the use of the term insomnia is varied; it can be used to describe a symptom as well as a discrete diagnostic entity, which poses difficulty regarding consistency in epidemiological studies (Ford & Cooper-Patrick, 2001; Lee-Chiong, 2006).
The prevalence of insomnia is reported to range between 10 and 15% in the general population throughout an array of epidemiological research (Ford & Kamerow, 1989; Ohayon, 1997). However, in population surveys as many as 30 to 45% of adults complain of insomnia over a one year period (APA, 2000). In a study using the DSM-IV diagnostic criteria to determine the prevalence of insomnia in a non-clinical sample, 18.6% of the population reported insomnia symptoms, yet only 5.6% warranted a diagnosis of a primary sleep disorder (Ohayon, 1997). The majority of these diagnoses were insomnia related to another mental disorder, whereas primary insomnia was only applicable to 1.3% of the sample (Ohayon, 1997). This suggests that whilst the prevalence of diagnosable primary sleep disorders is relatively low, the prevalence of subthreshold symptoms of sleep disturbance is quite high. The aforementioned figures highlight the high proportion of sleep related complaints among the non-clinical population, supporting the importance of examining sleep disturbances among a non-clinical sample.

In relation to demographic differences, researchers have found women are more likely to report insomnia than men (Hale et al., 2009; Roberts, Schema, Kaplan, & Strawbridge, 2000). Women tend to report twice as many sleep complaints than men; however this may be attributed to women being more likely to seek treatment for health concerns, in comparison to men (Barkouris et al., 2012; Pien, Phillips, & Collop, 2012). It is also unclear as to whether the higher prevalence rates of insomnia typically found among women is associated with the higher prevalence of anxiety and depression amongst women (APA, 2000; Barkouris et al., 2012; Hale et al., 2009). Interestingly, with ageing, women have been found to sleep better than men, with greater slow wave sleep, shorter sleep latencies and better sleep efficiency (Barkouris et al., 2012). Despite this, greater prevalence figures of insomnia have been cited among older adults (Roberts et al., 2000; Sateia & Nowell, 2004). Specifically sleep efficiency declines with age, and the number of arousals during sleep increases with age (Gander & Signal, 2008).

**Hypersomnia.** While insomnia is characterised by a difficulty in initiating and maintaining sleep, hypersomnia features a prolonged sleep period and excessive tiredness (APA, 2000). The criteria for a diagnosis of primary hypersomnia as defined by the DSM-IV-TR specifies that the predominant complaint is excessive sleepiness for
a minimum duration of one month, unless it is recurrent and is evidenced almost daily by prolonged sleep episodes or daytime sleep episodes (APA, 2000).

Epidemiological reports on hypersomnia are questionable due to inconsistent definition and measurement of the sleep disturbance (Ohayon, 2008). Prevalence estimates for hypersomnia have typically used the symptom of excessive daytime sleepiness, rather than a distinct disorder (Lee-Chiong, 2006). Due to the difficulties with measurement, the prevalence of hypersomnia is relatively unknown, yet estimated to lie between 5 and 10% of the general population (APA; 2000). Prevalence estimates have typically looked at hypersomnia as a symptom, rather than a distinct disorder and are commonly based on determining the ratio of idiopathic hypersomnia to narcolepsy in sleep clinic populations (Lee-Chiong, 2006). As the symptoms of hypersomnia such as excessive daytime sleepiness and long sleep duration are common markers of other disorders, it is difficult to determine the true prevalence within the general population. The predominant symptom for hypersomnia, excessive daytime sleepiness, is estimated to affect between 4 and 20% of the general population, whilst actual idiopathic hypersomnia is predicted to be rare, affecting only 0.3% (Ohayon, 2008), although some studies have found higher rates than this (Ford & Kamerow, 1989). For example, Ford and Kamerow (1989) reported a prevalence of 3.2% of people among a large community sample. It is estimated that between 5 and 10% of patients who present to sleep clinics with the complaint of daytime sleepiness are diagnosed with primary hypersomnia (APA, 2000).

Australian prevalence figures came from research by Johns & Hocking (1997) who specifically investigated excessive daytime sleepiness. In a sample of 331 Australian workers from one organisation, the prevalence of excessive daytime sleepiness was estimated to be 10.9% with no differences among men and women (Johns & Hocking, 1997). Similarly, there were no age related differences between the ages of 22 and 59. However, further research is needed to determine whether there would be any difference with young adults under the age of 22 and older adults above 59 years of age. Reports of sleep disordered breathing, insomnia, and insufficient sleep were significantly related to excessive daytime sleepiness, therefore indicating that excessive daytime sleepiness may be a consequence of another primary sleep disorder.
In relation to demographic differences, there does not seem to be any apparent gender differences amongst the hypersomnia prevalence figures, suggesting that males are just as likely to report hypersomnia sleep disturbance as females (APA, 2000; Ohayon et al., 2012). Hypersomnia is reported to be three times more common among individuals in a younger age cohort of 18 to 25 years in comparison to those over 65 years of age (Ford & Cooper-Patrick, 2001).

**Sleep apnoea.** Sleep apnoea is characterised by temporary periods of breathing cessation during sleep (APA, 2000). An apnoea is defined as a breathing cessation for 10 seconds or longer (Smith et al., 2008). The most prevalent breathing-related sleep disorder is obstructive sleep apnoea, whereby the upper airway is obstructed intermittently throughout sleep (APA, 2000). Prevalence rates have been estimated to lie between 1 and 10% in the adult population, with greater figures estimated in the elderly population (APA, 2000). Epidemiological studies report the ratio of men to women with obstructive sleep apnoea as two to one (Barkouris et al., 2012). Previously, obstructive sleep apnoea was classified as a male dominant disorder; however more recent epidemiological studies which include non-clinical settings demonstrate less of an imbalance (Barkouris et al., 2012). Differences in obstructive sleep apnoea presentations among men and women may explain to some extent the reasons behind women being relatively underdiagnosed (Barkouris et al., 2012). This suggests that the way sleep apnoea manifests in men is different in comparison to women, which may lead to difficulties in diagnosing symptoms of sleep apnoea.

Further, another Australian prevalence study was conducted by Johns (1993) who focused on distinguishing between a diagnosis of obstructive sleep apnoea syndrome and primary snoring, based on excessive daytime sleepiness scores. It was found that scores of excessive daytime sleepiness were predictive of the severity of the apnoea events, with increasing scores indicating greater severity. Therefore, it is likely that epidemiological studies will find symptoms of sleep apnoea and symptoms of hypersomnia to be highly comorbid. Whilst these findings suggest that excessive daytime sleepiness is a potential consequence of sleep apnoea, the nature of the study was cross sectional and therefore it cannot be inferred that excessive daytime sleepiness was a direct consequence of sleep apnoea in the study. Excessive daytime sleepiness is
recognised as the most common presenting symptom of obstructive sleep apnoea, yet can also present as a symptom of other sleep disorders, chronic health conditions, lifestyle factors and substance use (Doghramji, 2008). This highlights the importance of using objective sleep data to complement subjective self-report data in diagnosis and assessment.

**Parasomnias.** Parasomnias are described as a group of sleep disorders that occur during transition from wakefulness to sleep and also during particular stages of sleep (AASM, 2001). Under the broad banner of parasomnias are: nightmares, sleep terrors, sleep talking, hypnic jerks otherwise called sleep starts, rhythmic movement disorder and nocturnal leg cramps (AASM, 2001). The characteristic feature of parasomnias is the experience of disturbing physical phenomena during sleep (AASM, 2001).

Whilst largely unknown, the prevalence of parasomnias is estimated to be 4% for sleep walking and 2% for sleep terrors in the U.S adult population (Smith et al., 2012). In the U.S, it is estimated that 3% of young adults report having nightmares frequently or always, compared to as many as 50% of the adult population who report having nightmares occasionally (Ohayon et al., 2012). In relation to demographic differences, there does not seem to be any apparent gender differences in the prevalence figures of diagnosed parasomnias (APA, 2000; Ohayon et al., 2012). Despite this, females tend to report having nightmares more often than men, which is a symptom of parasomnias (APA, 2000). In addition, nightmares are more prevalent in childhood and are associated with psychosocial stressors (APA, 2000). There is limited research in the area of parasomnias and its relationship with other areas of health, such as emotion regulation. Thus, investigating the experience of parasomnias amongst young adults is of interest to the current study.

### 2.5 The Prevalence of Sleep Disturbances among Australian Young Adults

Young adults are an understudied cohort in relation to the investigation of sleep disturbances (Taylor et al., 2011). Whilst there has been extensive research attention dedicated toward mental health among young adults (Jorm & Butterworth, 2006; McCloughen, Foster, Huws-Thomas, & Delgado, 2012; Yap, Reavely, & Jorm, 2011;
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2013), mental health research has largely neglected to examine young adults’ sleep. The examination of sleep in the first two decades of development is particularly important given the potential for sleep disturbances to precipitate and/or exacerbate mental health disorders which are highly prevalent among younger age cohorts (ABS, 1997; 2007). Consequently, there is a need to explore the quality of sleep among young adults and obtain data pertaining to the prevalence, incidence and aetiology of sleep disturbances. The following section will review the literature on sleep disturbances among young people.

One reason as to why young adults may have received less sleep research attention in comparison to older age groups is that younger age groups appear to be potentially less affected by sleep disturbances than older adults (Bartlett, Marshall, Williams, & Grunstein, 2008). Australian researchers investigated sleep health among 3,300 randomly selected people from the electoral roll to provide information on the sleep habits of community dwelling Australians (Bartlett et al., 2008). Among the respondents, half of the sample was aged between 18 and 25 years and the other half between 25 and 64 years. The respondents answered questions relating to sleep behaviour, sleep medication, driver safety/fatigue as well as markers of depression. In addition, symptoms of insomnia and excessive daytime sleepiness were assessed. The findings revealed that those in older age categories, defined as 25 to 64 years, tended to be more likely to report short sleep duration and excessive daytime sleepiness, than people aged between 18 and 24 years. Given the changes that occur to sleep with ageing, it is to be expected that in comparison to older age groups, younger adults may seem to be less affected by sleep disorders characterised by sleep restriction. However, comparing young adults’ sleep to older adults sleep does not adequately address the issue of whether the quality of sleep amongst young adults is a concern for this age cohort. For example, Parker et al. (2006) estimated that the prevalence of hypersomnia is higher among the adolescent population in comparison to the general population (Parker et al., 2006). Thus, indicating the young people may not be as affected by sleep disorders characterised by sleep restriction but may be more affected by symptoms of excessive sleepiness that are not secondary to another sleep disorder such as insomnia or sleep apnoea. An associated health outcome of this estimation is increased prevalence
of substance use, given that data from one study identified young adults reporting
hypersomnia were 13.4 times more likely to abuse substances than those not reporting
hypersomnia symptoms (Breslau, Roth, Rosenthal & Andreski, 1996). Similarly, data
from another study indicated that adolescents suffering from insomnia were more likely
to use alcohol, cannabis and other drugs as well as experience depression, suicidal
thoughts and suicidal attempts, than young people who did not report insomnia
symptoms (Roane & Taylor, 2008). An increased risk of developing new incidences of
depression has been found among young people reporting insomnia six to seven years
prior (Roane & Taylor, 2008). In summary, there is limited research which outlines the
quality of sleep amongst Australian young adults in modern society. However there is
sufficient evidence to suggest that the prevalence of sleep disturbances amongst young
adults, and their associated health outcomes, warrant further research attention in
Australia.

Data from the ABS National Survey of Health and Wellbeing (ABS, 2007)
indicated that the rates of mental health disorders were higher among younger age groups
compared to older age groups. Specifically, 30% of females aged 16 to 24 years and 27%
of females aged 25 to 34 years reported experiencing symptoms of a mental disorder in the
12 months prior to the study. In comparison, 23% of males reported experiencing the
symptoms of a mental disorder, across age groups 16 to 24, and 25 to 34 years (ABS,
2007). These figures were substantially higher than the 75 to 85 year age group, where 7%
of females and 5% of males reported experiencing symptoms of a mental disorder in the
year prior to the survey. In relation to anxiety disorders, women reported higher prevalence
figures across all age groups than males (ABS, 2007). Specifically, 20% of women across
all age groups reported anxiety disorders compared to 9% of males aged between 16 and
24 years and 12% of males aged between 25 and 34 years. Whilst females reported nearly
twice the prevalence of affective disorders than males in the 16 to 24 age group, males
reported nearly three times the prevalence of substance use disorders than females in the 25
to 34 age group (ABS, 2007).

Similar findings were evident in the 1997 Survey of Mental Health and Wellbeing
(ABS, 1997). Among Australian women aged 18 to 24 years, 11% suffered from a mood
disorder, which was three times higher than that of men in this age range, however one in
five men of this age were affected by substance use disorders (ABS, 1997). It is possible these rates reflect a tendency for males to “self-medicate” emotional distress (Sawyer, Sawyer, & La Greca, 2012, p.11). Evidently differences exist with regard to the type of mental health disorders commonly reported between genders, yet despite these differences taken together, young adults aged 18 to 24 years had the highest prevalence of mental disorders (27%) compared to older age groups (ABS, 1997).

Evidently, young adults in Australia are a group at high risk for the onset of mental health disorders. It appears that the way the risk is manifested may differ between males and females, with males reporting higher prevalence of substance use disorders and females reporting higher prevalence of affective disorders. Regardless of these differences, young adults seem to be at risk for negative mental health outcomes. Another potential risk factor which may increase the vulnerability of young adults to mental health difficulties is sleep disturbance and consequent decreased or increased sleep duration. Given the lack of data pertaining to sleep disturbances amongst young adults and the potential role of sleep disturbances in the exacerbation and precipitation of mental health disorders, it follows that examining sleep disturbances among Australian young adults and their relationship with mood disordered symptoms is an important area of research.

Summary. In summary, the aforementioned proposed functions of sleep indicate that sleep plays an important role in maintaining healthy functioning and emotional well-being (Kandel et al., 2000; Lee & Douglass, 2010; LeBlanc et al., 2007; Mayers et al., 2009; Mume, 2010; Parker, et al., 2006; Roane & Taylor, 2008; Siegel, 2005; Vandeputte & De Weerd, 2003; Wong et al., 2009). The diverse proposed functions of sleep include; energy conservation; restoration; memory consolidation; immune system functioning; and emotional regulation (Imeri & Opp, 2009; Kandel et al., 2000; Siegal, 2005). Prevalence estimates for sleep disorders vary across age and gender and also differ between insomnia, hypersonnia, sleep apnoea and parasomnias. Prevalence data tend to indicate that whilst the prevalence of diagnosable primary sleep disorders is relatively low, the prevalence of subthreshold symptoms of sleep disturbance is quite high. The high prevalence of subthreshold symptoms highlights that a sizeable proportion of sleep related complaints exist among a non-clinical population, supporting the importance of examining sleep disturbances among a non-clinical
sample. Given the subthreshold symptoms of insomnia, hypersomnia, sleep apnoea and parasomnias are of higher prevalence than clinical symptoms which meet diagnostic criteria in the general population, examining subthreshold symptoms of these sleep disorders and their prevalence in an Australian context, will add to the limited research in this area and the current understanding of this important aspect of health. Thus, an extensive discussion of the relationship between sleep and mood disturbances as documented throughout the research literature is found in Chapter 4 (p.44). The following section will focus on the role of sleep in mood regulation, and emphasise the importance of examining the relationship between sleep and mood regulation amongst the young adult cohort, a developmental period when individuals are developing resources and strategies for emotional regulation and stress management.

**Chapter 3: Sleep: A Psychological Resource?**

Four centuries ago, William Shakespeare referred to sleep as “great nature’s second course, Chief nourisher in life’s feast” (Shakespeare, trans. 1999, 2.2.3). Consistent with Shakespeare’s ideas, in more recent times theoretical frameworks have characterised sleep as a psychological resource, particularly in the realm of coping and emotional regulation (Hamilton, Nelson, Stevens, & Kitzman, 2007; O’Donnell et al., 2008; Walker & Van Der Helm, 2009). This conceptualisation stems from research findings which suggest sleep deprivation can impair effective regulation of affective states (Gruber, 2013) and other research findings which support a positive relationship between psychological well-being and optimal sleep duration (Hamilton et al., 2007). Hamilton, Nelson, Stevens, and Kitzman (2007) examined the relationship between psychological well-being and sleep duration among 507 American adults using a self-report questionnaire. The findings revealed that individuals who reported their average nightly sleep duration as within the optimal range which was defined as ranging from 6 to 8.5 hours, reported fewer symptoms of depression and anxiety as well as greater psychological well-being compared with individuals reporting average nightly sleep duration outside of the optimal range. This relationship between sleep duration and psychological well-being remained significant after individuals with scores of
depression which were consistent with psychopathology were removed from the sample due to possible confounding effects. Thus, the findings provide support for the argument that sleep may serve a self-regulating role which facilitates psychological well-being (Hamilton et al., 2007).

Furthermore, these findings are consistent with recent developments in the field of cognitive neuroscience and psychobiology have led to a renewed interest in sleep as a form of “overnight therapy” (Walker & Van der Helm, 2009). Walker and Van der Helm (2009) argue that sleep has the potential to provide overnight therapy by reducing the affective tone associated with the recall of emotional experiences. Thus while research has been conducted with the aim of examining the relationship between the use of coping strategies and sleep research, findings by Sadeh et al. (2004) and Le Blanc et al. (2007) indicate that the use of coping strategies play a modulatory or mediating role in the relationship between sleep and psychological symptoms. Therefore, exploring the relationship between sleep quality, sleep disturbances, the use of mood regulation strategies and symptoms of depression, anxiety and stress is warranted among the young adult cohort, in order to contribute to further understanding of this complex relationship.

3.1 Mood Regulation

The definition of emotion or mood regulation varies widely throughout the literature and has undergone extensive adaptations. Earlier definitions emphasise regulatory strategies as response tendencies to the environment (James, 1884; as cited in Gross, 2003) whereas more current definitions expanding upon this definition to include “the process of initiating, avoiding, inhibiting, maintaining, or modulating the occurrence, form, intensity, or duration of internal feeling states…” (Eisenberg & Spinrad, 2004, p. 358). More recently Gross (2007), who uses the term emotion regulation as opposed to mood regulation, defined emotion regulation as “a set of heterogeneous processes which are used to regulate emotions” (p.7) and Augustine and Hemenover (2009) put forward that emotion regulation is “the purposeful alteration of one’s affective state” (pg. 1181). While these definitions vary considerably from one another, together they indicate that emotion regulation is characterised by processes which are intended to change ones current emotional or mood state.
The importance of mood regulation is evident throughout the mental health literature (Larsen, 2000). For example, the inability to regulate dysphoric affect has been highlighted as a fundamental feature of clinical depression (Kovacs, Joormann, & Gotlib, 2008). Given the large body of research emphasising a bi-directional relationship between sleep disturbances and mood disorders (Breslau et al., 1996; Fong & Wing, 2007; Ford & Kamerow, 1989; Taylor et al., 2005), it seems valuable insights may be gained by examining the relationship between sleep disturbances and mood regulation, which to date has received little attention.

The following section will provide a brief review of the prominent mood regulation models in the literature and as such the review will focus on research by Thayer (1996), Parkinson and Totterdell (1999), Larsen (2000) and Gross (2001; 2003).

### 3.2 A Review of Mood Regulation Models

The ability to effectively regulate negative emotion and mood has been associated with the use of particular types of strategies (Leblanc et al., 2007; Larsen, 2000; Marlowe, 1998; O’Donnell et al., 2008; Thayer, 1996). In attempts to classify and conceptualise the strategies used for mood regulation, several models have been put forward. The focus of the current review is on research which developed taxonomies of strategies, or behaviours, that may be used to modulate affect.

A collection of four studies by Thayer, Newman, and McClain (1994) were conducted to categorise and evaluate the effectiveness of various strategies people ranging in age from 16 to 89 years, employ to self-regulate negative moods. Results of the studies revealed 32 different behaviours people engage in to change a negative mood. The behaviours that were rated as most effective in changing a negative mood included exercise, relaxation, music and distraction activities. Behaviours that were found to be less effective in changing a negative mood were avoidance, eating, watching TV and spending time alone. The authors postulated that the 32 behavioural strategies which emerged from the research could be categorised into six general strategies to change a negative mood. The six general strategies included: active mood management (e.g., relaxation), seeking pleasurable activities and distraction (e.g., humour, music), passive mood management (e.g., watch TV, eat something), social
support, direct tension reduction (e.g., drugs, sex), and withdrawal-avoidance (e.g., try to be alone). Thayer et al. (1994) found that people aged between 16 and 34.5 years tended to use strategies that directly reduced the physiological tension of a negative mood, such as drugs or sex more so than people aged between 34.5 and 89 years.

Parkinson and Totterdell (1999) identified limitations in Thayer et al.’s (1994) structural model of mood regulation, which concerned the way in which items were selected and combined into categories of strategies. Therefore to address these limitations, Parkinson and Totterdell expanded upon Thayer et al.’s (1994) research by comprehensively classifying 162 distinct affect-regulation strategies using a hierarchical cluster technique. Parkinson and Totterdell (1999) collected qualitative and quantitate data from undergraduate students in relation to what strategies they used to improve their feelings with ratings of frequency and perceived efficacy. The authors revealed that two main clusters emerged, one representing cognitive strategies and the other behavioural strategies. Cognitive strategies included *tell myself that it could be worse* and *thinking positively*, whereas behavioural strategies consisted of *listen to radio/records* and *do(ing) something enjoyable*. Behavioural strategies were found to be rated as more effective in changing a negative mood state, compared with cognitive strategies. Therefore, certain strategies intended to change a mood state are perceived to be more effective than others, thus there are likely to be individual differences within the young adult cohort in relation to the types of strategies most frequently used.

Following the research conducted by Parkinson and Totterdell (1999), Larsen (2000) proposed a control theory of mood regulation, in order to emphasise the importance of distinguishing between the terms of emotion, mood and coping, which have been found to be used interchangeably in the emotion and coping literature. Larsen argued that mood tends to be longer in duration than emotion, while emotion tends to be of greater intensity. Larsen also distinguished mood regulation from coping, arguing that mood regulation does not concern the response to an objective life event but the “alteration of ongoing affective state” (Larsen, 2000, p.131). Therefore, examining mood regulation in relation to sleep quality and disturbances is more likely to provide insight into how impaired sleep may relate to the attempt to regulate ongoing affective
states, rather than previous research which has predominantly examined the role of coping in relation to sleep disturbances.

Larsen (2000) likened his model to a negative feedback loop, whereby the goal of mood regulation techniques are to achieve an individual’s desired affective state by reducing the discrepancy between that and their current state. The model is based on the assumption that people actively employ strategies to achieve a desired affective state. Larsen emphasised the importance of examining individual differences in this process given the wide range of variation inherent in the way in which people process emotion-related information, perceive their own affective state and the behaviours they choose to actively engage in, in order to change their affective state. Thus, individuals may differ in the strategies they use for mood regulation, or in the frequency and perceived effectiveness of their chosen mood regulating behaviours (Larsen, 2000). A meta-analysis by Augustine and Hemenover (2009) on the effectiveness of affect regulation strategies found that their effectiveness was moderated by the type of affect regulation strategy used. The types of strategies which were found to be the most effective were reappraisal, exercise and distraction strategies (Augustine & Hemenover, 2009). Thus, examining individual differences in the perceived efficacy of different mood regulation strategies may add to the understanding of why certain strategies are used more frequently than others.

Adding to the existing mood regulation literature by examining individual differences, Stevens and Lane (2001) studied mood regulation strategies used to regulate a bad mood amongst 107 athletes. The athletes completed Thayer’s et al. (1994) mood regulation questionnaire, selecting strategies which they used to regulate anger, confusion, depression, fatigue, tension, and vigour. The findings indicated that the strategies change location, exercise, and listen to music were common strategies athletes reporting using across each mood dimension. There were also self-regulating strategies which were found to be unique to specific mood dimensions such as; try to be alone for anger; analyse the situation for confusion; engage in pleasant activities for depression; and use relaxation techniques for tension. These findings suggest that particular strategies may be used depending on the type of negative mood or emotion being experienced, indicating that some strategies may be more effective than others in
regulating different moods. A limitation of Steven and Lane’s research is the absence of a measure which assessed how effective participants perceived the identified strategies to be. Assessing the efficacy of the mood regulating strategies individuals choose to change their mood states may provide valuable information regarding which strategies are most effective at different ages and may inform the focus of intervention for individuals with impaired mood regulation. This is relevant information for the development of treatment interventions for young adults with symptoms of mental health disorders, such as affective and anxiety disorders.

3.3 Mood Regulation and Young Adults

Young adulthood is identified as a time when individuals develop resources and strategies for mood regulation and stress management (Graham & Streitel, 2010), with sleep being one important psychological resource available (Hamilton et al., 2007; LeBlanc et al., 2007; Talbot et al., 2010). Prevalence figures highlight that young adulthood is also a time of increased risk of developing mental health disorders, compared to other age groups (ABS, 1997; 2007). Therefore, exploring the use of mood regulation strategies amongst young adults adds particular value to the current study as it may provide further understanding regarding the substantial proportion of young people experiencing mental health disorder symptoms in Australia (Australian Bureau of Statistics, 1997; 2007). Understanding the types of strategies young adults use to regulate their mood may also inform treatment interventions, by promoting a focus on psycho-education around mood regulation techniques which enhance sleep quality.

In Thayer et al.’s (1994) evaluation of mood regulation strategies among individuals aged between 16 and 89, younger people, which were defined as younger than the mean age of 34.5 years, were more likely to use strategies that directly reduced the physiological tension of a negative mood, such as drugs or sex. This suggests that age related differences may exist with regard to the choice of mood regulating strategies, with young people prioritising strategies with short term relief over longer term benefits. This is consistent with previous research by Schriber, Grant, and Odlaug (2012) which demonstrated a positive relationship between impulsive behaviours and emotional dysregulation among young adults. Specifically, the greater use of behaviours
such as drinking alcohol, drug use, sex, and smoking, among young adults compared to older adults may be the result of a need to immediately seek out pleasure or relief from emotional distress as well as from a lack of adaptive emotion regulation strategies (Schreiber, Grant, & Odlaug, 2012; Tice et al., 2001). Among individuals with low distress tolerance, the use of adaptive emotion regulation strategies may be at odds with a desire to immediately regulate negative affect, given that such strategies may not provide immediate relief from the distress (Tice et al., 2001).

Whilst coping is generally defined as a distinct construct from mood regulation (Gross, 2001; 2003), similarities exist in the way that coping and mood regulation are measured, with coping strategies overlapping with mood regulation strategies (Eisenbarth, 2012; Thayer et al., 1994). For example, whilst coping is defined as the response to an objective life event and mood regulation relates more to an ongoing affective state (Larsen, 2000), coping like mood regulation is often measured by a similar set of strategies which individuals use in order to manage stressful situations or to reduce the impact of the stressor or mood (Tandon et al., 2013). In the current study, mood regulation as opposed to coping was examined among young adults. Despite this, several studies which have examined coping profiles among young adults are relevant to the current study given their use of a person-oriented approach to examine individual differences in the way in which young people choose strategies to cope with adverse events. These studies will be reviewed as they demonstrate that heterogeneity exists regarding the use of different coping strategies among young adults, which is of interest to the current study in the context of mood regulation.

A study which adds to the understanding of individual differences in the development of mood regulation strategies and stress management was by Eisenbarth (2012) who examined profiles of coping strategies among North American college students and associated relationships with self-reported symptoms of stress, anxiety and depression. Coping profiles were defined as representing the emphasised relative reliance on some coping strategies and not on others, to meet stressful demands. Problem focused strategies included planning and decision making, whereas emotion-focused coping strategies included venting feelings and humour. Avoidance coping included denial and behavioural disengagement, and social support coping included
seeking help, advice, or comfort from others. The findings indicated that two unique coping profiles existed. The first coping profile represented those who reported lower levels of psychological distress and endorsed high problem and emotion focused coping, moderate seeking social support and low avoidance coping. In comparison, the second coping profile represented students who reported higher levels of psychological distress and high avoidance coping, moderate support seeking, together with low levels of problem and emotion focused coping. These findings suggest that there is variation amongst young adults in terms of the ways in which they cope with emotional distress, with a proportion of young adults choosing short term strategies, such as avoidance, which may act to maintain distress in the long term.

Furthermore, Tandon, Dariotis, Tucker, and Sonenstein (2013) applied a profile approach to examining coping strategies, social support and stress exposure amongst a young adult sample of African Americans aged between 16 and 24 years. A cluster analysis was conducted and the results revealed three distinct clusters of young adults based on their use of coping strategies, social support and stress exposure (Tandon et al., 2013). The largest cluster, which comprised almost two thirds of the sample, was characterised by moderate to high adaptive coping strategies and were less likely than the other clusters to report within the range of elevated depressive symptoms. Individuals in this cluster scored higher on active and support seeking coping strategies compared to avoidance and distraction strategies. The other two clusters were similar in size, each comprising 17% of the overall sample. One cluster was characterised by high scores on all coping strategies as well as emotional and financial support and also reported high stress exposure. The remaining cluster reported less use of coping strategies, low emotional and financial support and moderate exposure to stressors. Tandon et al. (2013) interpreted their findings as support for the notion that “one size does not fit all” emphasising that variation exists among young people in terms of the coping strategies they choose to use. Overall, these findings suggest that there is a degree of heterogeneity which exists regarding mood regulation and coping strategies used among young adults and validates the use of a person-oriented approach to explore subgroups within the young adult cohort.
Chapter 4: The Relationship between Sleep, Mood and Health

Sleep disturbances, particularly insomnia and hypersomnia, are commonly associated with psychiatric disorders and poor health (Breslau et al., 1996; LeBlanc et al., 2007; Mayers et al., 2009; Mume, 2010; Parker et al., 2006; Roane & Taylor, 2008; Vandeputte & De Weerd, 2003; Wong et al., 2009). Researchers have consistently demonstrated that people suffering from sleep disorders are more likely to report greater stress, depression, anxiety and alcohol use, in comparison to those reporting satisfying sleep (e.g. Cho et al., 2008; Ford & Kamerow, 1989; Gregory et al., 2008; Le Blanc et al., 2006; Parker et al., 2006; Roane & Taylor, 2008; Taylor et al., 2005). In addition, individuals reporting sleep disturbances have also been found to be more likely to report numerous health conditions such as chronic pain, gastrointestinal problems, high blood pressure, heart disease and breathing problems in comparison to individuals reporting no sleep disturbance (Taylor et al., 2007) The relationship between sleep, mood and health has prompted researchers to examine the nature of the relationship and has sparked debate regarding causation (Taylor et al., 2005; Turek, 2005; Roth, 2009).

Sleep disturbances have long been conceptualised as a consequence of mood disorders, however research over the last decade supports a bi-directional relationship between sleep and mood suggesting that sleep disturbances can also precipitate mood disturbances (Isaac & Greenwood, 2011; Morawetz, 2000; Taylor et al., 2005; Turek, 2005; Roth, 2009). Despite the support for a bi-directional relationship between sleep and mood, limited research has examined this relationship among young adults experiencing sleep disturbances. In view of the high prevalence of mental disorders among Australian young adults (ABS, 2007; Kuwabara et al., 2007; Jorm & Butterworth, 2006; McCloughen et al., 2012; Yap et al., 2011; 2013), it seems young adults are an understudied cohort in the sleep literature.

In this chapter, the literature supporting a positive relationship between sleep disorders and mood disorders is reviewed. The focus of the review is on the relationship between sleep disorders, depression, anxiety and substance use. Specifically, the relationship between sleep and mood disorders will be examined across clinical and non-clinical populations to investigate whether the relationship between subthreshold
compared to clinical sleep and mood disturbances differs, as well as varying across
different age groups. In addition, the focus of the review will be on the application of a
person-oriented approach to sleep disturbances. Further, the relationship between sleep
and physical health is briefly reviewed, given the importance of accounting for the
relationship between physical health problems and associated mental health symptoms.

4.1 The Relationship between Sleep and Mood Disturbances

Over the past decade, a vast amount of research attention has been directed
towards understanding the direction of causation in the relationship between sleep and
mood disturbances (Fong & Wing, 2007; Ford & Cooper-Patrick, 2001; Ford &
Kamerow, 1989; Roth, 2009; Taylor et al., 2005; Turek, 2005). As a result of this
research, researchers have argued that a bi-directional relationship exists between sleep
and mood, whereby mood disturbances can precipitate sleep disturbances and vice
versa, sleep disturbances can precipitate mood disturbances (Breslau et al., 1996; Ford
& Kamerow, 1989; Roth, 2009). The idea that a bi-directional relationship exists
between sleep and mood represents a shift in the conceptualisation of the relationship
from predominantly viewing sleep disturbances as secondary symptoms of a mood
disturbance (Roth, 2009).

For some time it has been well documented, and accepted in clinical practice,
that mental health disorders cause disturbances to sleep (e.g. Breslau et al., 1996; Ford
& Kamerow, 1989; Harvey, 2011, Staner, 2010). This is particularly evident when
examining the diagnostic criteria across a range of mental health disorders. Amongst a
range of mood and anxiety disorders, sleep disturbance is a criterion required to meet
the diagnosis (APA, 2000). For example, a criterion in the DSM-IV-TR for a diagnosis
of a depressive episode is the experience of insomnia or hypersomnia, nearly every day
for a two week period (APA, 2000). Similarly, reports of difficulty falling asleep,
staying asleep and early morning awakening are common sleep disturbances reported
among individuals with depression (Doghramji, 2006; Isaac & Greenwood, 2011; Roth,
2009; Sateia & Nowell, 2004; Vandeputte & deWeerd, 2003). In addition, a substantial
proportion of individuals with depression also report hypersomnia symptoms
(Monтеleone, Martiadia, & Maj, 2011; Mume, 2010; Parker et al., 2006). Moreover, a
criterion in the DSM-IV-TR for Post-Traumatic Stress Disorder refers to hyper-arousal, manifested as difficulty falling or staying asleep (APA, 2000). Furthermore, the diagnostic criteria for Generalised Anxiety Disorder includes sleep disturbance, specifically difficulty falling or staying asleep, or restless unsatisfying sleep as well as feeling easily fatigued (APA, 2000). It is evident that across several mood and anxiety disorders documented in the DSM-IV-TR, sleep disturbances are identified as a symptom or criterion required to meet the diagnostic criteria of certain primary mental health disorders.

The overlap in symptomatology across mood, anxiety and sleep disorders is argued to represent an overlap in the underlying pathophysiology of neural circuits and neurobiologic mechanisms (Ressler & Nemeroff, 2000). Norepinephrine and serotonin are neurotransmitters which play a role in regulating homeostatic drives and behavioural activity including sleep, sex and mood (Nakamaru-Ogiso et al., 2012) and dysregulation of these neurotransmitters contributes to disorders of sleep, mood, and anxiety (Ressler & Nemeroff, 2000). Sleep EEG abnormalities associated with depressive disorders include an increase in the amount of REM sleep and a decrease in REM onset latency (Armitage, 2007). Treatment responses which target the activity of these neurotransmitters, such as antidepressants which block the reuptake of serotonin thereby increasing the amount of serotonin available in the synaptic cleft or inhibiting metabolism, have been found to alter sleep architecture in an opposing direction to the sleep EEG abnormalities associated with depression (Wilson & Argyropoulos, 2005). Specifically, antidepressants effect REM sleep by reducing the amount and increasing the onset latency in both healthy volunteers and patients diagnosed with depression (Wilson & Argyropoulos, 2005). Therefore, at a neurobiological level sleep and mood are governed by overlapping neural circuits which suggest an interdependent, bi-directional relationship exists.

In order to untangle the complexity in determining the direction of causation between sleep and mood disturbances which often present concurrently, attention needs to be paid to the onset, course and fluctuation of sleep disturbance symptoms (Roth, 2009). In the following section several key longitudinal studies will be reviewed,
whereby researchers have examined the onset, prevalence and incidence of sleep disturbances, mood disturbances and substance use.

4.2 The Relationship between Sleep Disturbances, Depression, Anxiety and Substance Use

Longitudinal research has been undertaken in an effort to understand the complex nature of the association between sleep and mood disturbances. Toward the end of the twentieth century, Ford and Kamerow (1989) conducted an epidemiological study into the prevalence of sleep disturbances and psychiatric disorders. As part of the National Institute of Mental Health Epidemiologic Catchment Area study between 1981 and 1985, Ford and Kamerow (1989) obtained responses from a community sample comprising 7594 adults in relation to sleep complaints, specifically complaints of insomnia and hypersomnia, as well as information about psychiatric symptoms using the Diagnostic Interview Schedule (a structured interview based on the DSM). The community sample was administered the questionnaire at baseline and then again one year later. The prevalence figures among the community sample were 10.2% for insomnia and 3.2% for hypersomnia at the baseline interview. Reports of insomnia at both baseline and one year later, were positively associated with age, however reports of hypersomnia were negatively associated with age. Participants younger than 26 years of age, who had never been married and reported being unemployed were more likely to report symptoms of hypersomnia than those aged over 26. In contrast, adults who were female, divorced or separated and unemployed were more likely to report insomnia type symptoms than males, married people and those who were employed. The findings indicated that 40% of those who reported insomnia and 46.5% of those who reported hypersomnia, also reported having a psychiatric disorder. In comparison, only 16.5% of those who reported no sleep complaints reported having a psychiatric disorder. These findings highlight the comorbid relationship between sleep and mood disturbances.

The longitudinal analysis of the course of sleep complaints and psychiatric disorders indicated that insomnia was most strongly positively associated with major depression, followed by anxiety disorders and alcohol abuse. The incidence of depressive disorders was greater among people who had reported insomnia symptoms
either at the first interview, the second interview or both in comparison to those that had not reported experiencing insomnia at any interview. For those whose sleep complaint had resolved by the second interview, the incidence of new depressive disorders was much lower than those whose sleep complaint had not. The relationship was similar between hypersomnia and major depression, with the risk of incidence of depression lower among those that had resolved their sleep complaint by the second interview. Reports of alcohol and drug abuse disorders were also greater among people experiencing insomnia symptoms compared to hypersomnia. The findings indicated the prevalence of psychiatric disorders, particularly anxiety and depressive disorders, was significantly higher among those with sleep disturbances. Interestingly, the resolution of sleep disturbances a year later was associated with decreased incidence of new psychiatric disorders. An important finding in this research is that the resolution of sleep complaints, namely insomnia and hypersomnia, was found to be associated with lower incidence of new psychiatric disorders one year later. This highlights that to target the prevention of psychiatric disorders such as anxiety and depression, it may be necessary to first target the prevention of sleep disturbances.

Breslau, Roth, Rosenthal and Andreski (1996) expanded upon Ford and Kamerow’s (1989) research by investigating insomnia and hypersomnia in relation to whether each sleep disturbance was associated with an increased lifetime prevalence of psychiatric disorders. Of particular interest was whether these sleep disturbances were associated with an increased risk for the first onset of major depression, anxiety disorder and substance use disorder. Breslau et al. (1996) randomly selected 1200 members of a U.S health maintenance organisation between the ages of 21 and 30 years to complete a baseline interview which assessed each participant’s history of psychiatric disorders and asked questions regarding the occurrence of hypersomnia and insomnia. Breslau et al. (1996) argued their sample avoided selection bias as it was comprised of individuals with medical insurance, rather than individuals seeking medical assistance. However, it is possible that their sample was comprised of individuals which required medical insurance for pre-existing health conditions, which may have influenced the findings. For example, a review on the physical health and well-being of young adults with a mental illness conducted by McCloughen, Foster, Huws-Thomas, and Delgado (2012)
found that participants with underlying physical and mental health comorbidities were more likely to access health care. Individuals accessing health care more frequently may be more likely to invest in health insurance memberships. Follow up interviews were conducted three and a half years and five and a half years later with 97% retention of the original sample. The findings revealed that individuals with a reported history of either insomnia or hypersomnia had an increased prevalence of major depression, anxiety disorders and substance use disorders. Those reporting both insomnia and hypersomnia had a higher prevalence of psychiatric disorders in comparison to those reporting only one sleep disturbance. When controlling for a previous history of depressive symptoms, it was found that those with a prior history of insomnia at baseline, had a risk two times greater of developing major depression than someone without a prior history. These findings provide support for a positive, directional relationship between sleep disturbances and mood disorders amongst a young adult sample. This study also highlights that those reporting more than one sleep disturbance are at increased risk of developing subsequent psychiatric disorders. More recent research by Fong and Wing (2007) was conducted to investigate the diagnostic stability of insomnia and its relationship to other psychiatric disorders. Among a sample of 53 psychiatric outpatients in Hong Kong who suffered from chronic primary insomnia, 17% \((n=9)\) went on to develop subsequent mood, anxiety and somatoform disorders. Fong and Wing (2007) concluded that primary insomnia represents a risk factor or prodromal period for new-onset mood and anxiety disorders.

Several Australian studies have also provided evidence to support the conceptualisation of a directional relationship between sleep and mood disturbances (e.g., Isaac & Greenwood, 2011; Morawetz, 2000). A study conducted by Isaac and Greenwood (2011) demonstrated that treating sleep disturbances amongst individuals with comorbid sleep and mood disturbance, not only resolved the sleep disturbance but also significantly reduced the mood disturbance symptoms (Isaac & Greenwood, 2011). The sample comprised 379 participants who reported concerns about their sleep and volunteered to take part in an intervention for insomnia. Participants ranged in age from 22 to 87 years and reported both insomnia and depressive symptoms at the time of the study. The cognitive behavioural treatment intervention was delivered in three different
formats, one group received a self-help manual, one group received a therapist-led treatment and one group received both a self-help manual and telephone support from a therapist. As the results did not find any differences between the three treatment types in terms of treatment efficacy, the results from the three groups were combined. The findings indicate that participants’ rating of their sleep quality had significantly improved and depression scores were significantly reduced following the completion of the treatment intervention. These findings provide evidence in an Australian context to suggest that depression can occur secondary to insomnia, therefore indicating sleep disturbances may precipitate symptoms of mood disturbance.

Findings of past epidemiological research lend support for a positive, directional relationship between sleep and mood disorders. However, support of a positive directional relationship between sleep and mood has largely been found amongst clinical populations which casts doubt upon the nature of the relationship in general, suggesting it is a reflection of a more powerful association, than naturally exists (Ford & Cooper-Patrick, 2001; Ohayon et al., 2012). The doubt surrounding the directional relationship between sleep and mood has led to further research, with several researchers exploring the relationship between sleep and mood disturbances amongst non-clinical populations in an effort to provide data which is not affected by a powerful clinical association (Ramsawh et al., 2009; Taylor et al., 2005). Prevalence figures of diagnosable primary sleep disorders in the general population are relatively low; however the prevalence of subthreshold symptoms is quite high. The high proportion of sleep related complaints among non-clinical populations emphasises the importance of examining sleep disturbances among non-clinical samples (Ohayon, 1997).

Taylor et al. (2005) added to the knowledge of previous epidemiological studies of insomnia by having participants from a non-clinical population complete sleep diaries for 14 consecutive nights. A community based sample of 772 participants, ranging in age from 20 to 89 years completed the sleep diaries along with self-report measures of anxiety and depression as well as potential confounding variables such as health and demographic variables. Data from the diaries were analysed to calculate the variables of sleep onset latency, the average number of wakenings, average wake time after sleep onset, average total sleep time and average sleep quality rating. Specifically,
the authors collected demographic information as well as information related to sleep and medical disorders to control for the potential confounding effects of previous diagnoses. After controlling for these effects, analyses revealed that individuals with insomnia had significantly higher depression and anxiety levels in comparison to those without insomnia. Indeed, the more frequent the insomnia, the higher the depression and anxiety levels. Whilst the direction of causation was not implied given the cross-sectional nature of the study, the authors indicated support for the idea that a reciprocal relationship exists between insomnia and disorders of depression or anxiety. The findings of the study highlight an apparent positive association between sleep disturbances and mood disturbances amongst a sample from the general population, suggesting support for the idea that the relationship between sleep and mood is not limited to clinical populations.

Furthermore, a study by Ramsawh et al. (2009) focuses on the relationship between different anxiety disorders and sleep quality, in a community sample. The researchers used data from the German Health Survey, whereby the sample comprised 4181 individuals aged between 18 and 79 years from the general population. To assess sleep quality, the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1988) was used which measures seven different domains of sleep quality. The findings indicated a moderate positive association between anxiety disorders and poor sleep quality, with Generalised Anxiety Disorder and Social Phobia having the strongest relationship with poor sleep quality. Those with anxiety disorders were significantly more likely to report being a poor sleeper than those reporting no anxiety disorder. Several of the seven different domains of sleep quality on the PSQI were found to be positively associated with anxiety disorders, namely daytime dysfunction which measures excessive daytime sleepiness, and sleep disturbance which measures insomnia type symptoms, sleep apnoea type symptoms as well as other general disturbances such as temperature and pain. The sleep latency subscale was also positively associated with most of the anxiety disorders, with the exception of obsessive compulsive disorder. These findings suggest that various aspects of sleep quality relate to anxiety disorders in different ways. Therefore, further examination of the unique associations and patterns in
symptomatology between different sleep disturbances, components of sleep quality and mental health disorders is warranted.

Whilst the majority of research has focused on the nature of the relationship between insomnia, anxiety and depression, few studies have explored the relationship between hypersomnia, anxiety and depression (Ramsawh et al., 2009). Thus, knowledge regarding the relationship between hypersomnia and mental health disorders is limited. However, a predominant symptom of hypersomnia, excessive daytime sleepiness, has been found to be positively associated with depression in several studies yet the direction of this relationship is unclear (Mume, 2010; Ohayon, 2008; Ramsawh et al., 2009). Therefore, further research is needed to establish whether a directional relationship exists between hypersomnia and depression.

Further research was conducted by Mayers et al. (2009), who investigated the relationship between sleep, depression and anxiety in a non-clinical sample, focusing on whether a differential relationship existed between different components of sleep quality and mental health symptoms. Specifically, Mayers et al. (2009) focused on exploring the contribution of anxiety and depression to perceptions of sleep timing and sleep satisfaction. The findings indicate that participants reporting poorer perceived sleep satisfaction were more likely to also report symptoms of depression, than anxiety than participants who reported greater sleep satisfaction. However, participants reporting poorer sleep timing perceptions were more likely to report higher anxiety and older age, but not depression in comparison to participants reporting better sleep timing perceptions. Therefore, given the findings that depression and anxiety relate to aspects of subjective sleep quality in different ways, an alternative approach is needed to explore the profile of sleep and mood correlates. Developing an understanding of the profile of sleep disturbances and associated mental and physical health symptoms may be useful for guiding treatment interventions which are complicated by numerous symptoms. In summary, an increasing body of research is providing support for a bi-directional relationship between sleep and mood disturbances, which lends itself to a shift in the conceptualisation of sleep disturbances being secondary to mood disturbances. Therefore, sleep disturbances are recognised to be potential risk factors for the subsequent onset of mood disorders. Moreover, research using non-clinical samples
has demonstrated findings which support a directional relationship between sleep and mood symptoms in the young adult cohort. The relationship between sleep and mood symptoms has typically been demonstrated using a variable-oriented approach, whereby associations between variables are examined. Despite the value of the variable-oriented approach in facilitating an understanding of the average effect of one variable with another, the person-oriented approach facilitates an exploration of patterns and profiles among groups of individuals (Laursen & Hoff, 2006). The following section will review several studies which have utilised a person-oriented approach in the exploration of sleep disturbances.

4.3 A Person-Oriented Approach to Exploring Sleep Disturbances

The person-oriented approach differs from the variable-oriented approach which uses statistical techniques such as correlations and regressions, to explore and describe associations between variables. In contrast, the person-oriented approach uses techniques such as profile and cluster analysis to explore patterns and profiles among groups of individuals (Laursen & Hoff, 2006). The person-oriented approach is also used to identify sub-groups of individuals with specific combinations of comorbid conditions (Newcomer, Steiner, & Bayliss, 2011). The benefit of applying a person-oriented approach to the examination of sleep disturbances is that it can provide a more detailed and comprehensive description of the profile of individuals, compared to that of a variable-oriented approach (Le Blanc et al., 2007). Despite this, there is limited research in the sleep literature which has utilised a person-oriented approach.

One of the first studies to apply a profile approach to the exploration of sleep disturbances was conducted by Edinger, Stout, and Hoelscher (1988). These researchers examined whether personality subgroups existed among a clinical sample of insomniacs. In their findings they acknowledged two types of insomniacs, type one insomniacs were younger in age and clinically presented as anxious, ruminative and cognitively disorganised, compared to type two insomniacs who were older in age, less educated and less anxious yet were also cognitively disorganised. Edinger et al. (1988) explained the findings as indicating the personality profile for both groups represented underlying internalisation of affect, in keeping with the idea that those with sleep
disturbances may employ specific mood regulation techniques. Unexpectedly, they also found that the older, less educated insomniacs benefited from treatment more so than the younger, more educated insomniacs. This finding suggests sleep disturbances among younger people may be related to an internalisation of affect or alternatively the use of mood regulation strategies which are not effective. Edinger et al. (1988) also proposed that type one insomniacs may be more physiologically aroused, indicating a relatively weaker physiological sleep system and a biological disposition to poorer sleep. Evidently, applying a profile approach to the exploration of sleep disturbances led to broader implications regarding the use of different treatment approaches, tailored to specific subgroups. Thus, the use of a person-oriented approach to the exploration of sleep disturbances may facilitate the development of treatment which is tailored toward individuals and the unique symptoms of differing severity and their associated health profiles.

A study by Edinger et al. (2000) was conducted to compare markers of subjectively reported insomnia to objective markers of insomnia to assess how symptoms of depression and anxiety related to perceived sleep disturbance. A group of 64 men and women who reported insomnia complaints were compared to a group of 61 (age and gender matched) normal sleepers on subjective measures that assess symptoms and behaviours associated with insomnia, as well as depression, anxiety and dysfunctional beliefs about sleep. The objective measure of sleep involved six nights of polysomnography in a sleep laboratory for each participant. Results indicated four subgroups existed, namely, those who subjectively reported insomnia but seemingly slept well, objective normal sleepers, those that subjectively reported normal sleep, and finally those identified objectively as experiencing insomnia. The study demonstrated distinct groups of adults based on their classification into different profiles of insomnia experience, indicating the variation in their reported sleep symptoms, thus reflecting the limitations of the categorical approach to classification and the value of using a person-oriented approach which captures a range of symptom presentations.

Another study in the sleep literature which used a profile approach was conducted by Le Blan et al. (2007) who examined a range of health related quality of life factors associated with three distinct groups of sleepers (Le Blan et al., 2007).
Participants comprised 953 adults between the ages of 18 and 83. Of the three distinct groups of sleepers, the first group met criteria for insomnia syndrome, the second reported insomnia symptoms as opposed to syndrome, and the third group were classified as good sleepers. Those in insomnia syndrome and insomnia symptoms groups reported higher anxiety, depression and neuroticism in comparison to the good sleepers group. Similarly, participants classified in the insomnia syndrome and symptoms groups also reported greater perceived stress, arousability and use of emotion-focused coping than good sleepers. These findings indicate that among the subgroups of people with varying sleep profiles, there were also differences between the groups in terms of the type of mood regulation strategies they engage in. These findings suggest that the types of mood regulation strategies people use may be related to their experience of sleep disturbance symptoms.

Joosten et al. (2012) applied a cluster analysis technique to the exploration of obstructive sleep apnoea phenotypes amongst a sample of Australian patients from a tertiary referral sleep centre. The researchers’ rationale for conducting the cluster analysis was that the current classification system for obstructive sleep apnoea is based on a severity model which does not facilitate effective diagnosis, given the heterogeneity among individuals experiencing mild to moderate sleep apnoea symptoms. The findings of the cluster analysis revealed six distinct profiles based on sleep parameters related to obstructive sleep apnoea and demographic characteristics. These findings highlighted the presence of subtypes within already established disease classification categories as expected by Joosten et al. (2012). This indicates that the current categorical classification of sleep disorders does not adequately recognise the degree of heterogeneity and individual differences (Joosten et al., 2012). Thus, the use of a person-oriented approach facilitates the recognition of mixed symptomatology which is not accurately acknowledged by the DSM-IV-TR or the ICSD. Furthermore, Joosten et al.’s (2012) findings indicate that in order to identify subtypes which may exist in pre-established categories of sleep disorders, an examination of a variety of sleep parameters is needed.

In summary, the use of a person-oriented approach to explore subgroups within the young adult cohort is of importance given the large degree of heterogeneity evident
across the mood regulation and coping strategies used by young adults. The importance of exploring the relationship between sleep quality, sleep disturbances, and self-reported physical health has been documented in a variety of research studies which have examined the relationship between sleep disturbances and mental health and found that physical health explains a substantial portion of the relationship (Taylor et al., 2008). Therefore, an exploration of the relationship between sleep quality, sleep disturbances, and self-reported physical health is of interest to the current study. In the following section, the relationship between short sleep duration, sleep disturbances and physical health will be examined, with a particular focus on self-reported health and pain.

4.4 Sleep and Physical Health

In addition to the important role sleep plays in maintaining emotional health, sleep has also been implicated in maintaining physical health (Affleck et al., 1996; Imeri & Opp, 2009; Millman, 2005). A wide array of research has been conducted to examine the relationship between sleep and physical health. In particular, various sleep disturbances have been positively associated with increased mortality as well as a range of physical health problems including obesity, diabetes, cardiovascular disease, impaired immune system and chronic pain (Affleck et al., 1996; Bixler, 2009; Chiu et al., 2005; Imeri & Opp, 2009). However, limited research attention has been dedicated to exploring the association between sleep and health among young adults (De Visser, Rissel, Smith, & Richters, 2006). It seems that young Australian adults in comparison to older age groups are a neglected cohort in relation to the research attention which has been dedicated to sleep disturbances and physical health. This neglect may be due to the low prevalence rates of physical health conditions among young adults compared with older age cohorts.

While the majority of young adults report to be functioning well in relation to their physical health (AIHW, 2011), there are subgroups within the young adult cohort that may not be functioning as well in relation to sleep quality, sleep disturbances and physical health. A study by De Visser, Rissel, Smith and Richters (2006) found that among 19,307 Australians, those aged between 16 and 24 years had health profiles consistent with greater health risk behaviour than older adults. The health risk
behaviours De Visser et al. (2006) examined included alcohol use, injected drug use and safe sex practices. Across alcohol use and safe sex practices there were no differences in relation to the proportion of men and women who engaged in health risk behaviour, with the exception being that men were more likely than women to have engaged in injected drug use in the six months prior to the study (De Visser et al., 2006). These findings suggest that while previous research has consistently identified health risk behaviour to be higher among men compared to women, the gender gap may be narrowing with men and women equally as likely to engage in risky health behaviour (De Visser et al., 2006). Other socio-demographic variables which were differentially correlated to health risk behaviour included non-English speaking background and sexual identity, with young adults from non-English speaking backgrounds and young adults identifying as heterosexual less likely to engage in risky health behaviour such as smoking, drinking alcohol and using drugs (De Visser et al., 2006). In addition, students tended to report less risk behaviour than non-students and individuals who were unemployed reported more risk behaviour than those employed or studying. However, further research is needed to explore health risk behaviour within subcultures of students, as De Visser et al.’s (2006) findings reflected that male students were significantly less likely to smoke than non-students, but were equally as likely to binge drink as non-students. This study provides evidence for the existence of differences within the young adult cohort regarding their health risk behaviour.

Therefore, given that young adults are at higher risk of engaging in health risk behaviour, an investigation of the perceived physical health functioning of young adults is warranted. The way in which young adults perceive their physical health may be related to the health risk behaviours they engage in, which may in turn relate to their experience of sleep disturbances.

**Sleep duration and health risks.** The health consequences related to the increased prevalence of short sleep duration and long sleep duration have been examined in the literature. A systematic review by Gallicchio and Kalesan (2008) of 23 studies in PubMed, revealed that across males and females, short and long sleep duration were associated with an increased risk of all-cause mortality in comparison to medium sleepers, which was defined as seven to eight hours of sleep per night.
(Gallicchio & Kalesan, 2008). Similarly, data from a study in Japan showed that long sleep duration was associated with increased mortality risk due to increased cardiovascular disease, ischaemic heart disease, stroke and other causes in comparison to short sleep duration which was associated with increased risk of ischaemic heart disease mortality (Kakizaki et al., 2012). Short sleep duration has also been implicated in the obesity epidemic (Magee, Huang, Iverson, & Caputi, 2009) as research findings suggest that short sleep duration interferes with hormonal regulation of body weight (Magee et al., 2009). Thus, there are a wide range of health related consequences associated with too little or too much sleep.

Further support for the idea that both short and long sleep duration are associated with health risks is provided by Kripte, Garfinkel, Wingard and Marlers (2002). Kripte et al. (2002) examined data from The American Cancer Society’s study on cancer prevention in 1982. The study was conducted with a sample of one million American adults to investigate how sleep duration contributed to mortality rates. The lowest mortality rate was found among those who reported their average night’s sleep duration as typically seven hours (Kripke et al., 2002). Interestingly, those who reported typically sleeping for eight hours or more per night had a greater mortality risk than those reporting less than eight hours sleep per night. However, those reporting less than three and a half hours of sleep for women and four and a half hours for men were at similar higher risk of mortality to those reporting more than eight hours of sleep per night. The association between longer sleep duration and increased mortality was unable to be explained by sleep disordered breathing, obesity or depression. However, the hazard ratios for cerebrovascular deaths were higher than the hazard ratios for all-cause mortality, among men and women reporting 8, 9, or 10 hours of sleep. Despite this, causality is unable to be assumed and it is possible that health related conditions or medications which were unaccounted for, may have contributed to the need for greater sleep duration. Therefore, whilst these findings provide support for the idea that long sleep duration is associated with greater mortality risk, the reasons for this are unknown. It remains unclear whether long sleep duration may also contribute to increased health risks and if these risks can be reduced by limiting sleep time.
In an Australian context, Magee et al. (2011) examined the association between sleep duration and self-rated health among 63,408 Australian adults aged between 45 and 95 years. Interestingly, among adults aged 45 to 74 years, short and long sleep duration were positively associated with poor self-rated health. However, there was no association between sleep duration and self-rated health among adults aged 75 to 95 years, which may reflect expected age-related deterioration in health and sleep duration, independent of each other. These findings highlight differences across age exist in relation to sleep and health, with short and long sleep duration potentially indicating a health concern for young people, yet the mechanisms which underlie the bi-directional relationship between sleep duration and health are unknown (Magee et al., 2011). This finding warrants further research examining a wider age range of participants, including distinct cohorts such as young adults.

In addition to the association between sleep duration and health risks, more specifically the relationship between sleep disturbances and health has also been examined in the literature. In a longitudinal examination of the effect of sleep disturbance on mortality rates among 16,989 French nationals, Rod and colleagues (2010) found that sleep disturbances were associated with higher mortality rates among men, in particular younger men. Women who reported more disturbances to their sleep were not at a greater risk of a premature death. Despite this, both men and women who reported sleep disturbances were at higher risk of developing diabetes and hypertension. This suggests that men and women may differ in terms of the relationship between sleep disturbances and health risk in some regards such as mortality, but not others such as diabetes and hypertension. This finding may also reflect that men and women differ in terms of the treatment seeking behaviours or coping responses they engage in, given that higher suicide rates were found amongst men in this longitudinal study. For example, previous research has found that mood regulation is an important preventative factor in relation to the development of clinical depression, with the inability to regulate dysphoric affect highlighted as a fundamental feature of clinical depression (Kovacs, Joormann, & Gotlib, 2008). Thus, Rod et al.’s (2010) findings may reflect differences between men and women in terms of their ability to regulate dysphoric affect which
indicates the importance of accounting for confounding variables such as mood regulation.

**Sleep and pain.** The experience of pain has been found to affect sleep quality (Affleck et al., 1996; Chiu et al., 2005). Several studies have demonstrated that for people experiencing pain, particularly chronic pain, the quality of sleep is compromised (Affleck et al., 1996; Chiu et al., 2005; Graham & Streitel, 2010). However, limited research attention has been paid to the relationship between sleep and pain amongst young adults. A contribution toward addressing the gap in the literature was made by Graham and Streitel (2010) who examined self-reported sleep quality and pain among 362 college students. The findings indicated that among young adults reporting chronic pain, there was an association between pain severity and sleep quality, with greater pain severity associated with poorer sleep quality. Graham and Streitel (2010) interpreted their findings through the lens of sleep being a psychological resource, suggesting that when sleep is disturbed the resources available for responding to stress may be limited. Thus, sleep plays an important role in managing stress, such as chronic pain.

Several researchers have found support for a bi-directional relationship between sleep and pain (Affleck et al., 1996; Chiu et al., 2005). Research conducted by Affleck et al. (1996) investigated the effect sleep quality has on pain and attention to pain. In addition, the effect that pain and attention to pain has on sleep quality was also explored. Affleck et al. analysed self-reported sleep quality, pain intensity and attention to pain among 50 women with Fibromyalgia Syndrome over a 30 day period. The findings indicated a significant bi-directional relationship between pain attention and sleep quality, suggesting that poorer sleepers reported more pain the following day and those who reported greater pain had poorer sleep. This finding was not explained by changes in pain intensity, lending support to the idea that if pain affects the quality of sleep, sleep deprivation may also lower pain thresholds (“Waking”, 2009). Further support for the idea that sleep deprivation may lower pain thresholds is reflected in the findings of a study by Chiu et al (2005). These researchers found that among a sample of 424 participants from the general population, depression and sleep disturbances were independently related to low pain threshold, indicating that sleep may act as a mechanism to manage pain. Therefore, taken together these findings provide support for
the notion that when uncompromised, sleep may function as a pain management resource.

4.5 Summary

The research reviewed in this section demonstrates that anxiety and depression are differentially related to sleep disturbances, in particular insomnia and hypersomnia. For example, the non-clinical data demonstrates that a positive association between sleep disturbances and the onset of mental health symptoms exists in the general population. Despite these research findings, there is limited research looking at the sleep quality of young adults and the relationship with the high prevalence of mental health disorders among this cohort (Taylor et al., 2008). Furthermore, research regarding the relationship between sleep, self-rated health and pain amongst young adults is lacking in Australia, despite international research which indicates that sleep health among young people is an important area of health research (Gradisar et al., 2011). Sleep plays an important role in maintaining physical health; with short and long sleep duration as well as sleep disturbances reported to be positively associated with increased health risks including obesity, cardiovascular disease, diabetes and overall poor self-rated health (Affleck et al., 1996; Bixler, 2009; Chiu et al., 2005; Imeri & Opp, 2009). In addition, research indicates that sleep may play an important role in managing pain (Chiu et al., 2005; Graham & Streitel, 2010). An exploration of the quality of young adults sleep is needed to add to existing knowledge regarding the emotional and physical health of young adults. Thus, an aim of the current thesis is to address the gap in the literature by exploring the relationship between sleep quality, sleep disturbances and self-reported depression, anxiety, stress, alcohol use, illicit substance use as well as self-reported physical functioning and pain among Australian young adults. Chapter 5 will outline the aims and hypotheses of the current study.

Chapter 5: Aims and Hypotheses of the Current Study

The primary aim of the present study is to explore subthreshold symptoms of sleep disturbances among young Australian adults and their relationship with symptoms
of, depression, anxiety, stress, substance use, physical health symptoms and mood regulation strategies. It is of particular interest to examine whether psychological symptoms of depression, anxiety and stress, relate differently to each of the four sleep disturbances which were measured in this study, including insomnia, hypersomnia, sleep apnoea and parasomnias. In addition, a further aim was to identify distinct clusters of young adults based on their self-reported symptom of sleep disturbances and explore differences between clusters on specific emotional and physical health correlates.

Specifically, clusters that emerge will be compared on symptoms of depression, anxiety, stress, substance use, physical health, pain and the strategies they utilise to regulate their mood from a negative to positive state. Of a particular interest is to explore whether there is a cluster of young adults who report greater symptoms of sleep disturbances and have a negative association with the above mentioned health related variables. It is hoped that the findings of the current study will provide clinically relevant information regarding the dimensional nature of sleep disturbed symptoms reported by young adults and their emotional and physical health correlates in Australia. This information may facilitate increased recognition and treatment of sleep disturbances which do not meet diagnostic criteria and in turn, therefore may provide an opportunity for the early prevention of mental health disorders amongst young people.

The design of the current study involved complementary variable and person-oriented approaches. The aim of the variable-oriented approach was to examine the value of sleep variables in predicting self-reported depression, anxiety, stress, alcohol use and illicit substance use. A further aim of this approach was to investigate whether the addition of health related variables and mood regulating strategies improved the prediction of depression, anxiety, stress, alcohol use and illicit substance use, beyond that predicted by sleep-related variables. Previous research has consistently demonstrated a well-established negative relationship between sleep disturbances and physical health, as well as between sleep related variables and coping strategies. In the current study mood regulation was examined in relation to sleep, rather than coping, given that limited research has looked at the relationship between sleep and mood regulation. Mood regulation is defined as an attempt to regulate ongoing affective states (Larsen, 2000), which is in line with the aim of the current study to investigate young
adults experience of symptoms such as depression, anxiety, stress, which are not necessarily in response to a specific stressor. As correlations are expected between sleep related variables, physical health and mood regulation variables, analyses will be adjusted to control for these relationships. This will ensure that any observed effect between sleep related variables and symptoms of depression, anxiety and stress is not an artefact or an effect explained by the relationship with physical health and mood regulation. Furthermore, age and gender will also be controlled for.

In contrast, the aim of the person-oriented approach was to explore if there are common patterns of sleep disturbances that are more likely to be associated with negative health effects. In order to reflect a profile approach to exploring the data and develop sleep profiles, a cluster analysis was conducted. This was followed by an exploration of the clusters and their differential relationship with mood regulation, perceived emotional and physical health and substance use in a young adult sample.

Although the current study was largely of an exploratory nature, several hypotheses were proposed in relation to the variable-oriented approach. Firstly, it was hypothesised that sleep quality and sleep disturbance variables would be differently related to depression, anxiety, stress, alcohol use and illicit substance use. In particular, it was expected that insomnia would be a positive, significant predictor of anxiety and depression and that hypersomnia would be a positive, significant predictor of depression. Further, it was expected that the addition of self-rated health and mood regulating strategies to the hierarchical regression models would reveal a different pattern of positive and negative significant predictors across depression, anxiety, stress, alcohol use and illicit substance use. Specifically, it is hypothesised a unique combination of sleep, health and mood related variables will significantly predict each of depression, anxiety, stress, alcohol and illicit substance use. Finally, it was hypothesised that physical functioning, pain and role limitations due to health, will be negatively associated with depression, anxiety, stress, alcohol use and illicit substance use, with lower scores on these health variables predicting higher scores in the aforementioned dependent variables. Thus, young adults reporting fewer symptoms of depression, anxiety and stress are expected to report greater perceived physical health, fewer role limitations and fewer symptoms of pain.
Chapter 6: Method

6.1 Participants

Participation in the current study involved the completion of an online questionnaire which was comprised of 50 questions assessing self-reported sleep quality, sleep disorders, the frequency and effectiveness of mood regulation strategies, physical health, substance use and depression, anxiety and stress. Originally, a total of 563 participants accessed the online questionnaire. Of these, 405 completed the majority of the questionnaire, with less than 5% of responses missing for each scale. As such, 158 cases were removed from the dataset due to insufficient completion of the survey, with insufficient completion defined as nil responses to at least one entire scale of the questionnaire. To participate in the study, participants were originally required to be between 18 and 25 years of age. However, given that the emerging adulthood period has been described as extending through the mid to late twenties (Arnett, 2004), participants slightly outside this age range (26 and 27 years) were included in the analysis. Thus, the ages ranged from 18 to 27 years and a further 22 cases were removed as they were outside of the specified age range (18 to 27) for the study. Among the 383 remaining participants, 85.4% reported their country of residence as Australia, 13.1% reported America/North America, 1.3% reported Asia and .3% reported ‘Other’. To facilitate interpretation of the results, a decision was made to only include Australian residents in the study. Consequently, a further 56 participants were removed from the dataset, leaving a total of 327 participants. The demographic characteristics of the final sample \(N = 327\) participants are presented in Table 1 below.
Table 1

*Demographic Characteristics of the Final Sample*

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<td><strong>Highest Level of Education Obtained</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>graduated with a degree</td>
<td>15</td>
<td>4.6</td>
</tr>
<tr>
<td>graduated with a diploma</td>
<td>12</td>
<td>3.7</td>
</tr>
<tr>
<td>commenced a university or TAFE course</td>
<td>113</td>
<td>34.6</td>
</tr>
<tr>
<td>completed secondary education</td>
<td>155</td>
<td>47.4</td>
</tr>
<tr>
<td>completed year 11 or below</td>
<td>2</td>
<td>.6</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time employed</td>
<td>30</td>
<td>9.2</td>
</tr>
<tr>
<td>Part time employed</td>
<td>83</td>
<td>25.4</td>
</tr>
<tr>
<td>Casually employed</td>
<td>127</td>
<td>38.8</td>
</tr>
<tr>
<td>Not currently employed</td>
<td>87</td>
<td>26.6</td>
</tr>
<tr>
<td><strong>Current Student Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time student</td>
<td>271</td>
<td>82.9</td>
</tr>
<tr>
<td>Part time student</td>
<td>31</td>
<td>9.5</td>
</tr>
<tr>
<td>Currently not studying</td>
<td>25</td>
<td>7.6</td>
</tr>
</tbody>
</table>

| Age                      |    |      |
| 18-20                    | 208| 63.6 |
| 21-23                    | 63 | 19.3 |
| 24-27                    | 56 | 17.1 |

*Note. N=327. Sample N’s differ for the variable Education, as 30 participants did not provide their education level.*

As can be seen in Table 1, the majority of the sample was female and studying full time at the time of participation. The sample was fairly well-educated with approximately half having completed secondary education and a substantial proportion having commenced tertiary education. The majority of young adults in the current sample were employed at the time of participation, with a considerable proportion of the
sample casually employed. In regard to current sleep disorders, approximately 2.1% (n=7) reported a sleep disorder: namely, insomnia (n=5), sleep apnoea (n=1) and restless legs syndrome (n=1). After conducting outlier analyses (see p. 93), the decision was made not to remove participants reporting current sleep disorders from the sample.

6.2 Materials

The self-report questionnaire consisted of demographic questions as well as measures of: sleep quality components; sleep disturbance symptoms; mood regulation strategies; alcohol use; illicit substance use; health related symptoms; depression, anxiety and stress symptoms. Demographic questions included age, gender, education level, employment status, student status, country of residence and information relating to pre-existing sleep disorders. Self-report measures of sleep quality, sleep disturbance, mood regulation strategies, substance use, health related symptoms and psychological distress are outlined below. Cronbach’s alpha values for each measure in the current study are presented in Chapter 7. The full questionnaire is attached as Appendix A.

Sleep quality. The Pittsburgh Sleep Quality Index (PSQI) is a self-report questionnaire that measures sleep quality and sleep disturbances over a one month time period (Buysse et al., 1988). The questionnaire comprises 19 self-rated items, which are grouped into seven component scores: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication and subjective daytime dysfunction (there are five additional questions rated by the bed partner or roommate which are not calculated in the scoring of the PSQI. These items were excluded in the current study). Each component is weighted equally on a scale from 0 to 3, with 0 being ‘better’ and 3 being ‘worse’. Each of the seven component scores are then summed to provide an overall sleep quality score which ranges from 0 to 21, with higher scores indicating poorer sleep quality. The aim of the current study was to examine different components of sleep quality and therefore did not use an overall sleep quality score and so did not sum the component scores, but instead looked at six of the component scores individually: sleep quality, sleep latency, sleep duration, sleep disturbances, use of sleeping medication and subjective daytime dysfunction. One component of the PSQI, sleep efficiency, was not used in the current study, as the format of data entered for the
relevant items was not conducive to calculating this component score. Good reliability of the total seven PSQI components has been reported with a Cronbach’s alpha of .83 (Buysse et al., 1988). Whilst Cronbach’s alpha values have not been reported for each of the component scores, they have been reported to be internally consistent (Buysse et al., 1988). The PSQI has been found to discriminate between healthy controls and sleep disordered patients, thereby supporting its validity (Buysse et al., 1988).

**Symptoms of sleep disturbance.** Symptoms of sleep disturbance were measured using the Sleep Disorders Questionnaire (SDQ; Violani et al., 2000; 2004). The SDQ is an 18 item self-report measure that assesses sleep disordered symptoms based on the DSM-IV and ICSD-R criteria, over the past 30 days for insomnia (e.g. “While sleeping do you wake up often or do you remain awake for more than 30 min?”) as well as other sleep disordered symptoms such as hypersomnia (e.g., “Did you have problems staying awake during the day?”), sleep apnoea (e.g., “Have you realized or has someone told you that you stop breathing for a few seconds while you’re sleeping?”) and parasomnias (e.g., “Have there been episodes of sleep walking or of any other unusual behaviour during sleep?”). There are five additional questions regarding current sleeping habits, which were not used in the present study as the questions did not measure symptoms of sleep disorders. In the original scale responses are scored as yes or no answers. However, for the purposes of this study a five-point scale was used in order to measure a range of sleep disturbance symptoms (0=Never, 1=Rarely, 2=Sometimes, 3=Often and 4=Very Often), with higher scores indicating a more frequent experience of sleep disordered symptoms. The SDQ has been found to demonstrate good convergent validity with the PSQI (Violani et al., 2004), indicating it is an accurate measure of sleep disturbances. The modification made in the current study of using a five-point response scale may impact upon the psychometric properties of the SDQ which have been reported in previous research. The psychometric properties of the SDQ in the current study are presented in Table 2 on page 76; refer to this table for detail regarding the scale statistics of the SDQ in this study.

**Mood regulation strategies.** The Self-Regulating Strategies of Mood Questionnaire (Thayer et al., 1994) consists of 29-strategies identified as ways of regulating and managing negative mood. Participants were asked to nominate strategies
from the list of 29 items. In the original scale, the 29 strategies were organised into three categories of behaviours used to regulate a negative mood, namely, Active Mood Management (e.g., Exercise), Passive Mood Management (e.g., Watch TV) and Withdrawal-Avoidance (Use drugs). To confirm the underlying factor structure among an Australian sample, a confirmatory factor analysis of the Self-Regulating Strategies of Mood variables using principal components analysis was conducted by the author (See Appendix D).

Results of the factor analysis indicated that the original factor structure of the scale was not a good fit for the current sample. Therefore, in the present study, 25 strategies (three strategies were removed due to low factor loadings and one strategy was repeated and therefore removed from the original list) were organised into six categories of behaviours used to regulate a negative mood, and were renamed accordingly: Active Cognitive Management, Active Pleasurable Distraction, Active Behavioural Management, Physiological Distraction, Stress Management and Avoidance. In the original scale participants endorsed categorical responses; however, for the purposes of this study two scales were used. The first was a six-point scale measuring the frequency of how often the mood regulating strategy was used (0= Never to 5= Quite often), with higher scores indicating more frequent utilisation of the mood regulating strategy. This was to recognise the mood regulation strategies participants endorse may differ in regard to the frequency of use. The second scale measured participants’ perceived efficacy of the mood regulating strategies. Participants were asked to rate how effective they find each strategy to be in managing a negative mood, on a five-point scale (0= Not Applicable to 4= Very Effective), with higher scores indicating greater perceived efficacy of the mood regulating strategy.

Substance use. Both alcohol use and illicit substance use were measured. Alcohol use was measured using the Alcohol Use Identification Test (AUDIT; World Health Organisation [WHO], 2001). The AUDIT is a 10-item measure that was developed to screen for excessive alcohol use (WHO, 2001). Questions are rated on a response scale ranging from 0 to 4, with scores summed to create a total score. Higher scores indicate greater likelihood of hazardous and harmful drinking (WHO, 2001).
Good reliability and validity of the AUDIT has been reported in a variety of clinical and community samples, worldwide (WHO, 2001).

Illicit substance use was measured using the Severity of Dependence Scale (SDS; Gossop et al., 1995). The SDS is a 5-item scale used to measure the degree of dependence experienced by users of drugs other than alcohol. These items are specifically concerned with difficulty controlling drug use and with preoccupation and anxieties about drug use. Participants are presented with a list of various names of drugs, which include narcotics, hallucinogens, depressants (alcohol excluded) and stimulants. This list is to inform participants of what is meant by the term “drug”. Participants are not asked to state or identify the drug (s) they may have used. Items are rated on a 4-point scale (0= Never/Almost never and 3= Always/nearly always). Question five, “How difficult do you find it to stop or go without?” was rated on a different 4-point scale (0= Not difficult and 3= Impossible). Good reliability and validity of the scale has been reported in various samples of drug users in the Australia and United Kingdom (Gossop et al., 1995).

Health symptoms. The Short Form-36 (SF-36; Ware & Sherbourne, 1992) is a 36 item questionnaire which measures eight concepts: physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to personal or emotional problems, emotional well-being, social functioning, energy/fatigue, and general health perceptions. It also includes a single item which provides an indication of perceived change in health. The 36 items were adapted from a longer measure completed by patients participating in the Medical Outcomes Study (MOS), an observational study of variation in physician practice styles and patient outcomes in different systems of health care delivery (Hays & Shapiro, 1992; Hays, Sherbourne, & Mazel, 1995). Items 23 to 31 were omitted from the current survey as they comprise the subscale designed to measure emotional functioning/energy, which in the current study was measured using an alternative scale which differentiated between symptoms of depression, anxiety and stress. Three of the eight concepts: bodily pain, role limitations due to physical functioning and physical functioning were used in the current survey, as they were of the most interest. Items are scored so that higher scores indicate better
functioning. The Short Form-36 has been found to have high reliability with alpha coefficients ranging from 0.68 to 0.96 (Ramsawh et al., 2009).

**Symptoms of Depression, Anxiety and Stress.** Self-reported symptoms of depression, anxiety and stress were measured by the Depression, Anxiety and Stress scale, short form (DASS 21; Lovibond & Lovibond, 1995). The DASS-21 consists of three 7-item self-report scales taken from the full version of the DASS-42 measuring symptoms of depression, anxiety and stress. Participants respond on a 4-point scale (0= did not apply to me at all and 3= applied to me very much or most of the time) which measures the extent to which each state of depression (e.g. “I couldn’t seem to experience any positive feeling at all”), anxiety (e.g. “I was aware of dryness of my mouth”) and stress (e.g. “I was intolerant of anything that kept me from getting on with what I was doing”) had been experienced over the past week. The possible range of scores is from 0 to 21 for each subscale, with higher scores indicating greater distress. Good reliability of the total scale has been reported with a Cronbach’s alpha of .93 (Henry & Crawford, 2005). Similarly, good reliability has also been reported for each of the DASS-21 scales: .88 for Depression, .82 for Anxiety and .90 for Stress. The current study used the DASS-21 given its advantages of shorter length, cleaner factor structure and it has normative data based on an Australian sample (Crawford et al., 2011; Lovibond & Lovibond, 1995).

**6.3 Procedure**

The project protocol was approved on behalf of Swinburne's Human Research Ethics Committee (SUHREC) by SUHREC Subcommittee (SHESC2) and this approval is attached as Appendix A. The online survey was created using Opinio™ survey software (version 6). Participants were largely recruited through several universities in Melbourne, Australia. Flyers advertising the study were placed around the university which were accessible to both students and staff. The flyer used to advertise the study is attached as Appendix B. The web link for the study was posted onto Blackboard at one of the universities (a learning management system for current university students) as part of the Research Experience Program for first year psychology students. Students were given course credit for completion of the online survey. In addition, a group email
was sent to advertise the study to students within the Life and Social Sciences Faculty of the university.

Participants were also recruited from the social network of the researcher, which created a snowball effect as participants were encouraged to forward the web link to other friends and family members who may be interested in completing the study. In addition to snowball sampling, various research and general interest websites were contacted via email requesting permission to post the questionnaire link on their site. Approval was granted from the Society for Personality and Social Psychology (http://www.spsp.org/student/) and the link to participate in this research was posted onto a discussion board on the website. Participation involved the completion of an anonymous online questionnaire that took approximately 15 to 20 minutes. Informed consent was implied by submission of the completed online questionnaire. The advertising flyer and information sheet are attached as Appendix C.

6.4 Design

Self-report data was used to examine the relationship between sleep disturbances (i.e., insomnia, hypersonmia, parasomnias, and sleep apnoea) and depression, anxiety, stress substance use, mood regulating strategies and physical health symptoms. This design was considered appropriate for the current study given that both complementary variable and person-oriented approaches were able to be used to analyse the data (Mun, Bates, & Vaschillo, 2010). Furthermore, limited research has explored these relationships among an Australian young adult sample using a mixed-method design.

The variable-oriented approach is used to facilitate the description of associations among variables, which facilitates understanding the general or average effect of variables (Laursen & Hoff, 2006). In contrast, the person-oriented approach is used to facilitate the description of differences among individuals regarding how variables are related to each other, which is useful for the exploration of patterns and profiles among groups of individuals (Laursen & Hoff, 2006). While the variable-oriented approach assumes the population is homogenous in regards to the way in which variables influence each other, the person-oriented approach does not make this assumption (Laursen & Hoff, 2006). The person-oriented approach provides the
potential to explore patterns among individuals and it is also used to explore categories of individuals that share patterns among variables that differ between groups (Laursen & Hoff, 2006). Therefore, utilising a mixed method design, employing person-oriented and variable-oriented approaches enabled the exploration of a variety of different aims.

The aim of using the variable-oriented approach in the current study was to explore the value of sleep variables in predicting self-reported depression, anxiety and stress symptoms. A further aim of using this approach was to investigate whether the addition of health related variables and mood regulating strategies improved the prediction of depression, anxiety, stress, and substance use, beyond that predicted by sleep-related variables. In contrast, the aim of using the person-oriented approach in the current study was to explore if there are common patterns of sleep disturbances that are more likely to be associated with detrimental health effects. In order to reflect a pattern approach to exploring the data and develop sleep profiles, cluster analysis was conducted. A brief background on the technique of cluster analysis is provided in the following chapter.

**Chapter 7: Results**

This chapter presents the results of the scale statistics, preliminary analyses and descriptive statistics, followed by the results of the variable-oriented approach and finally, the person-oriented approach. The analyses which comprise the variable-oriented approach include a total of nine hierarchical regressions, while the analyses which comprise the person-oriented approach include a cluster analysis and a series of MANOVAs exploring differences between the clusters. Significance testing was set at the level of $p<.05$, for all analyses.

**7.1 Scale statistics**

Table 2 shows the sample means, standard deviations, ranges of observed scores, ranges of possible scale scores and where applicable, Cronbach’s alphas of all scales used in the current study.
Table 2
Cronbach's alphas, Observed Ranges, and Theoretical Ranges for PSQI, SDQ, Self-Regulating Strategies of Mood Questionnaire, AUDIT, SDS, DASS-21, and three subscales of the Short Form 36-Item Health Survey

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s alpha</th>
<th>Observed range</th>
<th>Theoretical range</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PSQI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep Duration</td>
<td>n/a</td>
<td>0-3</td>
<td>0-3</td>
<td>1</td>
</tr>
<tr>
<td>Sleep Latency</td>
<td>n/a</td>
<td>0-3</td>
<td>0-3</td>
<td>2</td>
</tr>
<tr>
<td>Sleep Disturbance</td>
<td>.64</td>
<td>0-3</td>
<td>0-3</td>
<td>9</td>
</tr>
<tr>
<td>Subjective Daytime Dysfunction</td>
<td>.57</td>
<td>0-3</td>
<td>0-3</td>
<td>2</td>
</tr>
<tr>
<td>Overall Sleep Quality</td>
<td>n/a</td>
<td>0-3</td>
<td>0-3</td>
<td>1</td>
</tr>
<tr>
<td>Need for Sleep Medication</td>
<td>n/a</td>
<td>0-3</td>
<td>0-3</td>
<td>1</td>
</tr>
<tr>
<td><strong>SDQ</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insomnia related disturbance</td>
<td>.80</td>
<td>0-5</td>
<td>0-5</td>
<td>4</td>
</tr>
<tr>
<td>Hypersomnia related disturbance</td>
<td>.76</td>
<td>0-5</td>
<td>0-5</td>
<td>3</td>
</tr>
<tr>
<td>Sleep Apnoea related disturbance</td>
<td>n/a</td>
<td>0-5</td>
<td>0-5</td>
<td>1</td>
</tr>
<tr>
<td>Parasomnias related disturbance</td>
<td>.54</td>
<td>0-4</td>
<td>0-5</td>
<td>2</td>
</tr>
<tr>
<td><strong>AUDIT</strong></td>
<td>.83</td>
<td>0-28</td>
<td>0-40</td>
<td>10</td>
</tr>
<tr>
<td><strong>SDS</strong></td>
<td>.60</td>
<td>0-12</td>
<td>0-20</td>
<td>5</td>
</tr>
<tr>
<td><strong>Short Form 36-Item Health Survey</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Functioning</td>
<td>.91</td>
<td>1-3</td>
<td>1-3</td>
<td>10</td>
</tr>
<tr>
<td>Role Limitations due to Physical Health</td>
<td>.79</td>
<td>1-2</td>
<td>1-4</td>
<td>4</td>
</tr>
<tr>
<td>Pain</td>
<td>.79</td>
<td>1-5</td>
<td>1-5</td>
<td>2</td>
</tr>
<tr>
<td><strong>DASS-21</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.91</td>
<td>0-42</td>
<td>0-42</td>
<td>7</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.85</td>
<td>0-34</td>
<td>0-42</td>
<td>7</td>
</tr>
<tr>
<td>Stress</td>
<td>.88</td>
<td>0-42</td>
<td>0-42</td>
<td>7</td>
</tr>
<tr>
<td><strong>The Self-Regulating Strategies of Mood Questionnaire</strong></td>
<td>&amp;</td>
<td>&amp;</td>
<td>&amp;</td>
<td>&amp;</td>
</tr>
<tr>
<td>Active Pleasurable Distraction</td>
<td>.71</td>
<td>.75</td>
<td>1-5</td>
<td>1-5</td>
</tr>
<tr>
<td>Active Cognitive Management</td>
<td>.71</td>
<td>.71</td>
<td>1-5</td>
<td>1-5</td>
</tr>
<tr>
<td>Physiological Distraction</td>
<td>.69</td>
<td>.68</td>
<td>1-5</td>
<td>1-5</td>
</tr>
<tr>
<td>Active Behavioural Management</td>
<td>.60</td>
<td>.64</td>
<td>1-5</td>
<td>1-5</td>
</tr>
<tr>
<td>Avoidance</td>
<td>.52</td>
<td>.26</td>
<td>1-5</td>
<td>1-5</td>
</tr>
<tr>
<td>Active Stress Management</td>
<td>.67</td>
<td>.62</td>
<td>1-5</td>
<td>1-5</td>
</tr>
</tbody>
</table>

Note. PSQI= Pittsburgh Sleep Quality Index (Buysse, 1988); SDQ= Sleep Disorders Questionnaire (Violani et al., 2000; 2004); AUDIT= Alcohol Use Identification Test (WHO, 2001); SDS=Substance Dependence Severity (Gossop et al., 1995); DASS-21=Depression, Anxiety and Stress scale (Lovibond & Lovibond, 1995); F= Frequency; E=Effectiveness; n/a denotes a single item or cumulative score for which internal consistency was not applicable.
Most scales used in the current study had a low number of items. It is difficult to obtain acceptable Cronbach’s alpha values for scales with less than 10 items (Pallant, 2011). However, most scales in the current study still had moderate to high internal consistency, apart from the frequency and effectiveness of avoidance, as well as the parasomnias subscales, which were all low at .52, .26 and .54, respectively. Given the low number of items for both these subscales it is preferable to report the mean inter-item correlation value (Pallant, 2011). The mean inter-item correlation value was .35 for the frequency of avoidance, .15 for the effectiveness of avoidance, and .42 for parasomnias, which indicates a low to moderate correlation between the items comprising these subscales. Given the particularly low Cronbach’s alpha coefficients and mean-inter item correlation statistic of the effectiveness of avoidance subscale, the decision was made to remove this subscale from further analyses. However, the frequency of avoidance and parasomnias subscales were retained. The reasoning behind this decision was based on research which suggests a Cronbach’s alpha of .50 is an indicator of good internal consistency for scales with a low number of items (Bowling, 2009). Therefore, in the current study Cronbach’s alphas of .50 will be accepted as an indicator of good internal consistency given the majority of subscales have a low number of items (Bowling, 2009).

7.2 Management of Missing Data and Preliminary Analyses

Prior to hypothesis testing, the data were screened to check suitability for data analysis. Less than 5% of cases were missing for each of the scales used in the questionnaire. Missing values were replaced using the series mean of each scale. This approach is not recommended if you have a large proportion of missing data as it can distort the results (Pallant, 2011). Given the proportion of missing data in the current study was small; the overall results should not be impacted upon by using the series mean for missing data.

Deviations from normality were assessed using histograms and probability plots of the data. All 24 variables were found to deviate from normality. Shapiro Wilks Tests of Normality indicated all variables significantly differed from a normal distribution. Given the size of the sample in the current study, it was preferable to view the shape of
the distribution rather than to use formal inference tests (Tabachnick & Fidell, 2007). Upon viewing expected normal probability plots and detrended expected normal probability plots, 15 out of 24 variables appeared to deviate from normality. Skewness and kurtosis values indicated that 7 of the 24 variables fell outside of the -1 to 1 range, indicating that these variables deviated from normality. In accordance with central limit theorem, analysis of variance is robust against violations of normality when using large sample sizes as the sampling distribution of means approaches normality despite the distribution of the variables (Tabachnick & Fidell; 2001; Hair et al., 2006). Therefore, it is likely that the distribution of the current sample will approach normality. Therefore, the decision was made to leave all the variables untransformed, which may also facilitate interpretation.

7.3 Descriptive Statistics for Variable Subscales

Table 3 shows the sample means and standard deviations, of all scales used in the current study.
### Table 3

*Means and Standard Deviations for PSQI, SDQ, Self-Regulating Strategies of Mood Questionnaire, AUDIT, SDS, DASS-21, and Three Subscales of the SF 36*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PSQI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep Duration</td>
<td>.34</td>
<td>.66</td>
</tr>
<tr>
<td>Sleep Latency</td>
<td>1.55</td>
<td>.96</td>
</tr>
<tr>
<td>Sleep Disturbance</td>
<td>1.28</td>
<td>.50</td>
</tr>
<tr>
<td>Subjective Daytime Dysfunction</td>
<td>1.40</td>
<td>.74</td>
</tr>
<tr>
<td>Overall Sleep Quality</td>
<td>1.25</td>
<td>.68</td>
</tr>
<tr>
<td>Need for Sleep Medication</td>
<td>.22</td>
<td>.63</td>
</tr>
<tr>
<td><strong>SDQ</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insomnia related disturbance</td>
<td>2.57</td>
<td>.95</td>
</tr>
<tr>
<td>Hypersomnia related disturbance</td>
<td>2.31</td>
<td>.89</td>
</tr>
<tr>
<td>Sleep Apnoea related disturbance</td>
<td>1.29</td>
<td>.71</td>
</tr>
<tr>
<td>Parasomnias related disturbance</td>
<td>1.69</td>
<td>.78</td>
</tr>
<tr>
<td><strong>AUDIT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.07</td>
<td>5.69</td>
</tr>
<tr>
<td><strong>SDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.92</td>
<td>1.78</td>
</tr>
<tr>
<td><strong>SF-36</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Functioning</td>
<td>2.72</td>
<td>.40</td>
</tr>
<tr>
<td>Role Limitations due to Physical Health</td>
<td>1.71</td>
<td>.34</td>
</tr>
<tr>
<td>Pain</td>
<td>2.00</td>
<td>.87</td>
</tr>
<tr>
<td><strong>DASS-21</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>11.38</td>
<td>9.98</td>
</tr>
<tr>
<td>Anxiety</td>
<td>9.14</td>
<td>8.60</td>
</tr>
<tr>
<td>Stress</td>
<td>14.56</td>
<td>9.74</td>
</tr>
<tr>
<td><strong>The Self-Regulating Strategies of Mood Questionnaire</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Pleasurable Distraction</td>
<td>3.08</td>
<td>3.21</td>
</tr>
<tr>
<td>Active Cognitive Management</td>
<td>3.12</td>
<td>3.24</td>
</tr>
<tr>
<td>Physiological Distraction</td>
<td>1.97</td>
<td>2.16</td>
</tr>
<tr>
<td>Active Behavioural Management</td>
<td>3.12</td>
<td>3.66</td>
</tr>
<tr>
<td>Avoidance</td>
<td>3.08</td>
<td>n/a</td>
</tr>
<tr>
<td>Active Stress Management</td>
<td>2.03</td>
<td>2.43</td>
</tr>
</tbody>
</table>

*Note. N=327. PSQI= Pittsburgh Sleep Quality Index (Buysse, 1988); SDQ= Sleep Disorders Questionnaire (Violani et al., 2000; 2004); AUDIT= Alcohol Use Identification Test (WHO, 2001); SDS=Substance Dependence Severity (Gossop et al., 1995); SF-36= Short Form 36-Item Health Survey; DASS-21=Depression, Anxiety and Stress scale (Lovibond & Lovibond, 1995); F= Frequency; E=Effectiveness. n/a=Not applicable*
Mean scores for the PSQI subscales indicated that the sample, as a whole, reported low scores for sleep duration and need for sleep medication, moderate scores for sleep latency, sleep disturbance, sleep quality and subjective daytime dysfunction, indicating on average the sample as a whole reported low to moderate sleep difficulties (Scale scores ranged from 0 to 3, with 0 indicating ‘better’ sleep and 3 indicating ‘worse’). The standard deviations for all PSQI subscales were small indicating there was little variation in the range of scores across the sample. Similarly, mean scores for the Sleep Disorders Questionnaire (SDQ) subscales indicated that the sample, as a whole, reported low scores on the sleep apnoea and parasomnias subscales and moderate scores on the insomnia and hypersonnia subscales. The standard deviations for the SDQ subscales were small indicating there was little variability in scores.

Mean scores for the frequency and effectiveness of Self-Regulating Strategies of Mood subscales indicated that the sample, as a whole, scored above the scale mid-point on active pleasurable distraction, active cognitive management, active behavioural management and avoidance, yet below the midpoint on physiological distraction and active stress management. The standard deviations were small indicating there was little variability in scores.

Mean scores for the Alcohol Use Disorder Identification Tool (AUDIT) and Substance Dependence Scale (SDS) indicated that the sample, as a whole, reported low scores on alcohol use and illicit substance use. However, the standard deviations for the scales were large indicating there was large variability in the scores.

Mean scores for the Short Form Health Survey subscales indicated that the sample, as a whole, scored well above the scale midpoint on physical functioning (Scale scores ranged from 0 to 3, with 0 indicating worse physical functioning and 3 indicating better) and below the midpoint on pain and role limitations on physical functioning (Scale scores ranged from 0 to 5, with 0 indicating better and 5 indicating worse). The standard deviations were small indicating there was little variability in the scores.

The mean scores for the Depression Anxiety Stress Scale (DASS-21) subscales indicated that the sample, as a whole, reported low scores on depression, anxiety and stress. According to the DASS severity ratings, which assess the severity of the depression, anxiety and stress scores reported, the current sample reported symptoms
within the mild range. Whilst the mean scores were low, the standard deviations were large indicating there was large variability in the scores. These scores are comparable to the normative data provided by Crawford et al. (2011) which compared mean depression, anxiety and stress subscale scores among a sample of Australians aged 18 to 24 years. Table 4 shows the means, standard deviations and range of observed scores on the DASS-21 provided by Crawford et al. (2011) in comparison to those obtained in the current study.

Table 4

<table>
<thead>
<tr>
<th>DASS-21</th>
<th>Crawford et al. (2011)</th>
<th>Range</th>
<th>Current sample</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=102</td>
<td></td>
<td>n=327</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Depression</td>
<td>7.92</td>
<td>9.02</td>
<td>40</td>
<td>11.38</td>
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<tr>
<td>Anxiety</td>
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<td>6.50</td>
<td>30</td>
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<tr>
<td>Stress</td>
<td>9.56</td>
<td>9.42</td>
<td>42</td>
<td>14.56</td>
</tr>
</tbody>
</table>

Note: DASS-21=Depression, Anxiety and Stress scale (Lovibond & Lovibond, 1995). The DASS-21 means, standard deviations and observed ranges from Crawford et al’s (2011) research were doubled to make them comparable to the means, standard deviations and observed ranges in the current study. Lovibond and Lovibond (1995) recommend doubling the DASS-21 scores to facilitate scoring and interpretation in comparison to the full length DASS.

7.4 Descriptive Statistics across Gender

Gender differences were explored to determine whether subsequent analyses should be conducted using the sample as a whole or considered separately by gender. A series of One Way MANOVAs were conducted to determine whether there were gender differences which could be potential confounding factors in subsequent analyses. Seven MANOVAs were performed exploring gender differences on subscales of the DASS, PSQI, SDQ, AUDIT, SDS and SF-36. Analyses revealed that there were no significant differences between males and females on self-reported depression, anxiety or stress.

Whilst not significant, there was a trend for females to report higher mean stress scores than males ($F(1,325)=3.74$, $p=.05$). Females reported a higher mean score ($M=2.64$, $SD=.97$) than males ($M=2.38$, $SD=.87$) on the insomnia subscale of the Sleep Disorders Questionnaire (SDQ; $F(1,326)=5.16$, $p=.02$), yet there were no differences between the
genders on the hypersomnia, sleep apnoea and parasomnias subscales. On the Pittsburgh Sleep Quality Index (PSQI) females ($M=1.62$, $SD=.96$) reported a higher mean sleep latency score than males ($M=1.37$, $SD=.93$; $F(1, 326)=4.32$, $p=.04$). There were no other differences between genders on the PSQI.

There were significant differences between males and females in the frequency of self-regulating strategies of mood. As Levene’s test of homogeneity of variance was violated, a more conservative alpha level of $p<.01$ was used (Tabachnick & Fidell, 2007). On average, males reported using physiological distraction ($M=2.19$, $SD=.93$; $F(1, 325)=9.52$, $p=.002$) and active behavioural management ($M=3.30$, $SD=.88$; $F(1, 325)=6.47$, $p=.01$), more frequently than females ($M= 1.89$, $SD=.73$; $M=3.06$, $SD=.71$, respectively). There was also a non-significant trend for males ($M= 2.24$, $SD=1.07$) to use active stress management more frequently than females ($M=1.96$, $SD=.88$) to regulate a negative mood ($F(1, 325)=5.73$, $p=.02$). On average, males reported higher scores ($M=8.34$, $SD=6.32$) on the Alcohol Use Disorders Identification Test (AUDIT) than females ($M=6.59$, $SD=5.38$; $F(1, 325)=6.19$, $p=.01$). There was also a trend for males ($M=1.20$, $SD=2.38$) to report higher mean scores than females ($M=.82$, $SD=1.49$) on the Substance Dependence Scale (SDS), however this difference was not significant. There were no significant differences between males and females on the Short Form-36 subscales of physical functioning, pain or role limitations due to physical health.

Table 5 summarises the means and standard deviations across males and females. The differences between the genders were in accordance with what would be expected in a non-clinical population with females on average reporting more insomnia symptoms, greater sleep latency times and greater stress, and males reporting greater alcohol use (Ford & Kamerow, 1989; Roberts et al., 2000; Teen Health, 2000). Previous Australian data has indicated that among Australian women aged 18 to 24, 11% suffer from a mood disorder which is three times higher than that of men in this age range, however one in five men of this age are affected by substance use disorders (ABS, 1997; 2007). Given the differences between males and females in the current study were consistent with previous research in the general population, the decision was made to run subsequent analyses using the sample as a whole.
Table 5

Summary of Means and Standard Deviations across Males and Females on the PSQI, SDQ, AUDIT, SDS, three subscales of the Short Form 36-Item Health Survey, DASS-21 and Self-Regulating Strategies of Mood Questionnaire

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>PSQI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep Duration</td>
<td>.33</td>
<td>.65</td>
</tr>
<tr>
<td>Sleep Latency</td>
<td>1.37</td>
<td>.93</td>
</tr>
<tr>
<td>Sleep Disturbance</td>
<td>1.21</td>
<td>.49</td>
</tr>
<tr>
<td>Subjective Daytime Dysfunction</td>
<td>1.33</td>
<td>.74</td>
</tr>
<tr>
<td>Overall Sleep Quality</td>
<td>1.27</td>
<td>.69</td>
</tr>
<tr>
<td>Need for Sleep Medication</td>
<td>.30</td>
<td>.73</td>
</tr>
<tr>
<td><strong>SDQ</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insomnia related disturbance</td>
<td>2.38</td>
<td>.87</td>
</tr>
<tr>
<td>Hypersomnia related disturbance</td>
<td>2.20</td>
<td>.86</td>
</tr>
<tr>
<td>Sleep Apnoea related disturbance</td>
<td>1.38</td>
<td>.79</td>
</tr>
<tr>
<td>Parasomnias related disturbance</td>
<td>1.66</td>
<td>.80</td>
</tr>
<tr>
<td><strong>AUDIT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.34</td>
<td>6.32</td>
</tr>
<tr>
<td><strong>SDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.20</td>
<td>2.38</td>
</tr>
<tr>
<td><strong>SF-36</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Functioning</td>
<td>2.69</td>
<td>.47</td>
</tr>
<tr>
<td>Role Limitations due to Physical Health</td>
<td>1.73</td>
<td>.33</td>
</tr>
<tr>
<td>Pain</td>
<td>1.90</td>
<td>.74</td>
</tr>
<tr>
<td><strong>DASS-21</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>11.53</td>
<td>9.06</td>
</tr>
<tr>
<td>Anxiety</td>
<td>8.78</td>
<td>8.68</td>
</tr>
<tr>
<td>Stress</td>
<td>12.85</td>
<td>8.48</td>
</tr>
<tr>
<td><strong>The Self-Regulating Strategies of Mood Questionnaire</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Pleasurable Distraction</td>
<td>2.96</td>
<td>.77</td>
</tr>
<tr>
<td>Active Cognitive Management</td>
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<td>.98</td>
</tr>
<tr>
<td>Physiological Distraction</td>
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<td>.93</td>
</tr>
<tr>
<td>Active Behavioural Management</td>
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<td>.88</td>
</tr>
<tr>
<td>Avoidance</td>
<td>3.15</td>
<td>.97</td>
</tr>
<tr>
<td>Active Stress Management</td>
<td>2.24</td>
<td>1.07</td>
</tr>
</tbody>
</table>

Note. N=327
7.5 Correlations between Sleep and Depression, Anxiety, Stress Scale (DASS) Variables

Bivariate correlations were calculated to examine the association between participants’ scores on the PSQI, SDQ, The Self-Regulating Strategies of Mood Questionnaire, DASS, AUDIT, SDS and three subscales of the Short Form 36-Item Health Survey. Correlational analyses were conducted to confirm adequate relationships existed between the variables to meet the assumptions for further statistical analyses including hierarchical multiple regression and analysis of variance. The correlations between scores on these variables are presented in Table 6.
|       | 1   | .14 | 1   | .17 | .27 | 1   | .08 | .18 | .36 | 1   | .30 | .51 | .31 | .37 | 1   | .19 | .17 | .10 | .12 | .24 | 1   | .24 | .63 | .45 | .37 | .61 | .21 | 1   | .07 | .25 | .37 | .59 | .38 | .11 | .50 | 1   | .05 | .01 | .20 | .22 | .15 | .13 | .24 | .36 | 1   | .20 | .14 | .42 | .26 | .25 | .13 | .36 | .39 | .44 | 1   | .11 | .10 | .18 | .16 | .11 | -.02 | .19 | .31 | .13 | .17 | 1   | .05 | -.00 | .08 | .00 | .07 | -.12 | .02 | .07 | -.01 | .02 | .00 | .32 | 1   | .19 | .05 | .15 | .07 | .06 | .19 | .12 | .23 | .27 | .29 | .34 | .12 | 1   | -.02 | -.05 | -.09 | -.10 | -.06 | -.05 | -.02 | -.02 | -.02 | .30 | .26 | .19 | 1   | .15 | .04 | .11 | .24 | .15 | -.02 | .13 | -.26 | .07 | .12 | .43 | .22 | .20 | .16 | 1   | .12 | -.02 | .08 | .06 | .02 | .11 | .07 | .17 | .19 | .24 | .37 | .36 | .36 | .32 | .23 | 1   | .03 | .08 | .13 | .20 | .04 | .07 | .09 | .23 | .16 | .28 | .15 | -.04 | .50 | .07 | .16 | .05 | 1   | .00 | .02 | .01 | .11 | .04 | .10 | .10 | .18 | .17 | .18 | .06 | .03 | .24 | -.06 | .09 | .14 | .14 | 1   | -.21 | -.12 | -.23 | -.17 | -.26 | -.13 | -.21 | -.27 | -.25 | -.28 | .06 | .05 | -.28 | .15 | -.05 | -.10 | -.11 | -.22 | 1   | -.16 | -.18 | -.30 | -.47 | -.42 | -.21 | -.31 | -.43 | -.18 | -.27 | -.12 | -.04 | -.17 | .05 | -.14 | -.07 | -.20 | -.19 | -.40 | 1   | .14 | .13 | .32 | .33 | .31 | .15 | .29 | .29 | .35 | .08 | -.02 | .14 | -.04 | .04 | .06 | .13 | .20 | -.26 | -.34 | 1   | .27 | .17 | .23 | .44 | .32 | .21 | .33 | .38 | .21 | .26 | .20 | -.01 | .23 | -.18 | .22 | .13 | .16 | .21 | -.32 | -.32 | -.33 | 1   | .27 | .16 | .34 | .28 | .29 | .18 | .32 | .37 | .29 | .39 | .20 | -.02 | .29 | -.09 | .13 | .21 | .20 | .22 | -.34 | -.34 | -.35 | .68 | 1   | .23 | .23 | .33 | .35 | .35 | .23 | .37 | .35 | .15 | .38 | .21 | .05 | .19 | -.07 | .21 | .15 | .15 | .13 | -.23 | -.34 | -.36 | .74 | .76 | 1   |

**Table 6**

*Correlations between PSQI, SDQ, Frequency of The Self-Regulating Strategies of Mood Questionnaire, DASS-21, AUDIT and SDS and Three Subscales of the SF-36*

**Note.** N=327. Figures in bold indicate a significant correlation at p<.05. 1=Sleep duration; 2=Sleep latency; 3=Sleep disturbance; 4=Subjective daytime dysfunction; 5=Overall sleep quality; 6=Need for sleep medication; 7=Insomnia; 8=Hypersomnia; 9=Sleep apnoea; 10=Parasomnias; 11=Active pleasurable distraction; 12=Active cognitive management; 13=Physiological distraction; 14=Active behavioural management; 15=Avoidance; 16=Active stress management; 17= AUDIT; 18= SDS; 19=Physical functioning; 20=Role limitations due to physical functioning; 21=Depression; 22=Stress;
As can be seen in Table 6, there was a small, positive correlation between sleep duration, sleep latency, sleep disturbance, need for sleep medication, and depression. There was a moderate, positive association between subjective daytime dysfunction and depression, as well as overall sleep quality and depression. Further, there was a moderate, positive correlation between insomnia, hypersomnia and depression, yet a small positive correlation between sleep apnoea, parasomnias and depression. Anxiety had a small, positive association with sleep duration, sleep latency, daytime dysfunction, sleep quality and sleep medication, yet a moderate, positive correlation with sleep disturbance. There was also a moderate, positive correlation between insomnia, hypersomnia and anxiety, yet a small, positive correlation with sleep apnoea and parasomnias. Stress had a weak, positive correlation with sleep duration, sleep latency and need for sleep medication, yet a moderate, positive correlation with sleep disturbance, daytime dysfunction and overall sleep quality. There was a moderate, positive correlation with insomnia, hypersomnia and parasomnias, yet a small, positive correlation with sleep apnoea.

7.6 The Variable-Oriented Approach: Investigating the Relationship between Sleep, Mood, Substance Use and Health using Hierarchical Regression Analyses

A variable-oriented approach was used to examine the relationship between sleep quality, sleep disturbances, mood regulating strategies, substance use, emotional and physical health variables among young adults. Specifically, it was predicted that poor sleep quality and sleep disturbances would predict greater scores of self-reported psychological symptoms such as depression, anxiety, stress as well as substance use. Moreover, it has been documented in previous studies that an important component of the variable approach is to explore the social context of age and gender (Bergman & Trost, 2006; Laursen & Hoff, 2006). However, the current study predominantly focused on young adults as a cohort, rather than exploring age-related inter-individual differences within the young adult cohort. In addition, preliminary analyses indicated only a few expected gender differences. As such, any differences in age and gender were controlled for in the present study. Thus, the following analyses control for the potentials effects of age and gender.

Hierarchical regression analyses: sleep, mood and substance use.
Preliminary analyses were conducted to ensure there was no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. After initially transforming several variables in an attempt to reduce skewness, reduce the number of outliers, and improve the normality, linearity, and homoscedasticity of residuals, the decision was made to leave all variables untransformed as there was not a significant improvement in the skewness and kurtosis values. Several independent variables including physical functioning, physiological distraction duration of sleep disturbance, use of sleep medication and sleep apnoea were positively skewed without transformation and negatively skewed with it. Therefore, this provided further justification for leaving the variables untransformed given that when transforming some variables, but not all, difficulties can arise with interpretation.

In relation to outlier detection, with the use of a p<.001 criterion for Mahalanobis distance, four outliers among the cases were identified. These cases were not removed from the dataset as each successive outlier did not exceed six units difference (D. Meyer, personal communication, August 30, 2012). No cases had missing data and no suppressor variables were found. A total of 327 participants were included in the analysis.

The independent variables of age and gender were entered at step 1 to account for the effects of these variables, followed by parasomnias, insomnia, hypersonnia, sleep apnoea, sleep latency, sleep disturbance, sleep quality, sleep duration, use of medication to sleep, daytime dysfunction due to sleepiness and duration of sleep disturbance at step 2. The results of the analyses are presented in Table 7.
### Table 7

*Summary of Hierarchical Multiple Regression Analyses Predicting Depression, Anxiety, Stress, Illicit Substance Use and Alcohol Use from Sleep Related Variables*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
<th>Illicit Substance Use</th>
<th>Alcohol Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔR²</td>
<td>β</td>
<td>ΔR²</td>
<td>β</td>
<td>ΔR²</td>
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<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.01</td>
<td>-.08</td>
<td>.00</td>
<td>.02</td>
<td>.00</td>
</tr>
<tr>
<td>Gender</td>
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<td>.03</td>
<td>.02</td>
<td>.08</td>
<td>-.05</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>.28***</td>
<td>-.03</td>
<td>.03</td>
<td>.08</td>
<td>.06</td>
</tr>
<tr>
<td>Age</td>
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<td>-.03</td>
<td>.01</td>
<td>.08</td>
<td>-.08</td>
</tr>
<tr>
<td>Gender</td>
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<td>-.03</td>
<td>.01</td>
<td>.08</td>
<td>-.06</td>
</tr>
<tr>
<td>Parasomnias</td>
<td>.02</td>
<td>.17**</td>
<td>.24***</td>
<td>.09</td>
<td>.24***</td>
</tr>
<tr>
<td>Insomnia</td>
<td>.08</td>
<td>.03</td>
<td>.06</td>
<td>.08</td>
<td>.10</td>
</tr>
<tr>
<td>Hypersonnias</td>
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<td>.16*</td>
<td>.06</td>
<td>.14</td>
<td>.12</td>
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<tr>
<td>Sleep Apnoea</td>
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<td>.09</td>
<td>-.06</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td>Sleep Latency</td>
<td>.05</td>
<td>-.03</td>
<td>-.01</td>
<td>-.04</td>
<td>.13</td>
</tr>
<tr>
<td>Sleep Disturbance</td>
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<td>.13*</td>
<td>.04</td>
<td>-.08</td>
<td>-.01</td>
</tr>
<tr>
<td>Sleep Quality</td>
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<td>.10</td>
<td>-.05</td>
<td>-.12</td>
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<tr>
<td>Sleep Duration</td>
<td>.14**</td>
<td>-.16**</td>
<td>-.07</td>
<td>.02</td>
<td>.03</td>
</tr>
<tr>
<td>Medication Use</td>
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<td>.12*</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>Daytime Dysfunction</td>
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<td>.15*</td>
<td>.05</td>
<td>.13</td>
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<tr>
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<td>-.02</td>
<td>.07</td>
<td>-.02</td>
<td>-.01</td>
</tr>
</tbody>
</table>

**Total R²** | .28*** | .28*** | .31*** | .09** | .14***

*Note. N=327. *p<.05 **p<.01 ***p<.001*
**Depression.** In relation to the prediction of depression symptoms, Table 7 shows that age and gender explained 1% of the variation in self-reported depression symptoms, however this model was not significant. After entry of the sleep related variables at step 2, the total variance explained by the model as a whole was 28.1%, $F(13, 313)=9.43$, $p<.001$. The sleep related variables explained an additional 27.5% of the variance in self-reported depression symptoms, even when the effects of age and gender were statistically controlled for: $R^2$ change=.27, $F$ change (11, 313)=10.90, $p<.001$. In the final model, only two sleep variables were statistically significant, with daytime dysfunction scoring the highest $\beta$ value ($\beta=.29$, $p<.001$), followed by sleep duration ($\beta=.14$, $p=.01$). Medication use approached significance ($\beta=.10$, $p=.05$). Part correlation coefficients revealed that 5.2% of the variance in depression was explained by daytime dysfunction compared to 1.61% explained by sleep duration.

**Anxiety.** In relation to the prediction of anxiety symptoms, age and gender did not explain any of the variation in self-reported anxiety symptoms. After entry of the sleep related variables at step 2, the total variance explained by the model as a whole was 28%, $F(13, 313)=9.30$, $p<.001$. The sleep related variables explained an additional 28% of the variance in self-reported anxiety symptoms, even when the effects of age and gender were statistically controlled for: $R^2$ change=.28, $F$ change (11, 313)=10.95, $p<.001$. In the final model, four sleep variables were statistically significant, with parasomnias ($\beta=.17$, $p=.01$) and hypersomnia ($\beta=-.17$, $p=.02$), scoring the highest $\beta$ values, followed by sleep duration ($\beta=.16$, $p=.002$) and sleep disturbance ($\beta=.13$, $p=.03$). Part correlation coefficients indicated that sleep duration explained 2.2% of the unique variance in anxiety scores, followed by 1.82% by parasomnias, 1.37% by hypersomnia, and 1.12% by sleep disturbance.

**Stress.** Age and gender explained 2% of the variation in self-reported stress symptoms; however this model was not significant. After entry of the sleep related variables at step 2, the total variance explained by the model as a whole was 31%, $F(13, 313)=10.96$, $p<.001$. The sleep related variables explained an additional 29% of the variance in self-reported stress symptoms, even when the effects of age and gender were statistically controlled for: $R^2$ change=.29, $F$ change (11, 313)=12.08, $p<.001$. In the final model, three sleep variables were statistically significant, with parasomnias scoring the highest $\beta$ value ($\beta=.23$, $p<.001$), followed by daytime dysfunction ($\beta=.15$, $p=.01$) and use of medication to sleep ($\beta=.12$, $p=.02$). Part correlation coefficients revealed that parasomnias explained 3.61% of the unique variance in stress, followed by
daytime dysfunction which explained 1.59% and use of medication to sleep which explained 1.3%.

**Illicit substance use.** In relation to the prediction of illicit substance use, age and gender explained 2% of the variation in reported illicit substance use. This model was significant: $R^2$ change = .02 $F$ change (11, 313) = 3.28, $p = .04$. After entry of the sleep related variables at Step 2 the total variance explained by the model as a whole was 9%, $F(13, 313) = 2.40, p = .004$. The sleep related variables explained an additional 7% of the variance in self-reported illicit substance use, even when the effects of age and gender were statistically controlled for: $R^2$ change = .07 $F$ change (11, 313) = 2.21, $p = .01$. In the final model, only parasomnias was statistically significant ($\beta = .14, p = .04$), with the part correlation coefficient indicating it explained 1.14% of the unique variance in illicit substance use.

**Alcohol use.** Finally, age and gender significantly explained 2% of the variation in self-reported alcohol use $R^2$ change = .02 $F$ change (11, 313) = 3.45, $p = .03$. After entry of the sleep related variables at Step 2, the total variance explained by the model as a whole was 14%, $F(13, 313) = 4.07, p < .001$. The sleep related variables explained an additional 12% of the variance in self-reported alcohol use, even when the effects of age and gender were statistically controlled for: $R^2$ change = .12 $F$ change (11, 313) = 4.12, $p < .001$. In the final model, gender and parasomnias were statistically significant, with parasomnias recording a higher $\beta$ value ($\beta = .24, p < .001$) than gender ($\beta = -.16, p = .003$). Part correlation coefficients indicated that parasomnias explained 3.84% of the unique variance in alcohol use, followed by gender which explained 2.4%.

**Hierarchical regression analyses: sleep, mood regulating strategies and health predicting mood and substance use.** Four further hierarchical regression analyses were conducted to determine if the addition of health related variables and mood regulating strategies improved the prediction of depression, anxiety, stress, illicit substance use and alcohol use, beyond that predicted by sleep related variables. The aim of the regression model was to explore the potential variance in depression, anxiety, stress, illicit substance use and alcohol use that may be explained by variables that were not sleep related. The order in which the variables were entered into the model was driven by the stronger correlations between depression, anxiety, stress, illicit substance use and alcohol use, with health variables in comparison to the correlations between these variables and mood regulating strategies variables (Refer to Table 2, p.76). For
this reason, the health related variables were entered before the mood regulating strategies. It was expected that the health related variables would explain a greater amount of the variance in depression, anxiety, stress, illicit substance use and substance use, than mood regulating strategies.

**Depression.** Table 8 displays the $R^2$ Square Change and $\beta$ values for depression after entry of the predictor variables at each of the four steps. $R$ was not significant after the entry of age and gender at Step 1, yet was significant after the entry of health related variables at Step 2, mood regulating strategies at Step 3 and sleep related variables at Step 4.
Table 8
*Summary of Hierarchical Multiple Regression Analyses Predicting Depression Symptoms from Health, Mood regulating and Sleep Related Variables*

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</table>

Note. $N=327$ *$p<.05$ **$p<.01$ ***$p<.001$
Age and gender explained 1% of the variation in self-reported depressive symptoms; however this model was not significant. After entry of the three health related variables at Step 2, the total variance explained by the model was 19% $F(5, 321)=15.56, p<.001$. The health related variables explained an additional 19% of the variance in depression symptoms, when the effects of age and gender were statistically controlled for: $R^2_{\text{change}}=.19$ $F$ change $(3, 321)=25.09, p<.001$. All three of the health related variables were statistically significant, with pain recording the highest $\beta$ value ($\beta=.23, p<.001$), followed by physical functioning ($\beta=-.20, p<.001$) and role limitations ($\beta=-.16, p<.01$).

After the entry of the mood regulating variables at Step 3, the total variance explained by the model was 29% $F(11, 315)=11.52, p<.001$. The mood regulating variables explain an additional 9% of the variance in depression symptoms, after age, gender and health have been statistically controlled for $R^2_{\text{change}}=.09$ $F$ change $(6, 315)=6.76, p<.001$. One mood regulating variable and all three health related variables were statistically significant, with behavioural management recording the highest $\beta$ value ($\beta=-.24, p<.001$), followed by pain ($\beta=.22, p<.001$), followed by role limitations ($\beta=-.13, p<.05$) and physical functioning ($\beta=-.13, p<.05$).

After the entry of the sleep related variables at Step 4, the total variance explained by the model was 37% $F(21, 305)=8.49, p<.001$. The sleep related variables explain an additional 8% of the variance in depressive symptoms after age, gender, health and mood regulating variables have been statistically controlled for $R^2_{\text{change}}=.08$ $F$ change$(10, 305)=3.97, p<.001$. In the final model, one sleep related variable, one mood regulating variable and two health related variables were statistically significant, with daytime dysfunction recording the highest $\beta$ value ($\beta=.27, p<.001$) followed by behavioural management ($\beta=-.20, p<.001$), pain ($\beta=-.14, p<.01$) and physical functioning ($\beta=-.13, p<.05$). Part correlation coefficients indicated that daytime dysfunction made the largest unique contribution, accounting for 3.72% of the variance in depression scores, followed by behavioural management which explained 3.06%.

**Anxiety.** Table 9 displays the $R^2$ values for anxiety after entry of the predictor variables at each of the four steps. $R$ was not significant after the entry of age and gender at Step 1, yet was significant after the entry of health related variables at Step 2, mood regulating strategies at Step 3 and sleep related variables at Step 4.
Table 9
Summary of Hierarchical Multiple Regression Analyses Predicting Anxiety Symptoms from Health, Mood regulating and Sleep Related Variables

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Note. N=327. *p<.05 **p<.01 ***p<.001
Age and gender did not explain any of the variation in self-reported anxiety symptoms which is unusual given the higher prevalence figures for anxiety disorders among women in comparison with men. After entry of the three health related variables at Step 2, the total variance explained by the model was 21%, $F(5, 321)=17.33, p<.001$. The health related variables explained an additional 21% of the variance in anxiety symptoms, when the effects of age and gender were statistically controlled for: $R^2$ change=.21, $F$ change (3, 321)=28.71, $p<.001$. All three of the health related variables were statistically significant, with pain recording the highest $\beta$ value ($\beta=.24, p<.001$), followed by physical functioning ($\beta=-.21, p<.001$) and role limitations ($\beta=-.17, p<.01$). After the entry of the mood regulating variables at Step 3, the total variance explained by the model was 29% $F(11,315)=11.54, p<.001$. The mood regulating variables explain an additional 7% of the variance in anxiety symptoms, after age, gender and health have been statistically controlled for: $R^2$ change=.07, $F$ change (6, 315)=5.40, $p<.001$. Three mood regulating variables and all three health related variables were statistically significant, with pain recording the highest $\beta$ values ($\beta=-.22, p<.001$) followed by stress management ($\beta=.15, p<.01$), role limitations ($\beta=-.15, p<.01$), physiological distraction ($\beta=.15, p<.05$), physical functioning ($\beta=-.13, p<.05$) and behavioural management ($\beta=-.13, p<.05$). After the entry of the sleep related variables at Step 4, the total variance explained by the model was 35% $F(21, 305)=7.73, p<.001$. The sleep related variables explain an additional 6% of the variance in anxiety symptoms after age, gender, health and mood regulating variables have been statistically controlled for $R^2$ change=.06, $F$ change (10, 305)=2.87, $p<.01$. In the final model, sleep duration and pain were statistically significant, with pain recording a higher $\beta$ value ($\beta=-.14, p=.01$) than sleep duration ($\beta=-.12, p<.05$). Part correlation coefficients indicated that pain made the largest unique contribution, accounting for 1.46% of the variance in anxiety symptoms.

**Stress.** Table 10 displays the $R$ Square Change and $\beta$ values for stress after entry of the predictor variables at each of the three steps. $R$ was not significant after the entry of age and gender at Step 1, yet was significant after the entry of health related variables at Step 2, mood regulating strategies at Step 3 and sleep related variables at Step 4.
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<th>Predictor</th>
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*Note. N=327 *p<.05 **p<.01 ***p<.001*
Age and gender explained 2% of the variation in self-reported stress symptoms; however this model was not significant. After entry of the three health related variables at Step 2, the total variance explained by the model was 20% $F(5, 321)=16.25, p<.001$. The health related variables explained an additional 18% of the variance in stress symptoms, when the effects of age and gender were statistically controlled for: $R^2$ change=.18, $F$ change (3,321) =24.72, $p<.001$. Pain and role limitations were statistically significant, with pain recording the higher $\beta$ value ($\beta=.25, p<.001$) than role limitations ($\beta=-.22, p<.001$). After the entry of the mood regulating variables at Step 3, the total variance explained by the model was 26% $F (11, 315)=9.78, p<.001$. The mood regulating variables explain an additional 5% of the variance in stress symptoms, after age, gender and health have been statistically controlled for: $R^2$ squared change=.05 and $F$ change (6, 315)=3.71, $p<.01$. Two mood regulating variables and two health related variables were statistically significant, with pain and role limitations recording the higher $\beta$ values ($\beta=.24, p<.001; \beta=-.19, p<.01$, respectively), followed by avoidance ($\beta=-.12, p<.05$) and behavioural management ($\beta=-.11, p<.05$). After the entry of the sleep related variables at Step 4, the total variance explained by the model was 34% $F(21, 305)=7.62, p<.001$. The sleep related variables explain an additional 9% of the variance in stress symptoms after age, gender, health and mood regulating variables have been statistically controlled for $R^2$ squared change=.09, $F$ change (10, 305)=4.15, $p<.001$. In the final model, parasomnias, medication use, pain and age were statistically significant, with parasomnias recording the higher $\beta$ value ($\beta=.19, p<.01$) followed by pain ($\beta=.13, p<.05$), medication use ($\beta=-.11, p<.05$) and age ($\beta=.11, p<.05$). Part correlation coefficients revealed that parasomnias made the largest unique contribution, accounting for 2.13% of the variance in stress symptoms.
**Illicit substance use.** Table 11 displays the $R$ Square Change and $\beta$ values for illicit substance use after entry of the predictor variables at each of the three steps. $R$ was significant after the entry of age and gender at Step 1, was significant after the entry of health related variables at Step 2, mood regulating strategies at Step 3 and sleep related variables at Step 4. Age and gender explained 2% of the variation in self-reported illicit substance use. This model was significant $F(2, 324)=3.28, p=.04$.

After entry of the three health related variables at Step 2, the total variance explained by the model was 10% $F(5, 321)=6.87, p<.001$. The health related variables explain an additional 8% of the variance in illicit substance use, when the effects of age and gender were statistically controlled for: $R$ squared change=.08, $F$ change (3, 321)=9.11, $p<.001$. Pain, physical functioning and age were statistically significant, with pain recording the higher $\beta$ value ($\beta=-.15, p<.01$), followed by physical functioning ($\beta=-.14, p<.05$) and Age ($\beta=-.11, p<.05$). After the entry of the mood regulating variables at Step 3, the total variance explained by the model was 14% $F(11, 315)=4.66, p<.001)$. The mood regulating variables explained an additional 4% of the variance in illicit substance use, after age, gender and health have been statistically controlled for: $R$ squared change=.04, $F$ change (6, 315)=2.64, $p<.05$. Physiological distraction, pain and age were statistically significant with physiological distraction recording the higher $\beta$ value ($\beta=.19, p<.01$) followed by pain ($\beta=.14, p<.05$) and Age ($\beta=-.13, p<.05$). After the entry of the sleep related variables at Step 4, the total variance explained by the model was 17% $F(21, 305)=3.11, p<.001)$. The addition of the sleep related variables did not explain a significant additional amount of the variance in illicit substance use after age, gender, health and mood regulating variables have been statistically controlled for: $R$ squared change=.05, $F$ change (10, 305)=1.35, $p=.20$. In the final model, physiological distraction, pain, sleep disturbance and age were statistically significant, with physiological distraction and pain recording the higher $\beta$ values ($\beta=.17, p<.01; \beta=.17, p<.01$) followed by sleep disturbance ($\beta=-.15, p<.05$) and Age ($\beta=-.11, p<.05$). Part correlation coefficients indicated that pain made the largest unique contribution, accounting for 2.07% of the variance in illicit substance use.
Table 11
Summary of Hierarchical Multiple Regression Analyses Predicting Illicit Substance Use from Health, Mood regulating and Sleep Related Variables

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<td>Sleep Latency</td>
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Note. N=327* p<.05 **p<.01 ***p<.001****
**Alcohol use.** Table 12 displays the $R^2$ Change and $\beta$ values for alcohol use after entry of the predictor variables at each of the three steps. $R$ was significant after the entry of age and gender at Step 1, was significant after the entry of health related variables at Step 2, mood regulating strategies at Step 3 and sleep related variables at Step 4. Age and gender explained 2% of the variation in self-reported alcohol use. Gender was statistically significant ($\beta=-.14, p<.05$), with males reporting greater alcohol use on average, than females $F(2, 324)=3.45, p<.05$

After entry of the three health related variables at Step 2, the total variance explained by the model was 7% $F(5, 321)=4.63, p<.001$. The health related variables explained an additional 5% of the variance in alcohol use, when the effects of age and gender were statistically controlled for: $R^2$ change=.05, $F$ change (3, 321)=5.34, $p<.01$. Role limitations and gender were statistically significant, with role limitations recording a higher $\beta$ value ($\beta=-.17, p<.01$) than gender ($\beta=-.15, p<.01$). After the entry of the mood regulating variables at Step 3, the total variance explained by the model was 32% $F(11, 315)=13.15, p<.001$). The mood regulating variables explain an additional 25% of the variance in alcohol use, after age, gender and health have been statistically controlled for: $R^2$ change=.25, $F$ change(6, 315)=18.95, $p<.001$. Two mood regulating variables and one health related variable were statistically significant, with physiological distraction recording the higher $\beta$ value ($\beta=.54, p<.001$) followed by stress management ($\beta=-.15, p<.05$) and role limitations ($\beta=-.14, p<.05$).

After the entry of the sleep related variables at Step 4, the total variance explained by the model was 36% $F(21, 305)=8.28, p<.001$). The sleep related variables explain an additional 5% of the variance in alcohol use after age, gender, health and mood regulating variables have been statistically controlled for: $R^2$ change=.05, $F$ change (10, 305)=2.31, $p<.05$.

In the final model, physiological distraction, stress management, parasomnias and daytime dysfunction were statistically significant, with physiological distraction recording the higher $\beta$ value ($\beta=.53, p<.001$) followed by parasomnias ($\beta=.19, p<.01$), stress management ($\beta=-.17, p<.01$) and daytime dysfunction ($\beta=.13, p<.05$). Partial correlation coefficients indicated that physiological distraction made the largest unique contribution, accounting for 18.49% of the variance in alcohol use.
Table 12
Summary of Hierarchical Multiple Regression Analyses Predicting Alcohol Use from Health, Mood regulating and Sleep Related Variables

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
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<td>$\Delta R^2$</td>
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<td>-.06</td>
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<td>-.15**</td>
<td>-.07</td>
<td>-.09</td>
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<td>.09</td>
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<tr>
<td>Pain</td>
<td>.08</td>
<td>.04</td>
<td>.00</td>
<td></td>
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<tr>
<td>Role Limitations</td>
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<td>-.14**</td>
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<td>.53***</td>
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<td>Active Cognitive Management</td>
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<td>Medication Use</td>
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<tr>
<td>Daytime Dysfunction</td>
<td>.13*</td>
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<tr>
<td>Sleep Latency</td>
<td>.10</td>
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</tbody>
</table>

Note. $N=327$ *$p<.05$ **$p<.01$ ***$p<.001$
Summary. A variable approach was used in the current study to examine whether self-reported depression, anxiety, stress, and substance use could be predicted by sleep quality and sleep disturbances. Four hierarchical regression analyses were used to examine the predictive value of sleep variables in self-reported depression, anxiety, stress, illicit substance and alcohol use, whilst controlling for the effects of age and gender.

The findings indicated that sleep related variables explained an additional 27.5% of the variance in self-reported depression symptoms after age and gender were controlled for. Daytime dysfunction and sleep duration made statistically significant contributions, with daytime dysfunction making the largest unique contribution. In relation to anxiety, the sleep related variables explain an additional 28% of the variance in self-reported anxiety symptoms after age and gender were controlled for, with parasomnias, hypersomnia, sleep duration and sleep disturbance, making statistically significant contributions. In particular, parasomnias and hypersomnia made the largest unique contributions. Furthermore, in relation to stress, the sleep related variables explain an additional 29% of the variance in self-reported stress symptoms after age and gender were controlled for. Three sleep variables made statistically significant contributions including parasomnias, daytime dysfunction and use of medication to sleep. Parasomnias made the largest unique contribution to the explained variance in self-reported stress symptoms. In relation to illicit substance use, the sleep related variables explain an additional 7% of the variance in self-reported illicit substance use, with only parasomnias making a statistically significant contribution. Finally, in relation to alcohol use, the sleep related variables explain an additional 12% of the variance in self-reported alcohol use. Gender and parasomnias made statistically significant contributions, with parasomnias making the largest unique contribution.

Further, five more hierarchical regression analyses were conducted to examine how much of the variance in self-reported depression, anxiety, stress, illicit substance and alcohol use, sleep related variables were able to explain, once health related and mood regulating variables were accounted for. Findings of these analyses indicate that once health related and mood regulating related variables were entered into the model, sleep related variables accounted for an additional 8% of the variance in depression, 6%
in anxiety, 9% in stress and 5% in alcohol use. Sleep related variables did not significantly explain any variance in illicit substance use.

Daytime dysfunction, behavioural management, pain and physical functioning made unique contributions to the explained variance in self-reported depression, with the most useful predictors identified as daytime dysfunction and behavioural management. Sleep duration and pain made unique contributions to the explained variance in self-reported anxiety, with pain identified as the most useful predictor of anxiety. Parasomnias, medication use, pain and age made unique contributions to self-reported stress. Parasomnias were found to be the most useful predictor of stress. Physiological distraction, pain, sleep disturbance and age made unique contributions to the explained variance in self-reported illicit substance use, with the most useful predictor identified as pain. Physiological distraction, stress management, parasomnias and daytime dysfunction made unique contributions to the explained variance in self-reported alcohol use, with physiological distraction identified as the most useful predictor.

7.7 A Person-Oriented Approach Using Cluster Analysis: Young Adults’ Sleep Profiles and Their Relationship to Perceived Emotional and Physical Health, Substance Use and Mood regulating Strategies

The focus of this section is the results of a person-oriented approach, which was used in the current study to explore sleep profiles of young Australian adults. A person-oriented approach was used to consider the profile of scores among individuals (Bergman & Magnussen, 1997) based on sleep disturbance characteristics. This approach was used to explore whether there were distinct profiles of young adults who reported a pattern of different symptoms of sleep disturbances. In addition, another aim was to examine if these profiles could be differentiated by specific emotional and physical health symptoms. Cluster analysis was used to identify profiles characterised by differing scores on the four subscales of the Sleep Disorder Questionnaire (Violani et al.; 2000; 2004), namely, insomnia, hypersomnia, sleep apnoea and parasomnias. Following the cluster analysis, a series of MANOVAs were performed to explore differences and similarities between the sleep disorder clusters.
First, in this chapter a brief review of the cluster analysis literature is presented to provide a rationale for the methodology and to outline some of the issues that are relevant to the use of cluster analysis. Secondly, the results of the cluster analysis for the current study are presented. Finally, the findings from a series of MANOVAs are presented which examine differences and similarities between the clusters on depression, anxiety, stress, physical functioning, pain, illicit substance use, alcohol use and mood regulating strategies, to examine whether different sleep profiles are associated with different physical and emotional health outcomes.

**Background on cluster analysis.** Cluster analysis is a statistical classification technique used to generate classifications from previously unclassified data (Everitt, 1980). Classifications are generated by sorting cases or variables into groups, given their similarity on a number of specified dimensions (Henry, Tolan, & Gorman-Smith, 2005). The aim of the sorting process is to produce clusters that maximise within-group similarity and minimise between-group similarity (Henry et al., 2005). The fundamental idea behind classification is to identify meaningful patterns among groups in order to understand the way in which members of each group are similar and the way in which groups may differ from one another (Everitt, 1980).

Cluster analysis has been used widely in research, with studies using classification methods to explore symptoms of cancer (Atay et al., 2012), obesity (Lo Coco, Gullo, Scrima, & Bruno, 2012), illness perception (Clatworthy et al., 2007), emerging adults (Padilla-Walker, Nelson, & Carroll, 2012), college students (Bahr & House, 2011), substance use among university students (Primack et al., 2012), family psychology (Henry, Tolan, & Gorman-Smith, 2005), adolescent sexual styles (Buzwell, 1996) and personality profiles among insomnia patients (Edinger, Stout, & Hoelscher, 1988). These studies demonstrate the usefulness of cluster analysis in determining the existence of sleep profiles within a population. In the current study, the use of this design facilitated an exploration of young adults’ sleep profiles and their associated correlates of mood regulation, substance use, as well as emotional and physical health, contributing to the current health literature among Australian young adults. Knowledge regarding young adults perceived sleep quality and sleep disturbances and its relationship with symptoms of depression, anxiety, and stress as well as physical health,
is limited in Australia. Thus, the design of the current study facilitated the identification of young adults who fit different health profiles according to their reported sleep disturbances, adding to the current knowledge in this area.

**Essential issues in cluster analysis.** Despite the widespread use of cluster analysis in research, the advancement of knowledge regarding the effective management of methodological issues with this technique has been limited (Bergman & Magnussen, 1997; Blashfield & Aldenderfer, 1988; Everitt, 1980). The common criticisms of cluster analysis include the unique manner for deciding upon the number of clusters, justifications for choosing the best cluster method and how to best validate and justify the solution (Blashfield, 1980; Blashfield & Aldenderfer, 1988; Everitt; 1980). Blashfield (1980) recommended five propositions to be kept in mind when using a subjective procedure such as cluster analysis. These include:

1. An unambiguous description of the cluster analytic method should be provided.
2. The choice of the similarity measure (or statistical criterion if an iterative procedure is used) should be clearly specified.
3. The computer program used to perform the cluster analytic method should be stated.
4. The procedure used to determine the number of clusters should be explained.
5. Adequate evidence of the validity of a cluster analytic solution should be provided before the solution is published.

The following section will address each of Blashfield’s (1980) propositions as well as other considerations such as the sample to be clustered, choice of variables, as well as the standardisation of data, in relation to the current study.

**The cluster analytic method.** The seven major families of clustering methods are hierarchical agglomerative, hierarchical divisive, iterative partitioning, density search, factor analytic, clumping and graph theoretic (Aldenderfer & Blashfield, 1988). Among these, the most popular methods for cluster analysis are the agglomerative hierarchical methods (Blashfield, 1976). In a review of all published articles using
cluster analysis during the 1970s, hierarchical agglomerative cluster methods were found to account for approximately two thirds of all applied uses of cluster analysis (Blashfield & Aldenderfer, 1978). Historically, hierarchical methods were a faster solution to produce and for that reason were the most popular during the 1970s and remain so today (Hair, Anderson, Tatham, & Black, 2006). Hierarchical agglomerative methods create clusters using a similarity-dissimilarity matrix and gradually, similar entities are placed within the same cluster (Blashfield, 1976). The culmination of this process is when all individuals are in the same cluster (Everitt, 1981). Differences between hierarchical agglomerative methods are due to the different ways in which distance or similarity can be defined between individuals and groups (Everitt, 1981). Single linkage, average linkage, complete linkage and Ward’s method are four different hierarchical agglomerative methods. These methods will be briefly described as follows.

Single linkage methods work by fusing individuals, to other groups based on the distance between the groups. The groups with the smallest distance between them are fused. Therefore, distance between groups is defined as the distance between their closest members (Everitt, 1981). In “single linkage cluster analysis, clusters are defined as group of entities, so that within the cluster every member is more similar to at least one member of the same cluster than to any member of another cluster” (Blashfield, 1976, p.378). Average linkage differs in the sense that the members of each cluster have a greater mean similarity with all members of the same cluster than with members of other clusters (Blashfield, 1976). The complete linkage method is opposite to the single linkage method in terms of the way in which distance is defined. Complete linkage method defines distance between groups as the distance between the furthest pair of individuals. Finally, Ward’s method, also known as the minimum variance method, creates clusters to minimise the variance within the clusters (Blashfield, 1976). Several studies have empirically investigated the accuracy of each of these methods in determining the number of groups in underlying populations (e.g., Blashfield, 1976; Borgen & Barnett, 1987; Breckenridge, 2000; Clatworthy et al., 2007; Everitt, 1980; Hair et al., 2006). The consensus seems to be that average linkage and Ward’s method are the best of the hierarchical methods in terms of their efficacy in recovering underlying natural structure in a dataset (Blashfield, 1976; Borgen & Barnett, 1987;
Breckenridge, 2000; Clatworthy et al., 2007). More recently, a combination of both hierarchical and non-hierarchical methods has been used throughout research to reap the benefits of each approach (Hair et al., 2006). Most commonly, Ward’s method and K-means have been used to complement the strengths of each approach, Ward’s method being run first to identify the centroids and number of clusters and then K-means analysis using the centroids and number of clusters to fine tune the clusters, reassigning cases (Clatworthy et al., 2007; Hair et al., 2006; Lorr & Strack, 1994). Therefore, a combination of both Ward’s method and K-means analysis was used in the current study.

**Similarity measure.** The concept of similarity and distance is important to the resulting cluster solution, as this is what defines the way the entities are grouped (Everitt, 1981; Hair et al., 2006). Distance measures, which are converted into a similarity measure by using the inverse relationship, are the most commonly used measure of similarity in cluster analysis (Hair et al., 2006). As the squared Euclidean distance is the recommended distance measure for Ward’s method (Hair et al., 2006) this distance measure was used in the current study.

**Cluster procedure and validation.** The computer program used to generate the cluster solution in the current study was IBM’s Statistical Package for the Social Sciences (Version 19). Prior to performing the cluster analysis, the data were screened for missing values. Less than 5% of cases were missing for each of the scales used in the questionnaire. Missing values were replaced using the series mean of each scale. The SDQ variables were used to cluster the data, given the aim of the current study was to explore the differential experience of sleep disturbances among young adults. The decision was made not to use the PSQI to cluster data, in order to be able to use the sleep quality measure to compare and validate the clusters. Before performing the analysis, scores on the SDQ measure were converted to Z scores to reduce potential bias from differences across the variables means and standard deviations (Hair et al., 2006).

Both hierarchical and non-hierarchical clustering procedures were used. This allowed for the non-hierarchical procedure to complement the initial hierarchical solution by ‘fine tuning’ and confirming the number of clusters (Hair et al., 2006). Firstly, a hierarchical cluster analysis was performed using Ward’s method and squared
Euclidean distance. Hierarchical classifications are represented by a dendogram which is a two dimensional illustration that picture the fusions or divisions which have been made at each stage of the cluster analysis (Everitt, 1980). Groups formed at each level of the dendogram demonstrate a separation within the set of data and therefore can be used to determine how many clusters are represented in the dataset (Everitt, 1980). Examination of the dendogram (see Appendix E) indicated possible cluster solutions of two, three or eight clusters. An independent observer was also asked to inspect the dendogram and confirmed there were between two, three and eight clusters evident (D.Meyer, personal communication, September 26, 2012). Analyses of Variance were conducted to compare each cluster solution on whether the clusters were clearly defined by differences on mean scores of insomnia, hypersomnia, sleep apnoea and parasomnias. Conceptually, a three cluster solution was most appropriate as there were clear differences between each cluster’s profile on mean scores of insomnia, hypersomnia, sleep apnoea and parasomnias. Results of the analyses of variance for a three cluster solution are reported on page 116.

To confirm the appropriateness of a three cluster solution, a non-hierarchical K-means Quick Cluster analysis was performed to ‘fine tune’ the solution obtained using the hierarchical method (Hair et al., 2006). The cluster centroids (means) from the hierarchical three cluster solution were used as the initial cluster centres and a three cluster solution was specified. The K-means analysis then reassigned cases based on the closest centroid, refining the clusters. A Chi square analysis indicated that 87.5% of cases being correctly clustered into cluster 1, 96.8% of cases were correctly clustered into cluster 2, and 85.7% of cases being correctly classified into cluster 3 \( \chi^2(4)=416.54, \ p<.001 \). This indicates that the majority of cases were reassigned to the same cluster in the K-means analysis as they were in the hierarchical method, with only a small proportion being reassigned to a different cluster. This provides support for the stability of the cluster membership and given the little variability between the hierarchical solution and the K-means solution, thus further analyses will be based on the initial hierarchical solution which made greater conceptual sense which was determined by examining whether each cluster significantly differed from one another on mean scores on insomnia, hypersomnia, sleep apnoea and parasomnias.
Further confirmation for a three cluster solution was indicated in the agglomeration schedule. Limited variation in the agglomeration schedule coefficients existed between two, three and four clusters which indicated homogenous clusters were being formed up to a four cluster solution. In addition, a Principal Components Analysis was conducted on the variables used to generate the cluster solution, as this has been reported as an acceptable validation of the number of clusters (Buzwell, 1996). The principal components analysis on the variables resulted in three factors with Eigenvalues greater than one. This supported the decision to retain a three cluster solution.

Profile of the three clusters. Figure 1 below displays each cluster’s profile of standardised scores on the SDQ (Violani et al., 2000; 2004) variables. Each cluster had a distinct profile on scores of the SDQ and as such they were named accordingly. The profile of each cluster is described below, followed by an examination of the differences on the SDQ variables using MANOVA which is presented on page 116.

![Figure 1. Standardised scores on the Sleep Disorders Questionnaire (SDQ) variables for each of the three clusters of young adults](image-url)
As can be seen in Figure 1, the profile of Z-scores on the variables of the SDQ differed between clusters. These distinct profiles represent three clusters of young adults, which significantly differ in regard to their scores on each of the sleep disturbances; insomnia, hypersomnia, parasomnias and sleep apnoea. Of the 327 young adults in the current study, 68.5% (n=224) were classified into Cluster 1. Further, Cluster 1 scored significantly lower than Clusters 2 and 3 on symptoms of insomnia, hypersomnia and parasomnias. Cluster 1 scored significantly lower than Cluster 3 on symptoms of sleep apnoea, yet did not differ from Cluster 2. Cluster 2 comprised approximately 22% (n=72) of the sample. Young adults in cluster 2 scored significantly higher than those in both Cluster 1 and Cluster 3 on symptoms of insomnia, distinguishing this cluster as consistent with an insomniac type profile. Cluster 3 comprised 9.5% (n=31) of the sample. Participants in cluster 3 scored significantly higher on sleep apnoea, hypersomnia and parasomnias than any other cluster. Cluster 3 scored significantly higher than Cluster 1 on symptoms of insomnia, yet significantly lower than the Cluster 2 on this variable. Therefore, this cluster was consistent with a profile of mixed sleep disturbances, distinguishing them as the Problem Sleepers.

**Analysis of differences between the clusters on the SDQ variables.** A MANOVA was conducted to examine differences between each cluster on each of the four sleep disorder variables. Post hoc comparisons using Bonferroni’s adjustment were used to determine statistically significant differences between clusters. Statistically significant differences between clusters was expected given clusters were formed on the basis of these differences, however the MANOVA results will be reported to describe the profile of each cluster rather than to imply these differences validate the clusters (Borgen & Barnett, 1987).

First, in order to examine whether it was possible to collapse across gender when examining differences between clusters on the SDQ variables, an initial MANOVA was performed with both gender and cluster as factors. A significant main effect of cluster was revealed (Wilks’ Lambda=.12, F (8, 636) =149.47, p<.001), yet the effect of gender was not significant (Wilks’ Lambda=.97, F(4, 318)= 2.32, p=.06). When the results for the dependent variables were considered separately using a Bonferroni adjusted alpha level of .01, the interaction term was not statistically
significant for any of the SDQ variables. Upon inspection of the mean scores, there was a non-significant trend where females reported higher scores on insomnia than males, across the three clusters. As this was a non-significant trend expected in the normal population (Hale et al., 2009; Roberts et al., 2000), results were collapsed across gender to explore differences between the three clusters on the dimensions of the SDQ. Table 13 displays the means, standard deviations and results of post-hoc comparisons for each cluster, which examines differences among the clusters on dimensions of the SDQ.
Table 13

Means and Standard Deviations on the Four Subscales of the Sleep Disorders Questionnaire (SDQ) for the Three Young Adult Clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
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<td>Problem Sleeper</td>
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</tr>
<tr>
<td></td>
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<td>SD</td>
<td>M</td>
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</tr>
<tr>
<td></td>
<td>1.10a</td>
<td>.25</td>
<td>1.14a</td>
<td>.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.23b</td>
<td>.35</td>
<td></td>
</tr>
</tbody>
</table>

Note. N=327. Means having the same subscript were not significantly different at p < .01 in the Bonferroni adjusted significantly difference comparison. Partial η² effect sizes: small=.10, medium=.30, large=.50

Non-disturbed sleepers had significantly lower mean scores (indicating less of the condition) on insomnia, hypersomnia and parasomnias, indicating less frequent experience of these symptoms. In relation to mean sleep apnoea scores, Non-Disturbed sleepers did not differ from the Insomniacs. The Insomniacs scored significantly higher than all other clusters on insomnia symptoms, indicating that on average, this cluster reports more frequent experience of insomnia type symptoms. This cluster scored significantly higher than the Non-Disturbed Sleepers on hypersomnia and parasomnias, yet significantly lower on these measures compared to the Problem Sleepers cluster. These findings suggest that whilst the Insomniacs cluster predominantly report greater insomnia symptoms, they also report other sleep disturbance symptoms such as hypersomnia and parasomnias more so than the Non-Disturbed sleepers, yet not as frequently as the Problem Sleepers.

The Problem Sleepers group scored significantly higher than the other clusters on hypersomnia, parasomnias and sleep apnoea, except for insomnia, where they scored significantly lower than the Insomniacs but significantly higher than the Non-Disturbed Sleepers. These findings indicate the Problem Sleepers reported the most frequent
experience of sleep disturbance symptoms including hypersomnia, parasomnias and sleep apnoea compared to the Non-disturbed sleepers and Insomniacs.

**Descriptive demographics for each of the young adult sleep clusters.** The demographic profile of each cluster was explored in order to examine whether there are different demographic characteristics associated with each sleep profile. The clusters were compared on age, gender, education, employment and student status. Mean ages and gender distribution across cluster are presented in Table 14 and the frequency distribution of education, employment and student status are presented in Table 14.

Table 14

*Pattern of Descriptive Demographics and Distributions for Gender and Age across the Young Adult Sleep Clusters.*

<table>
<thead>
<tr>
<th></th>
<th>Non-Disturbed Sleepers n=224</th>
<th>Insomniacs n=79</th>
<th>Problem Sleepers n=31</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M</em></td>
<td>20.45</td>
<td>19.99</td>
<td>20.39</td>
</tr>
<tr>
<td><em>SD</em></td>
<td>2.61</td>
<td>2.43</td>
<td>2.69</td>
</tr>
<tr>
<td><strong>% of Total Males and Females within each cluster</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>29</td>
<td>15.3</td>
<td>41.9</td>
</tr>
<tr>
<td>Female</td>
<td>71</td>
<td>84.7</td>
<td>58.1</td>
</tr>
<tr>
<td><strong>N of Total Males and Females within each cluster</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>65</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Female</td>
<td>159</td>
<td>61</td>
<td>18</td>
</tr>
</tbody>
</table>

*Note. N=327*

**Age and gender.** A one-way analysis of variance (ANOVA) was conducted to examine differences in age between clusters. Results revealed no significant differences in age between the clusters (*F* (2, 324) =.89, *p*=.41). Next, a one-way contingency table analysis was conducted to examine differences between clusters in gender distribution. A significant association was found among the clusters regarding gender, *χ^2* (2, *N*=327) = 8.94, *p*=.01. Upon further inspection, whilst the cell cross tabulating males in cluster 2 approached the critical value with a standardised residual of -1.9, all other standardised residuals for particular cells were less than two, thus indicating no
differences in the distribution of gender across clusters. Therefore, this suggests that
gender was not a distinguishing demographic characteristic across the three clusters,
with males and females comprising relatively equivalent proportions in each of the
clusters.

**Employment, education and student status.** Table 15 presents the frequency of
employment, education and student status for each of the three clusters. Three separate
one-way contingency table analyses were conducted to examine differences between
clusters in employment, education level and student status. No significant associations
were found between the clusters for employment, education and student status,
indicating that the pattern of demographic information relevant to employment,
education and student status was similar across clusters
Table 15
Frequency Distributions for Employment, Education and Student Status across the Young Adult Sleep Clusters.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Disturbed Sleepers (n=224)</th>
<th>Insomniacs (n=72)</th>
<th>Problem Sleepers (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not currently employed</td>
<td>25.9</td>
<td>29.2</td>
<td>25.8</td>
</tr>
<tr>
<td>Employed casually</td>
<td>39.7</td>
<td>40.3</td>
<td>29.0</td>
</tr>
<tr>
<td>Employed part time</td>
<td>23.2</td>
<td>23.6</td>
<td>45.2</td>
</tr>
<tr>
<td>Employed full time</td>
<td>11.2</td>
<td>6.9</td>
<td>.0</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 10 or lower</td>
<td>.50</td>
<td>.0</td>
<td>.0</td>
</tr>
<tr>
<td>Year 11</td>
<td>.50</td>
<td>.0</td>
<td>.0</td>
</tr>
<tr>
<td>VCE</td>
<td>53.3</td>
<td>46.3</td>
<td>58.1</td>
</tr>
<tr>
<td>Commenced University/TAFE</td>
<td>36.2</td>
<td>44.8</td>
<td>35.5</td>
</tr>
<tr>
<td>Graduated with a diploma</td>
<td>4.5</td>
<td>1.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Graduated with a degree</td>
<td>5.0</td>
<td>7.5</td>
<td>.0</td>
</tr>
<tr>
<td>Student Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not a student</td>
<td>8.9</td>
<td>5.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Part time student</td>
<td>11.2</td>
<td>8.3</td>
<td>.0</td>
</tr>
<tr>
<td>Full time student</td>
<td>79.9</td>
<td>86.1</td>
<td>96.8</td>
</tr>
</tbody>
</table>

Note. \(N=327\). Sample N’s differ for the variable Education, as 30 participants did not provide their education level.

Validation of the clusters using the PSQI. To examine and validate differences between clusters on the PSQI a second MANOVA was conducted. This was to develop a more comprehensive understanding of the profile of each of the clusters and to examine whether each cluster differentially related to components of sleep quality. To rule out the possibility of gender interacting with cluster, which would warrant a separate analysis across gender, a MANOVA was performed with both gender and cluster as fixed factors. No gender or cluster interaction effects were found; therefore results were collapsed across gender when exploring differences between the three clusters. As seen in Table 16, the MANOVA analysis revealed a significant multivariate effect of sleep latency, daytime dysfunction, use of sleep medication, sleep disturbance and sleep quality across the three clusters of young adults (Wilks’...
As can be seen in Table 16, there was no significant difference between the clusters in terms of their reported sleep duration. However, in relation to sleep latency, the Insomniacs scored significantly higher than the other clusters, indicating that on average they reported it took them longer to fall asleep; whereas there was no difference in sleep latency scores between the Non-Disturbed Sleepers and the Problem Sleepers. Daytime
dysfunction was lowest among the Non-Disturbed Sleepers and higher in the Insomniacs and Problem Sleepers who significantly differed from the Non-Disturbed Sleepers, but who did not differ from one another. The Non-Disturbed Sleepers also reported significantly lower use of sleep medication than the Problem Sleepers. However they did not differ in their sleep medication use from the Insomniacs and the Insomniacs did not significantly differ from the Problem Sleepers. The Non-Disturbed Sleepers scored lower compared to the other clusters on sleep quality and sleep disturbance, which indicates greater quality sleep and fewer disturbances to sleep. Insomniacs and Problem Sleepers did not significantly differ on their sleep quality and sleep disturbance mean scores. These findings provide validation for the three cluster solution, indicating that the two clusters which reported more frequent sleep disturbances had a similar profile in relation to their reported sleep quality and differed significantly from those reporting minimal sleep disturbances. The Insomniacs reported significantly greater sleep latency scores than the other clusters, providing further validation that this group’s scores are consistent with an insomniac profile. When examining the proportion of varying sleep durations among young adults within each cluster, it is evident that a greater proportion of young adults in the non-disturbed cluster reported obtaining between 8 and 9 hours sleep per night, on average (44.6%), compared to the Insomniacs (30.6%) and the Problem Sleepers (29%). Similarly, a greater proportion of young adults in the Insomniacs (31.94%) and Problem Sleepers (32.3%) groups reported obtaining less than 6 hours sleep duration on average, per night, compared to the Non-Disturbed Sleepers (16.5%).

**Analysis of differences between the clusters on the DASS variables.** To examine whether there were differences among males and females in the profile shown on depression, anxiety and stress across the clusters; a MANOVA was performed to examine potential gender differences. The MANOVA showed a significant main effect of cluster (Wilks’ Lambda = .86, $F(6, 638) = 8.14, p < 0.001$, partial $\eta^2 = .07$) and gender (Wilks’ Lambda = .97, $F(3, 319) = 2.97, p = .03$, partial $\eta^2 = .03$), with the main effect for gender indicating the greater propensity for females to report greater stress (See Table 17). The interaction term, (Wilks’ Lambda = .96, $F(6, 638) = 2.07, p = .06$), was not significant, indicating that the pattern of differences between clusters on these variables was similar for males and females. Results were therefore collapsed across gender to
explore differences between the three clusters on the variables. Table 17 displays the means, standard deviations and results of post-hoc comparisons for scores of depression, anxiety and stress across cluster.

Table 17
Means and Standard Deviations on the Three Subscales of the DASS-21 for the Three Young Adult Clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Disturbed Sleepers n=224</th>
<th>Insomniacs n=72</th>
<th>Problem Sleepers n=31</th>
<th>F</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>$M$ 9.43$_a$</td>
<td>14.35$_b$</td>
<td>18.49$_b$</td>
<td>11.29***</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>$SD$ 8.81</td>
<td>9.89</td>
<td>13.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>$M$ 6.93$_a$</td>
<td>12.93$_b$</td>
<td>16.35$_b$</td>
<td>22.82***</td>
<td>.12</td>
</tr>
<tr>
<td></td>
<td>$SD$ 7.58</td>
<td>7.92</td>
<td>10.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>$M$ 12.53$_a$</td>
<td>18.61$_b$</td>
<td>19.74$_b$</td>
<td>12.04***</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>$SD$ 9.07</td>
<td>8.65</td>
<td>12.03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N=327 Means having the same subscript are not significantly different at $p<.02$ in the Bonferroni adjusted significantly difference comparison. Partial $\eta^2$ effect sizes: small=.10, medium=.30, large=.50

The results revealed a significant multivariate effect of depression, anxiety and stress across the three clusters of young adults, ($Wilks' \Lambda=.86, F(6, 638)=8.14$, $p<.001$, partial $\eta^2=.07$). Univariate tests showed significant differences in depression $F(2, 321)=11.29, p<.001$, partial $\eta^2=.07$), anxiety $F(2, 321)=22.82, p<.001$, partial $\eta^2=.12$) and stress $F(2, 321)=12.04, p<.001$, partial $\eta^2=.07$) between the clusters, as displayed in Table 15. Post hoc comparisons revealed that the Non-Disturbed cluster scored significantly lower on depression, anxiety and stress in comparison to the Insomniacs and the Problem Sleepers, yet the Insomniacs and Problem Sleepers did not significantly differ from each other on these variables. In order to examine whether the severity of depression, anxiety, and stress symptoms differed across the clusters, participants depression, anxiety and stress scores were classified according to severity using the DASS severity ratings (Lovibond &
Lovibond, 1995). The severity ratings were cross-tabulated and a Chi Square test was conducted. According to the DASS severity ratings (Lovibond & Lovibond, 1995), 41.9% of the Problem Sleepers cluster scored in the extremely severe range of depression, with lower proportions of the Insomniacs (12.5%), and Non-Disturbed Sleepers (4.5%) reporting scores in this range. A Chi Square analysis indicated a significant association between depression severity rating and cluster membership $\chi^2(8, n=327)=54.29$, $p<.001$, $Cramer's V=.29$. Young adults reporting depressive symptoms within the extremely severe range were more likely to be represented in the Problem Sleepers cluster, compared with the other two clusters.

In relation to the anxiety severity ratings (DASS; Lovibond & Lovibond, 1995), 41.9% of the Problem Sleepers scored in the extremely severe range of anxiety, whereas a lower proportion of Insomniacs (26.4%) and Non-Disturbed Sleepers (9.4%) reported scores in this range. A Chi Square analysis indicated a significant association between anxiety severity rating and group membership $\chi^2(8, n=327)=57.28$, $p<.001$, $Cramer's V=.30$. Therefore, young adults reporting extremely severe anxiety were more likely to be represented in the Problem Sleepers cluster, compared to the other two clusters.

In relation to the stress severity ratings (DASS; Lovibond & Lovibond, 1995), 12.9% of the Problem Sleepers scored in the extremely severe range of stress, while lower proportions of the Insomniacs (4.2%) and Non-Disturbed Sleepers (3.1%) reported scores in this range. A Chi Square analysis indicated a significant association between stress severity rating and cluster membership $\chi^2(8, n=327)=37.20$, $p<.001$, $Cramer's V=.24$. Therefore, young adults reporting extremely severe to severe stress symptoms were more likely to be represented in the Problem Sleepers cluster in comparison with the other two clusters.

Analysis of differences between the clusters on the health, alcohol and illicit substance use variables. To examine whether there were differences between males and females in each cluster’s profile of health and substance use; a MANOVA was conducted to explore potential gender effects. The MANOVA showed a significant main effect of cluster ($Wilks' Lambda = .85$, $F(10, 634) = 5.38$, $p<.001$, partial $\eta^2 = .08$). However, no gender or cluster interaction effects were found; indicating differences between clusters on these variables was similar for males and females. Results were
therefore collapsed across gender to explore differences between the three clusters on the variables. Table 18 displays the means, standard deviations and results of post-hoc comparisons for each cluster, on physical functioning, pain, role limitations, alcohol use and illicit substance use.

Table 18

Means and Standard Deviations on the SF-36 Subscales of Physical Functioning, Pain, and Role Limitations, DASS-21, Alcohol and Illicit Substance Use Measures for the Three Sleep Clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Disturbed Sleepers</th>
<th>Insomniacs</th>
<th>Problem Sleepers</th>
<th>F</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=224</td>
<td>n=72</td>
<td>n=31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Functioning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>2.80</td>
<td>2.62</td>
<td>2.43</td>
<td>15.80***</td>
<td>.08</td>
</tr>
<tr>
<td>SD</td>
<td>.34</td>
<td>.45</td>
<td>.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1.85</td>
<td>2.31</td>
<td>2.34</td>
<td>11.18***</td>
<td>.03</td>
</tr>
<tr>
<td>SD</td>
<td>.74</td>
<td>1.05</td>
<td>.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Role Limitations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1.80</td>
<td>1.57</td>
<td>1.49</td>
<td>21.26***</td>
<td>.08</td>
</tr>
<tr>
<td>SD</td>
<td>.30</td>
<td>.37</td>
<td>.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol Use Dependence Identification Tool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>6.44</td>
<td>7.67</td>
<td>10.19</td>
<td>6.65***</td>
<td>.03</td>
</tr>
<tr>
<td>SD</td>
<td>5.19</td>
<td>6.62</td>
<td>5.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substance Dependence Severity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>.46</td>
<td>.46</td>
<td>.99</td>
<td>6.13***</td>
<td>.03</td>
</tr>
<tr>
<td>SD</td>
<td>.79</td>
<td>.70</td>
<td>1.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N=327. ***Significant at the Bonferroni adjusted alpha level of \( p < .01 \). Means having the same subscript are not significantly different at \( p < .01 \) in the Bonferroni adjusted significantly difference comparison. Partial η² effect sizes: small=.10, medium=.30, large=.50

The results revealed a significant multivariate effect of physical functioning, pain, role limitations, alcohol use and illicit substance use between the three clusters of young adults (Wilks’ Lambda = .85, \( F (10, 634) = 5.38, p < .001 \), partial η² = .08). As can be seen in Table 18, univariate tests indicated significant differences in physical functioning \( F (2, 321) = 13.77, p < .001 \), partial η² = .08, pain \( F (2, 321) = 13.77, p = .009 \), partial η² = .08, role
Post hoc comparisons revealed that the Non-Disturbed cluster scored significantly higher on physical functioning and role limitations in comparison to the Insomniacs and the Problem Sleepers, indicating the Non-Disturbed cluster reported better perceived health in terms of their physical functioning and fewer limitations to their social, occupational roles. The Insomniacs and Problem Sleepers did not significantly differ from each other on their perceived physical functioning or role limitations. The Non-Disturbed cluster was significantly lower on perceived pain, in comparison to the Insomniacs and Problem sleepers, while the Insomniacs and Problem sleepers did not differ from each other. A significant difference in mean alcohol use was found between the Non-Disturbed cluster and the Problem sleepers, with the Problem sleepers reporting greater alcohol use. The Insomniacs’ mean alcohol use did not significantly differ from the Non-Disturbed cluster or the Problem sleepers. In relation to illicit substance use, the Problem sleepers reported significantly greater use of illicit substances than the Insomniacs and Non-Disturbed clusters, the Insomniacs and Non-Disturbed clusters did not differ from each other.

Differences between young adult sleep clusters regarding frequency and effectiveness of mood regulation strategies.

**Frequency.** The last two MANOVAs were conducted to compare differences across clusters regarding how frequently they used a variety of different mood regulation strategies and how effective they rated each group of strategies to be at changing a negative mood. The first MANOVA examined differences across gender and clusters regarding the frequency of use of different mood regulating strategies. To first test whether there were differences between males and females on these variables a MANOVA was performed with both gender and cluster as fixed factors. Multivariate tests showed a significant main effect of cluster (Wilks’ Lambda=.85, F (12, 632) =4.38, p<.001) and gender (Wilks’ Lambda=.89, F(6, 316)= 6.27, p<.001) with the main effect for gender indicating the greater propensity for males to more frequently use physiological distraction to regulate a negative mood than females F (1, 321)=9.53, p<.001, partial $\eta^2=.03$. Upon inspection of the mean scores, there was a non-significant trend where females reported
higher mean scores on active pleasurable distraction than males and males reported higher mean scores on stress management than females, across the three clusters. Importantly, the interaction term was not significant, indicating that the pattern of differences in mood regulating strategies across the clusters for both males and females was similar. Results were therefore collapsed across gender to explore differences between the three clusters on the dimensions of the mood regulating strategies. Table 19 displays the means, standard deviations on all mood regulating strategies and the results of univariate and post hoc comparisons.
Table 19

Means and Standard Deviations on the Frequency of Mood regulating Strategies of Active Pleasurable Distraction, Active Cognitive Management, Physiological Distraction, Behavioural Management, Stress Management and Avoidance for the Three Sleep Clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Disturbed Sleepers</th>
<th>Insomniacs n=72</th>
<th>Problem Sleepers n=31</th>
<th>F</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Pleasurable Distraction</td>
<td>M = 2.99, SD = .69</td>
<td>M = 3.24, SD = .80</td>
<td>M = 3.36, SD = .89</td>
<td>5.50**</td>
<td>.03</td>
</tr>
<tr>
<td>Active Cognitive Management</td>
<td>M = 3.13, SD = .88</td>
<td>M = 3.07, SD = .98</td>
<td>M = 3.19, SD = .88</td>
<td>.51</td>
<td>.00</td>
</tr>
<tr>
<td>Physiological Distraction</td>
<td>M = 1.86, SD = .73</td>
<td>M = 2.01, SD = .70</td>
<td>M = 2.68, SD = 1.09</td>
<td>17.24***</td>
<td>.10</td>
</tr>
<tr>
<td>Behavioural Management</td>
<td>M = 3.14, SD = .75</td>
<td>M = 3.11, SD = .77</td>
<td>M = 2.98, SD = .89</td>
<td>.79</td>
<td>.01</td>
</tr>
<tr>
<td>Stress Management</td>
<td>M = 1.94, SD = .86</td>
<td>M = 2.07, SD = .97</td>
<td>M = 2.63, SD = 1.21</td>
<td>8.10***</td>
<td>.05</td>
</tr>
<tr>
<td>Avoidance</td>
<td>M = 3.19, SD = .75</td>
<td>M = 3.05, SD = .67</td>
<td>M = 2.85, SD = .54</td>
<td>1.75</td>
<td>.01</td>
</tr>
</tbody>
</table>

Note. N=327. Means having the same subscript were not significantly different at $p < .008$ in the Bonferroni adjusted significantly difference comparison. ***Significant at the Bonferroni adjusted alpha level of $p<.008$. Partial $\eta^2$ effect sizes: small=.10, medium=.30, large=.50

Results revealed a significant multivariate effect of mood regulating strategies across the three clusters of young adults (Wilks’ Lambda =.85, $F (10, 634) = 5.38$, $p<.001$, partial $\eta^2=.08$). Univariate tests indicated significant differences in physiological distraction $F(2, 321)=17.24$, $p<.001$, partial $\eta^2=.10$ and stress management $F(2, 321)=8.10$, $p<.001$, partial $\eta^2=.05$ across the clusters. Post hoc comparisons revealed that Problem Sleepers reported more frequent use of physiological distraction to regulate a negative mood than any of the other clusters and this difference was significant. The Insomniacs and Non-Disturbed sleepers did not significantly differ from one another on the frequency on physiological distraction as a mood regulating strategy. Similarly, Problem sleepers also
scored the highest on the frequency of active pleasurable distraction and stress management as a mood regulating strategy in comparison to the Insomniacs and Non-Disturbed Sleepers. The Insomniacs and Non-Disturbed Sleepers did not differ on the frequency of use of stress management, however the Insomniacs reported more frequent use of active pleasurable distraction than the Non-Disturbed Sleepers.

**Effectiveness.** A second MANOVA was performed to compare differences across clusters regarding how effective they rated each group of strategies to be at changing a negative mood. To test whether there were differences between males and females on these variables a MANOVA was first performed with both gender and cluster as fixed factors. Multivariate tests showed a significant main effect of cluster (Wilks’ Lambda=.88, F (12, 632) =3.44, p<.001) and gender (Wilks’ Lambda=.92, F(6, 316)= 4.40, p<.001) with the main effect for gender indicating that females tended to rate active cognitive management F(1, 321)=5.44, p<.05, partial $\eta^2 =.02$, and active pleasurable distraction $F(1, 321)=12.30$, $p=.001$, partial $\eta^2 =.04$, as more effective, in comparison with males. The interaction term was not significant, indicating that the pattern of differences in mood regulating strategies across the clusters for both males and females was similar (Wilks’ Lambda=.96, F (12, 632) =1.01, $p=.44$). Results were therefore collapsed across gender to explore differences between the three clusters on the dimensions of the mood regulating strategies. Table 20 displays the means, standard deviations on all mood regulating strategies and the results of univariate and post hoc comparisons.
Table 20

Means and Standard Deviations on the Effectiveness of Mood regulating Strategies of Active Pleasurable Distraction, Active Cognitive Management, Physiological Distraction, Behavioural Management, and Stress Management for the Three Sleep Clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-Disturbed Sleepers n=224</th>
<th>Insomniacs n=72</th>
<th>Problem Sleepers n=31</th>
<th>F</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Pleasurable Distraction</td>
<td>M 3.17 SD .06</td>
<td>M 3.08 SD .13</td>
<td>M 3.01 SD .14</td>
<td>.66</td>
<td>.00</td>
</tr>
<tr>
<td>Active Cognitive Management</td>
<td>M 3.27 SD .07</td>
<td>M 3.01 SD .15</td>
<td>M 2.97 SD .17</td>
<td>2.46</td>
<td>.02</td>
</tr>
<tr>
<td>Physiological Distraction</td>
<td>M 2.09 SD .06</td>
<td>M 2.35 SD .14</td>
<td>M 2.55 SD .15</td>
<td>4.73*</td>
<td>.03</td>
</tr>
<tr>
<td>Behavioural Management</td>
<td>M 3.76 SD .06</td>
<td>M 3.64 SD .14</td>
<td>M 2.96 SD .15</td>
<td>11.41***</td>
<td>.07</td>
</tr>
<tr>
<td>Stress Management</td>
<td>M 2.41 SD .09</td>
<td>M 2.43 SD .19</td>
<td>M 2.54 SD .21</td>
<td>.15</td>
<td>.00</td>
</tr>
</tbody>
</table>

Note. N=327. Means having the same subscript were not significantly different in the Bonferroni adjusted significantly difference comparison; *** p<.001, ** p<.01, *p<.05. Partial $\eta^2$ effect sizes: small=.10, medium=.30, large=.50

Results revealed a significant multivariate effect of mood regulating strategies across the three clusters of young adults ($Wilks' Lambda = .88$, $F (12, 632) = 3.44, p<.001$, $partial \eta^2 = .06$). Univariate tests indicated significant differences in physiological distraction $F(2, 321)=4.73, p<.01$, $partial \eta^2 = .03$ and behavioural management $F(2, 321)=11.41, p<.001$, $partial \eta^2 = .07$ across the clusters. Post hoc comparisons revealed that Problem Sleepers rated physiological distraction as more effective in regulating a negative mood than the Non-Disturbed sleepers; however they did not differ from the Insomniacs. There was no difference between the efficacy ratings of physiological distraction between the Non-Disturbed Sleepers and the Insomniacs. Moreover, the Problem sleepers rated behavioural management as less effective in changing a negative mood than both the Non-
Disturbed Sleepers and the Insomniacs; however these cluster did not differ from one another.

**Summary.** Results of the cluster analysis identified three distinct profiles of young adults regarding the extent to which they reported experiencing each of the four sleep disturbances of insomnia, hypersomnia, parasomnias and sleep apnoea as measured by the SDQ. There were no differences across the clusters regarding the pattern of demographic information including age, gender, employment, education, and student status. Firstly, the Non-Disturbed Sleepers had greater quality sleep and fewer disturbances to sleep, better perceived health in terms of their physical functioning and social, occupational roles, lower depression, anxiety and stress scores compared to the other clusters. The Insomniacs reported more frequent insomnia symptoms, whereas the Problem Sleepers reported more frequent symptoms of hypersomnia, sleep apnoea and parasomnias. Insomniacs and Problem Sleepers did not differ in terms of their reported sleep quality. Insomniacs and Problem Sleepers reported greater depression, anxiety and stress compared to the Non-Disturbed Sleepers yet they did not significantly differ from each other. However a greater proportion of people reporting extremely severe to severe levels of depression, anxiety and stress were represented in the Problem Sleepers cluster. Problem Sleepers also reported more frequent use of physiological distraction to regulate a negative mood than any of the other clusters. This is consistent with the finding that the Problem sleepers reported significantly greater use of illicit substances than the Insomniacs and Non-Disturbed clusters. Interestingly, Problem Sleepers also reported greater use of stress management as a mood regulating strategy in comparison to the Insomniacs and Non-Disturbed Sleepers, perhaps a reflection of the greater perceived stress experienced amongst this cluster. Findings in the present sample indicated a degree of variation among young Australian adults’ pattern of sleep disturbances, substance use, mood regulating strategies and emotional and physical health characteristics. A comprehensive discussion of these findings is presented in the following chapter.
Chapter 8: Discussion

The primary aim of the current study was to explore the relationship between self-reported sleep quality, sleep disturbances and symptoms of depression, anxiety, stress, alcohol use and illicit substance use among young adults. A further aim was to identify distinct clusters of young adults based on their self-reported symptoms of sleep disturbances and explore differences between the clusters on specific emotional and physical health correlates. The hypothesis that different components of sleep quality and various sleep disturbances would be uniquely associated with depression, anxiety, stress, alcohol use and illicit substance use was supported. However contrary to expectation, the hypothesis that insomnia would be a significant, positive predictor of anxiety and depression and that hypersomnia would be a significant, positive predictor of depression, was not supported. Further, the hypothesis that the addition of self-rated health and mood regulating strategies to the hierarchical regression models would reveal different patterns of significant, positive and negative predictors across depression, anxiety, stress, alcohol use and illicit substance use, was supported. A unique combination of sleep, health and mood related variables were found to significantly predict each of depression, anxiety, stress, alcohol and illicit substance use scores. As expected, physical functioning, pain, and role limitations due to health, were found to have negative associations with depression, anxiety, stress, alcohol use and illicit substance use, with lower scores on these health variables predicting higher scores in the aforementioned dependent variables. Consistent with expectation, young adults who reported fewer symptoms of depression, anxiety and stress were found to report greater perceived physical health, fewer role limitations due to their health and fewer symptoms of pain. These findings will be discussed in the context of previous research throughout this chapter.

The aim of this chapter is to provide a discussion of the current study’s contributions to the existing knowledge regarding sleep health among young adults. Furthermore, the broader implications of these findings will be considered in regard to their relevant application to mental health practice. Limitations of the current thesis will also be considered as well as suggestions for future research. Finally, the thesis will
conclude by summarising the contribution of the current thesis to the existing mental health literature on young adults in Australia.

8.1 Sound Asleep? Young Adults in a 24/7 society

In exploring the sleep quality of predominantly university educated, Australian young adults, the current study adds to previous literature which has found young adults with high levels of education, report better sleep quality than older, less educated adults (Bruck & Astbury, 2012; Krueger & Friedman, 2009; Soltani et al., 2012). In the current study, young adults reported sleeping for an average of 7.42 hours per night and overall indicated low to moderate difficulties with their sleep. The U.S National Sleep Foundation (2013) and Sleep Disorders Australia (2006) recommend obtaining between 7 and 9 hours of sleep per night, indicating that young adults in the current study are generally obtaining the recommended sleep duration. On average, the young adults in this sample reported low to moderate symptoms of insomnia, hypersomnia, sleep apnoea and parasomnias.

These findings are consistent with previous research, whereby young adults aged between 18 and 25 were relatively less affected by sleep disturbance symptoms such as insomnia and excessive daytime sleepiness and were more likely to report longer sleep duration, than older age groups (e.g. Bartlett et al., 2008). The current study extends the findings of Bartlett et al. (2008) to include young adults up to the age of 27 years. Whilst two years is a minimal age increase, it suggests that young adults up to the age of 27 may be less affected by sleep disturbances than older adults. Therefore, in keeping with Bartlett et al. (2008), young adults up to the age of 27 seem to be less affected by sleep disturbances than older adults which may indicate that sleep health amongst the young adult cohort in the general population may not be a significant health concern.

These findings provide a general “snapshot” of how young adults perceive their sleep habits. In relation to sleep quality and sleep disturbances, the findings reflect that young adults are obtaining adequate quality and duration of sleep and are experiencing minimal sleep disturbances. These findings may reflect that in general the sleep health of Australian young adults is not of significant concern, despite previous research findings which indicate young Australians are obtaining inadequate sleep (Short et al.,
While the overall findings indicated that the majority of young adults in the current sample sleep well, this was not the case for all participants. A proportion of young adults reported more frequent sleep disturbances than others, which was demonstrated by the results of a cluster analysis. Results of the cluster analysis revealed three distinct symptom clusters. One cluster of young adults, named Non-Disturbed Sleepers, reported greater quality sleep and fewer disturbances to their sleep than the other two clusters of young adults, named the Insomniacs and Problem Sleepers. These clusters reported different sleep disturbances to each other, with the Problem Sleepers identifying various sleep complaints on a more frequent basis than the Insomniacs. The emotional and physical health correlates of each cluster are discussed in detail in section 8.5 of this chapter.

Taken together, the findings emphasise that the general snapshot of sleep as revealed by a variable-oriented approach is that young Australian adults are reporting minimal disturbances to their sleep and adequate sleep quality. However, examining the results of the person-oriented approach reveals a more “fine grained” examination of sleep quality amongst young adults which recognises that while the majority do fit the “normal” picture this is not true for all young adults. The picture is fairly heterogeneous in that three distinct clusters of young adults reported mixed perceptions of the experience of sleep disturbances and mixed symptom presentations on a dimensional scale (Clark et al., 1995), with some reporting better sleep quality and fewer sleep disturbances, than others.

### 8.2 Support for a Relationship between Sleep and Mood among Young Australian Adults

The aim of using the variable-oriented approach in the current study was to examine the extent to which sleep quality and sleep disturbances predicted self-reported depression, anxiety and stress symptoms, as well as alcohol and illicit substance use. It was also of interest to investigate which sleep variable was the most important predictor of each of the aforementioned dependent variables in order to explore whether different components of sleep quality and sleep disturbances were uniquely associated with each of depression, anxiety, stress, alcohol use and illicit substance use. As expected, a
unique pattern of significant predictors was revealed with the findings indicating that different sleep variables explained a moderate proportion of the variance in depression, anxiety and stress symptoms. Furthermore, a different pattern of sleep variables predicted a low proportion of the variance in alcohol and illicit substance use. Therefore, the findings provide support for the idea that unique components of sleep quality and sleep disturbances are important in the prediction of depressive symptoms, anxiety symptoms, stress symptoms and substance use. Thus, these unique relationships suggest that treatment programs need to consider that particular disruptions to sleep impact upon mood and anxiety symptoms as well as substance use behaviour, in different ways. Thus, it may be more cost and time effective for treatment interventions to focus on one or two components of sleep quality and disturbance to reduce depression, anxiety, stress, and substance use symptomatology. In particular, it may be useful to focus on the relevant sleep components which are shown to be associated with an increase in these psychological and behavioural factors.

These findings are consistent with the idea that different aspects of sleep may play a precipitating role in the onset of depression, anxiety, and stress symptoms, as well as alcohol and illicit substance use, however causality cannot be determined. In line with previous research showing that the greater the frequency of insomnia, the greater the severity of depression and anxiety symptoms (Taylor et al., 2005) the findings of the present study highlighted a positive association between a variety of different sleep disturbances and symptoms of mood disorders, in an Australian non-clinical sample. These findings also support those of Ford and Kamerow (1989) which indicated that the prevalence of psychiatric disorders, particularly anxiety and depression, was significantly higher among those with sleep disturbances. A key difference between this study and the research of Ford and Kamerow (1989) is that the present study was cross-sectional, whereas Ford and Kamerow (1989)’s research was longitudinal. Therefore unlike Ford and Kamerow (1989), the present study cannot infer that sleep disturbances cause mood disturbance, but instead argues that the current findings make a contribution in support of a positive association between sleep disturbances and symptoms of mood disorders. Given that the variance explained by sleep disturbances was low to moderate, this suggests that there are other factors which
contribute to the development of mental health symptoms and need to be taken into account for treatment purposes.

The current study used a person-oriented approach to examine clusters of young adults regarding their identification with sleep disturbances and found that one cluster, the Problem Sleepers, reported significantly higher scores on sleep apnoea, parasomnias and hypersomnia than the other two clusters. This cluster of young adults also reported greater depression, anxiety, and stress in comparison to the Non-Disturbed Sleepers cluster, but was not significantly different from the Insomniacs cluster. Furthermore, the Problem Sleepers reported greater illicit substance use than both other clusters. These findings may suggest that experiencing co-occurring sleep disturbances may place young adults at greater risk of mental health symptoms. These findings support those of previous research, which indicate that young adults reporting multiple sleep disturbances are at a higher risk of developing psychiatric symptoms, which includes substance use behaviour, in comparison with their peers (Breslau et al., 1996; Roane & Taylor, 2008).

In summary, the findings of the current study provide support for a relationship between sleep and mood disturbances, whereby sleep disturbances explain a low to moderate proportion of the variance in depression, anxiety, stress, alcohol use and illicit substance use. This supports a shift in the conceptualisation of sleep disturbances being secondary to mood disturbances. Sleep disturbances are becoming increasingly recognised as potential risk factors for the subsequent onset of mood disorders (Fong & Wing, 2007), and this study demonstrates that this risk is also evident for a small proportion of young adults from a non-clinical population.

8.3 Sleep Variables as Predictors of Depression, Anxiety, Stress, Alcohol Use and Illicit Substance Use

In the current study, sleep variables were found to explain a moderate proportion of the variance in depression, anxiety and stress scores, as well as a low proportion of the variance in alcohol and illicit substance use. This suggests that sleep is a more important predictor of mood disturbances than of substance use, which may indicate that other factors, possibly peer influence, account for additional variance in substance
use among young adults. Another potential explanation for the lower proportion of variance in substance use that was accounted for by sleep variables in comparison with mental health symptoms is that substance use is a covariate of depression, anxiety, and stress. Thus, symptoms of depression, anxiety, and stress may moderate the impact of sleep variables on alcohol and illicit substance use, therefore accounting for a lower proportion of the variance. The finding that a low to moderate proportion of variance was explained supports the argument that despite similarities in the symptomology of depression, insomnia and hypersomnia, a unique positive relationship exists between sleep and mood disturbances.

There are similarities between the findings of the present study and those described by Isaac and Greenwood (2011) who found that among 379 Australian adults, sleep quality, as measured by the PSQI, explained 17% of the shared variance in scores on the cognitive factor of the Beck Depression Inventory (BDI) and 12% of the shared variance in scores on the somatic factor of the BDI. Whilst Isaac and Greenwood acknowledged the difference in variance explained between the cognitive and somatic factors was not significant, they argued that the positive association consistently found in the literature between insomnia and depressive symptoms, was a genuine relationship and not simply a reflection of measurement artefact. The findings of the current study support the research by Isaac and Greenwood (2011), demonstrating that the aforementioned variance explained between unique sleep related variables and depression, stress, anxiety, alcohol use and illicit substance use, reflected distinct measurement constructs. Thus the findings of the current study may reflect that specific sleep disturbances function as a mechanism or risk factor, for the development of distinct mental health symptoms. However, given the direction of this relationship is unknown, the possibility that sleep disturbances are symptoms of depression, anxiety, stress, and substance use, is also considered.

The hypothesis that sleep quality and sleep disturbance variables would be differentially related to depression, anxiety, stress, alcohol and illicit substance use was partially supported. Partial support was indicated by finding that while there were differences in terms of which sleep related variables were significant predictors, there
was also some overlap, thus suggesting that the relationships between sleep and mood symptoms were not entirely distinct.

**Depression.** Daytime dysfunction and sleep duration predicted depression symptoms, with daytime dysfunction being the most important predictor of depression. Contrary to expectations, insomnia and hypersomnia were not found to be significant predictors of depression. Instead, daytime dysfunction and sleep duration were the only sleep variables which made statistically significant contributions to depression, with daytime dysfunction making the largest unique contribution. One explanation for this finding is that similarities are recognised between the items measuring daytime dysfunction and those measuring hypersomnia. Specifically, when examining the face validity of these items, it appears that they may be measuring similar symptoms. For example, the two items comprising the daytime dysfunction component scale included “During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?” and “During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?” In comparison, the hypersomnia subscale comprised three items consisting of “Did you have problems staying awake during the day?”, “Did you have irresistible sleep attacks during the day?” and “Have you had an excessive need to sleep (10 hours weren’t enough)?” Therefore, it is possible that the two subscales of daytime dysfunction and hypersomnia are measuring overlapping symptomatology of excessive daytime sleepiness. Excessive daytime sleepiness is a predominant symptom of hypersomnia that has been found to be positively associated with depression in several studies; yet the causal direction of this relationship remains unclear (e.g., Mume, 2010; Ohayon, 2008; Ramsawh et al., 2009). It may be the case that, despite the similarity between the items comprising the subscale of hypersomnia and the sleep quality items of daytime dysfunction and sleep duration, an important difference between the measures exists. Whilst it is unclear what this difference may be, one possible explanation lies in the wording of the second item of the hypersomnia subscale (e.g., “Did you have irresistible sleep attacks [author’s emphasis] during the day”), a term which may not have resonated with the current non-clinical sample of young Australian adults. For example, it is possible that the term sleep attacks, is more consistent with the symptoms
experienced by individuals with narcolepsy, rather than young adults who may be experiencing excessive daytime sleepiness. Therefore, given that the overall sample was characterised by low to moderate sleep disturbance symptoms, this item may be more relevant to assess clinical populations who may identify symptoms corresponding with narcolepsy type sleep disorders. Therefore, in the current study it is evident that symptoms of a similar nature to hypersomnia, including daytime impairment from sleepiness and longer sleep duration, predicted greater depression scores. It may be the case that these findings indicate that symptoms of daytime dysfunction and longer sleep duration reflect subthreshold symptoms of hypersomnia, hence explaining the significant relationship between these symptoms and depressive symptoms in a non-clinical sample. This is consistent with epidemiological research conducted by Ohayon (1997) who found that whilst the prevalence of diagnosable primary sleep disorders is relatively low, the prevalence of subthreshold symptoms of sleep disturbance is quite high.

**Anxiety.** The hypothesis that insomnia would significantly predict anxiety was not supported. The findings indicated that parasomnias, hypersomnia, sleep duration and sleep disturbance, were significant predictors of anxiety, with parasomnias and hypersomnia being the most important predictors. One explanation for this finding is that in the current sample hypersomnia is functioning as a coping response for young adults with anxiety. For example, Parker et al. (2006) found that hypersomnia was common among young adults 25 years and younger with a range of psychological conditions and interpreted this finding as indicating that hypersomnia has diagnostic non-specificity and may reflect a homeostatic coping response to stress (Parker et al., 2006). Physiologically, the need for sleep and rest may be increased in response to frequent stress or anxiety. This is in keeping with Seyle’s (1946; as cited in Lindeberg, Ostergren, & Lindbladh, 2006) model of the general adaptation syndrome, which consists of three stages which describe the body’s response to stress and attempt to adapt to it (Lindeberg et al., 2006). Therefore symptoms of hypersomnia may correspond to the stage of exhaustion in Seyle’s (1946; as cited in Lindeberg et al., 2006) model, which is described as the body’s inability to adapt to chronic or prolonged stress (Lindeberg et al., 2006). Thus, the relationship between anxiety and
hypersomnia in the current study may indicate that young adults reporting symptoms of hypersomnia may be physiologically recovering from prolonged anxiety.

The findings of the current study may reflect different relationships between sleep disturbances and mental health symptoms given that a broader range of sleep disturbances were examined including sleep apnoea and parasomnias in comparison to previous research which has typically focused on insomnia and hypersomnia (Breslau et al., 1996; 1997; Ford & Kamerow, 1989; Mume, 2010; Parker et al., 2006; Taylor et al., 2005). Thus, the current findings are unique given that limited research has been conducted which has examined sleep apnoea and parasomnias among young adults. Furthermore, the current study comprised an Australian young adult sample which differs to that of previous research (Breslau et al., 1996; Fong & Wing, 2007; Ford & Kamerow, 1989). Young Australians may not necessarily differ from young people in other countries regarding the way in which sleep is related to depression, anxiety, and stress, however there is some evidence to suggest that sleep patterns and trends in sleep duration differ across geographical region (Bin et al., 2012) which may go some way to explaining the differences found in the current study. The current sample of young Australians, on average, reported optimal sleep duration, low to moderate sleep disturbances and sleep variables were found to account for a moderate proportion of the variance in depression, anxiety, stress and substance use symptoms. This suggests that young Australians may be obtaining more sleep than young people from other countries such as the United States, Asia, and Europe (Gradisar, Gardner, & Dohnt, 2011) and are possibly less affected by sleep restriction and delayed sleep phase syndrome in comparison with adolescents (Short et al., 2013a). This may imply that there are cultural differences regarding sleep patterns between Australia and other developed countries which impact upon sleep health. In particular, extracurricular load, parent-set bed times and school start times have been implicated in playing a role regarding the differences in sleep duration between Australian and American adolescents (Short et al., 2013b). This suggests that in general, sleep health amongst Australian young adults may not be a significant health concern, in relation to other countries, which may be explained by lifestyle factors which impact on sleep duration. Furthermore, Short et al. (2013b) found that depression and anxiety were moderately related to measures of sleep such as sleep
duration and sleep latency among a sample of Australian adolescents who did not report the same degree of sleep restriction as displayed in other developed countries. Regardless, the findings of the present study indicate that there are a small proportion of young adults that do report a higher degree of sleep disturbances, which warrants clinical attention.

Findings in the present study are partially consistent with the findings of Ramsawh et al. (2009) who found that the daytime dysfunction and the sleep disturbance components of the PSQI were most strongly associated with anxiety disorders as compared to other components of sleep quality. The daytime dysfunction component measures excessive daytime sleepiness, whereas the sleep disturbance component measures insomnia type symptoms, sleep apnoea type symptoms as well as other general disturbances. In relation to the current study, it is interesting that the sleep disturbance component of the PSQI was found to be a significant predictor of anxiety symptoms, while the insomnia subscale of the SDQ was not. This suggests that the experience of anxiety in the current sample was predicted by general disturbances of sleep, such as temperature changes, pain, and toilet related disturbances, rather than specific insomnia symptoms. It may be the case that general disturbances to sleep cause some anxiety, or vice versa, that young adults who are experiencing subthreshold anxiety symptoms experience general sleep disturbances as a result. It is possible that the reason as to why insomnia did not predict anxiety in the current study is that young adults were unlikely to be reporting chronic symptoms of insomnia which may be more likely to predict anxiety. Previous research findings indicate that the frequency of insomnia symptoms are associated with the severity of mental health symptoms (Taylor et al., 2005). Therefore, subthreshold symptoms of insomnia may not be associated with subthreshold anxiety among young adults. Ramsawh et al. (2009) found that the sleep latency subscale was significantly associated with most of the anxiety disorders, with the exception of obsessive compulsive disorder, whereas sleep latency was not found to be a significant predictor of anxiety in the current study. Therefore, it may be the case that sleep latency does not relate to subthreshold anxiety symptoms in the same way as an anxiety disorder, given the symptoms are not as likely to be as severe and thus may not have the same degree of impact upon sleep latency. This finding may also be
explained by the possibility that poor sleep patterns become well established over the course of a chronic anxiety disorder, and therefore impact upon sleep latency.

The findings that sleep variables other than insomnia and hypersomnia predicted anxiety and depression were not consistent with the original predictions made, however they did further substantiate the argument that different components of sleep quality and sleep disturbance predict different psychological symptoms (Mayers et al., 2009; Ramsawh et al., 2009). The current study lends support to previous research which has demonstrated that depression and anxiety relate to aspects of subjective sleep quality in different ways. Evidently, these findings suggest that particular sleep disturbances predict unique mental health symptoms, thereby supporting the argument that an alternative approach to diagnosis and classification is needed to promote treatment approaches which explore the heterogeneous profile of sleep and mood correlates.

**Stress, alcohol and illicit substance use.** A further aim of the current study was to examine which sleep disturbance and sleep quality related variables predicted stress, alcohol and substance use. In relation to stress, three sleep variables were significant predictors including parasomnias, daytime dysfunction and use of medication to sleep. Parasomnias were the most important predictor of stress symptoms, illicit substance use and alcohol use. The finding that parasomnias was a significant predictor of anxiety, stress, alcohol use and illicit substance use suggests symptoms of parasomnias play a role in a variety of psychological symptoms and substance use behaviours. In relation to the prediction of stress symptoms, the three variables of parasomnias, daytime dysfunction and use of medication to sleep, were found to be significant predictors. Thus, it may be the case that certain sleep related variables such as parasomnias are associated with a range of mood disturbances, whereas specific combinations of sleep related variables are uniquely associated with either depression, anxiety, or stress symptoms. For example, the parasomnias variable was found to be the most important predictor of stress symptoms, anxiety symptoms, the only significant predictor of illicit substance use and the most important predictor of alcohol use. Interestingly, parasomnias did not significantly predict depression symptoms. This suggests that the sleep disturbances associated with depression are unique in some sense from anxiety, stress and substance use, as young adults reporting symptoms of depression are
reporting longer sleep duration and sleepiness during the day, and not tending to report symptoms of parasomnias.

Parasomnias are thought to result from an interruption to sleep, which precipitates an arousal from slow wave sleep (Pressman, 2007). It is thought that prior to parasomnias occurring, a person’s arousal threshold is lowered, which means that slow wave sleep is interrupted and fragmented (Pressman, 2007). For example, in the context of sleepwalking, the combination of sleep deprivation and alcohol use can lower the arousal threshold of sleep and is explained as a potential precipitant for individuals predisposed to sleepwalking (Pressman, 2007). Factors such as alcohol, medication, and sleep deprivation are known to deepen and yet also fragment sleep, which may increase the chances of parasomnias occurring (Pressman, 2007). Contrary to previous research findings which indicate that insomnia symptoms are associated with the use of alcohol, cannabis, and other drugs (Roane & Taylor, 2008), this was not the case in the current study. Instead the current findings indicated that parasomnias were positively associated with alcohol and illicit substance use. This may reflect that parasomnias are a consequence of anxiety, stress, illicit substance use and alcohol use or alternatively, a contributor to these symptoms. As parasomnias are largely understudied in the literature, the positive association with substance use variables has been less consistently demonstrated in empirical research and therefore further research is needed to develop further understanding of this sleep disturbance. It is unclear whether the use of illicit substances also has the same effect of lowering the arousal threshold of sleep as there is limited research which consistently demonstrates this effect. However it may be speculated that the use of certain illicit substances may also act as a precipitant to parasomnias. For example, previous research has found evidence to suggest that ecstasy use among young adults is associated with an increased risk of sleep disturbances and the worsening of sleep quality (Ogeil et al., 2011). In addition, stress has also been acknowledged to precipitate sleepwalking (Pressman, 2007). While the direction of causality between 1.) parasomnias and anxiety; 2.) parasomnias and stress; 3.) parasomnias and substance use behaviours cannot be determined in the current study, it may be the case that those who experience more frequent parasomnias such as sleepwalking, report greater stress as a result of this sleep disturbance. For example,
high anxiety and stressful triggering factors have been found to be precipitating factors for sleepwalking (Laberge, Trembley, Vitaro, & Montplaisir, 2000; Lecendreux et al., 2003). Therefore, symptoms of parasomnias may precipitate symptoms of anxiety, stress and substance use behaviour among young adults, which implies that the treatment of parasomnias may provide an opportunity for early intervention for the prevention of mental health disorders in the young adult cohort.

Previous research in the United States (e.g., Ohayon et al., 1999) has shown that two parasomnias namely, sleep walking and arousals, are common among young people (15 to 24 years) and are associated with a range of factors including shift work, hypnagogic hallucinations, daily smoking, other sleep related disturbances and mental health disorders. For example, Ohayon et al. (1999) explained that parasomnias, particularly night terrors and arousals, are symptoms of a mental disorder. The findings of the current study suggest that symptoms of parasomnias are frequently experienced by a proportion of young adults and are associated with depression, anxiety, stress and alcohol use, warranting further research into the prevalence of this particular sleep disturbance given that the findings of the current study indicate that parasomnias are associated with mental health symptoms among a non-clinical sample. As the current study used self-report data to determine the frequency of parasomnias amongst the young adult sample, it may be the case that the proportion of young adults experiencing this sleep disturbance has been underestimated (Ohayon et al., 1999). Therefore, longitudinal research is needed to obtain accurate prevalence rates amongst young adults as well as to further examine the directional nature of its relationship with anxiety, stress and substance use, as it may be the case that parasomnias are symptoms of a range of different mental health disorders among young adults.

In the current study, males were found to report significantly greater alcohol use, in comparison with females. Whilst the examination of gender differences was not a focus of the current study, the findings also indicate a non-significant trend for males to report greater illicit substance use than females. These findings may be indicative of a trend among young adult males to use alcohol and illicit substances more frequently or to be more likely to endorse using illicit substances more frequently, in comparison with young women. These findings are in keeping with previous research by the Australian
Bureau of Statistics (1997; 2007) who found that males aged between 18 and 25 were significantly more likely suffer from a substance use disorder in comparison to females. Interestingly, De Visser et al. (2006) found that among Australians aged 16 to 24, there was a lack of differences between males and females on risky health behaviours. De Visser et al. (2006) interpreted this finding as a reflection of sociological change, whereby there are no longer apparent differences between what is perceived to be socially acceptable for women compared to men, in relation to health risk behaviours.

The difference between the findings of the current study and those of De Visser et al. (2006) may be due to the current study’s limited generalisability as the sampling was restricted to predominantly university students, whereas De Visser et al. ‘s (2006) sample was a nationally representative sample of Australians aged 16 to 59. It is also possible that in the university environment, gender differences are maintained due to peer and sociological influences, resulting from subcultures of students (De Visser et al., 2006). Being a student has been associated with lower health risk behaviour than non-students (De Visser et al., 2006), which is consistent with findings of the current study which comprised a majority student sample. Despite the overall low health risk behaviours reported by the current sample of young adults, differences in risk were found between male and female students indicating that there may be differing sociological influences which impact upon health risk behaviour among young adults in a university environment such as peer influence or differing views on substance use.

Yap, Reavely, and Jorm (2011) found that the majority of Australian young adults endorsed beliefs which indicated awareness of the negative health impact of substance use, however males were found to be less likely to endorse these beliefs. Therefore, the findings of the current study may reflect that males are more likely to report substance use given that they may not endorse negative views of substance use to the same extent as females. Thus, health promotion efforts to reduce substance use among young adults need to address the beliefs that males tend to hold regarding the health consequences of substance use, which may predict substance use behaviour (Yap, Reavely, & Jorm, 2011).

The findings discussed above, highlight the importance of examining the relationship between sleep disturbances and symptoms of depression, anxiety, stress and
substance use behaviours as they indicate that specific sleep disturbances have a unique relationship with a range of mental health symptoms as well as with substance use. These findings are not limited to insomnia and hypersomnia but extend to other sleep disturbances, such as parasomnias, as well as other components of sleep quality such as daytime dysfunction and shorter sleep duration. Limited previous research has examined whether specific sleep disturbances can predict symptoms of depression, anxiety, stress, alcohol use and illicit substance use. In particular, the research has largely neglected to examine the role of parasomnias in relation to mood, anxiety and substance use. This is likely due to the large heterogeneity of disturbances that exist under the diagnostic category of parasomnias and the difficulty in obtaining objective data. The findings of the current study, whilst limited to self-report data and elementary measures, suggest that further research is warranted to understand the role of parasomnias in mental health among young adults.

8.4 Sleep, Mood and Health: Unique Predictors of Depression, Anxiety, Stress, Alcohol Use and Illicit Substance Use

A further aim of using the variable-oriented approach was to investigate whether the addition of health related variables and mood regulating strategies improved the prediction of depression, anxiety, stress, and substance use, beyond that predicted by sleep-related variables. It was expected that the addition of self-rated health symptoms and mood regulating strategies to the hierarchical regression models would improve the prediction of depression, anxiety, stress, alcohol and illicit substance use. This expectation was upheld as findings indicated different combinations of health symptoms, mood regulating strategies, and sleep related variables made unique contributions to the explained variance in depression, anxiety, stress, alcohol and illicit substance use. The following discussion will focus on the health and mood regulation strategies which were found to significantly predict the dependent variables.

Once health and mood regulating strategies were entered into the model, sleep related variables accounted for a significantly lower proportion of the variance in depression, anxiety, stress and alcohol use. Despite this, several sleep related variables remained significant predictors. Therefore, these findings suggest that mood regulating
strategies and self-reported health symptoms explain a substantial proportion of the variance in depression, anxiety, stress, alcohol use and illicit substance use, with a smaller proportion of variance explained by sleep related variables. This finding indicates that the strategies a young adult uses to change a negative mood as well as how a young adult perceives their own physical health is more likely to accurately predict symptoms of depression, anxiety and stress, than sleep quality and sleep disturbances. A unique pattern of predictors for each of the dependent variables of depression, anxiety, stress, alcohol use and substance use was revealed which suggests that unique combinations of variables relating to sleep, mood regulation strategies and health provide a picture of the most important variables to consider in accurately predicting symptoms of either depression, anxiety, stress, alcohol and illicit substance use.

**Mood regulation strategies.** In the current study, young adults who reported less frequent use of behavioural management to change a negative mood were more likely to report higher depression scores. This suggests that young adults who are behaviourally active, meaning that they engage in exercise and hobbies on a frequent basis are less likely to report symptoms of depression. It is possible that this finding also indicates that young adults who are reporting symptoms of depression may be less inclined to be behaviourally active, given the nature of this mental health symptom. Previous research has consistently found behavioural activation interventions are effective for the treatment of depression (Augustine & Hemenover, 2009; Cuijpers, Van Straten, & Warmerdam, 2006) as it counteracts and challenges the cognitive and behavioural symptoms of depression which include amotivation, inertia, low self-worth and withdrawal (McEvoy et al., 2013). Therefore, the current findings lend support to previous research and imply that behavioural activation strategies may be protective for young adults who are vulnerable to the development of depressive symptoms (McEvoy et al., 2013).

Whilst it was expected that participants who reported greater use of the mood regulating strategy physiological distraction, would report greater illicit substance and alcohol use, it is unclear whether this relationship can solely be attributed to the use of this mood regulating strategy or whether lifestyle factors relating to young adulthood
may also play a role such as experimentation and increasing trends for substance use within the subculture of young adulthood (Arnett, 2007; De Visser et al., 2006; Smart & Sanson, 2005). In the current study those who were younger in age reported greater illicit substance use. This finding is in keeping with previous Australian research, whereby young adults and young people reporting greater psychological distress were more likely to have favourable attitudes toward substance use (Yap, Reavley, & Jorm, 2011). Therefore, within the young adult cohort there may be subgroups of individuals who are younger in age and use substances as a form of experimentation and other subgroups of individuals who use substances as a mood regulation strategy in order to regulate psychological distress. Thus, young adults seem to be at particularly high risk of substance use given that the age range of 18 to 25 is associated with greater risk taking, impulsivity and psychological distress, which when combined creates a potential reliance on physiological distraction to regulate negative moods.

In contrast, young adults in the current study who reported more frequent use of stress management, tended to report lower alcohol use. It is speculated that these findings indicate the use of adaptive mood regulation strategies contribute to less frequent use of substances, given that young adults in the current study who reported using physiological distraction more frequently reported greater depressive symptoms. This is consistent with previous research which has found that young adults with greater difficulty regulating their emotional state also reported greater impulsivity, which is often associated with risk taking behaviours such as alcohol use (Schreiber et al., 2012; Tice et al., 2001). Previous research findings suggest a bi-directional relationship exists between sleep and affective regulation, whereby ineffective regulation of emotion may precipitate sleep difficulties and in turn, poor sleep quality may impair affective regulation skills (Alfano et al., 2009). Therefore, young adults in the current study who reported more frequent use of stress management, may be less vulnerable to the development of sleep disturbances and emotional dysregulation, and as such may be less likely to use alcohol. These findings emphasise the idea that young adulthood is an important time for the continued development of emotional regulation skills, with sleep being one important psychological resource which may be a protective factor against health risk behaviours such as alcohol use. Thus, poor sleep quality may limit the
resources available for responding to stress and may perpetuate the use of maladaptive mood regulation strategies (Graham & Streitel, 2010), whereas young adults using adaptive mood regulation strategies such as stress management, are less likely to engage in health risk behaviour which may in turn compromise sleep quality.

**Pain.** Another finding of interest in the current study was that that among young adults the experience of pain significantly predicted greater symptoms of depression, anxiety, stress and also illicit substance use. This suggests that young adults suffering from pain symptoms or disorders are at a greater risk of developing mental health symptoms than young adults not reporting pain. These findings are in accordance with Chiu et al. (2005) who found that among a sample of participants from the general population, depression and sleep disturbances were independently related to a low pain threshold, indicating that sleep may act as a mechanism to manage pain. It is possible that the current findings lend support to Chiu et al. (2005), as self-reported pain and parasomnias were independent predictors of depression, anxiety, stress and illicit substance use, thus, potentially indicating that parasomnias may compromise sleep quality and therefore compromise pain management. The relationship between sleep and pain has been described as bi-directional, with sleep deprivation lowering pain thresholds and pain reducing sleep quality (Affleck et al., 1996). This implies that variables related to health, such as pain, plays an important role in the relationship between sleep and mood, and such that when sleep is compromised so is the capacity to effectively manage pain.

Taken together, the findings discussed in this section support the claim in the existing literature that specific domains of sleep quality and disturbances predict psychological distress (Wong et al., 2013) and extend the claim to specific mood regulating strategies and aspects of physical health, demonstrating that these variables also predict mental health symptoms. These findings provide further support for a differential relationship between not only sleep related variables and depression, anxiety, stress and substance use, but also with the addition of self-reported health and mood regulating strategies. The implication of this is that there is a need to understand the relationship between sleep disorders and common comorbidities such as physical health conditions and psychiatric disorders (Crome, 2004), in order to develop holistic,
tailed, treatment approaches. In summary, the findings of the variable-oriented approach in the current study have facilitated greater understanding of the general or average associations between sleep related, physical health, mood regulating variables and mental health symptoms such as depression, anxiety, stress as well as substance use. However, this approach is not sensitive to the individual variation and unique clusters of mixed symptom sleep disturbance presentations that may exist among young adults. In the following section the findings of the person-oriented approach will be discussed, which is useful for the exploration of patterns and profiles among groups of individuals (Laursen & Hoff, 2006).

8.5 Sleep Clusters: A Comparison of the Non-Disturbed Sleepers, Insomniacs, and Problem Sleepers

The aim of using a person-oriented approach was to explore if there were common patterns of sleep disturbances that were more likely to be associated with specific emotional and physical health correlates among young adults and add to the limited previous research which has applied a person-oriented approach to the exploration of sleep disturbances and sleep quality (Edinger et al., 1988, 2000; Le Blanc et al., 2007). In relation to this exploratory aim the results revealed three distinct clusters of self-reported symptoms of insomnia, hypersomnia, parasomnias and sleep apnoea. The three clusters of young adults differed in relation to their identification with sleep disturbances, mood regulation strategies, self-reported health and self-reported symptoms of depression, anxiety, stress, alcohol and illicit substance use. Only one sleep disturbed cluster was expected, however two sleep disturbed clusters emerged, namely the Insomniacs and Problem Sleepers, who both had more negative associations with health related variables in comparison to the Non-Disturbed Sleepers who reported significantly fewer sleep complaints. These findings provide clinically relevant information regarding the nature of specific sleep disturbances that young adult report experiencing as well as emotional and physical health correlates of these sleep disturbances among young adults in Australia.

The cluster comprising the majority of the young adults in the sample was named the Non-Disturbed Sleepers. This cluster reported greater quality sleep and fewer
disturbances to sleep compared to the other clusters whereas the Insomniacs were distinguished by their more frequent experience of insomnia symptoms and comprised 22% of the young adults in the study. Whilst these findings suggest that Australian young adults are not as affected by insomnia symptoms as the general adult population, there is an indication that a greater proportion of young adults in the current study reported insomnia symptoms in comparison with other sleep disturbances. This may be a reflection of the high prevalence of sub-threshold insomnia symptoms in the general population which implies that insomnia treatment programs are also needed to address subthreshold symptoms of insomnia amongst the young adult cohort, given the vulnerability of this age group to developing mental health symptoms. The last cluster was titled the Problem Sleepers as they reported more frequent symptoms of hypersomnia, sleep apnoea and parasomnias. This profile comprised less than 10% of the sample and indicated that for a small proportion of young adults their sleep is somewhat disturbed by a variety of sleep complaints. It is unclear as to why the symptoms of hypersomnia, sleep apnoea and parasomnias were more likely to be reported amongst one small cluster of young adults. It is possible that the range of symptoms across the different disturbances reflect one underlying sleep disturbance or disorder. For example, symptoms of hypersomnia can be a consequence of sleep apnoea and are commonly reported among sleep apnoea sufferers (APA, 2000). In addition, symptoms associated with sleep apnoea including irregular breathing and hypopneas have been found to precipitate parasomnias such as sleepwalking, and treatment of the sleep apnoea has resulted in resolution of the sleepwalking episodes (Pressman, 2007). Thus, sleep apnoea may precipitate symptoms of hypersomnia and parasomnias among young adults. This implies there is a need to develop treatment guidelines for specific co-occurring sleep disorders, which may be unique to the young adult cohort, however further research is needed to determine whether other age groups also report these combined sleep disturbances. The Insomniacs and Problem Sleepers did not differ in terms of their reported sleep quality, indicating that the difference between these clusters was in relation to the nature of the sleep disturbances they reported experiencing. These findings indicate that a degree of variation exists amongst the young adults in the current study, with the majority reporting minimal sleep
disturbances relative to two distinct clusters of their peers who identify with insomnia symptoms and a combination of parasomnias, hypersomnia and sleep apnoea symptoms.

**Patterns of self-reported health between clusters.** The Non-Disturbed cluster reported relatively better health than the Insomniacs and Problem Sleepers on physical functioning, pain and role limitations due to health. This suggests that young adults who perceive themselves to be sleeping adequately also perceive themselves to have fewer health concerns than young adults reporting more frequent sleep disturbances and poorer sleep quality. Therefore, sleep disturbances and sleep quality may provide a broader indicator of a young adult’s physical health and overall functioning. This idea is consistent with previous research findings indicate that short sleep duration is associated with poorer physical health (Kakizaki et al., 2012; Magee et al., 2009). As expected, the Insomniacs and Problem Sleepers reported shorter sleep duration on average, than the Non-disturbed cluster, which is consistent with the idea that short sleep duration is associated with poorer physical health. In addition, the differences between the Non-Disturbed Sleepers, Insomniacs and Problem Sleepers are also in keeping with Le Blanc et al.’s (2007) profile of sleep groups. In Le Blanc et al.’s (2007) research individuals who reported lower sleep quality and sleep duration also reported poorer health. Thus, regardless of the type of sleep disturbance reported by young adults, the physical health correlates are similar indicating that various sleep disturbances may compromise physical health or at least the perception of physical health quality. These findings suggest that in keeping with previous research, the majority of young adults report to be functioning well in relation to their physical health (AIHW, 2011), yet there are clusters within the young adult cohort that are not functioning as well in relation to sleep quality, sleep disturbances and physical health. A proportion of young adults are reporting poorer physical and sleep health as well as greater engagement in risky health behaviours such as substance use.

The current study examined differences among the three profiles in relation to alcohol use and illicit substance use. The profile of the Problem Sleepers indicates that there is a cluster of young adults in the current study that are reporting slightly greater health risk behaviours than their peers. The Problem Sleepers reported more frequent
symptoms of hypersomnia, parasomnias and sleep apnoea in comparison to their peers which was associated with greater illicit substance use and symptoms of depression, anxiety and stress. However, it is acknowledged that overall the current sample reported relatively low mean scores on both alcohol and illicit substance use. The implication of these findings is that while most young people are aware of the negative impact substances such as alcohol, cannabis and tobacco can have on mental health, high-risk groups which include males, young adults and those reporting greater psychological distress are the exception to the majority of young people and may be more vulnerable to engaging in substance use (Yap, Reavley, & Jorm, 2011).

Risk behaviour has been found to be less common among students (De Visser et al., 1996), which may explain the tendency for young adults in the current study to report low alcohol and illicit substance use as 92.6% of the current sample were currently studying. This suggests that being a student may be a protective factor in terms of reducing the likelihood that young adults engage in health risk behaviour such as substance use. Despite students being at a lower risk of health risk behaviour, previous research conducted by De Visser et al. (1996) found that young Australian adults aged 16 to 24 years had greater health risks profiles of behaviour in comparison with older adults (De Visser et al., 1996). The health risk behaviours De Visser et al. (1996) examined included alcohol use, injected drug use and safe sex practices. Therefore, the findings of the current study imply that in general, young adults perceive themselves to be in good health and report relatively low frequency of alcohol and illicit substance use. However, the young adult cohort may be at a greater risk than they perceive themselves to be which suggests that further research with objective measures is warranted to determine whether the degree of risk needs to be a focus of clinical attention. It is apparent that for subgroups of young adults who report frequent insomnia symptoms and those who report frequent parasomnias, hypersomnia and sleep apnoea symptoms are at greater risk of poor health and substance use. This suggests that for a proportion of young adults in the current study, sleep treatment interventions that also to address co-occurring sleep disturbances as well as aspects of health which may be perpetuating the sleep disturbance, are necessary.
Cluster differences in symptoms of psychological distress and mood regulation strategies. In support of the profile of the Problem Sleepers who experienced more frequent sleep disturbed symptoms of parasomnias, hypersomnia and sleep apnoea than the other two clusters, was their experience of greater depression, anxiety, and stress. The Problem Sleepers reported higher levels of depression, anxiety and stress than the other clusters, although these differences were only significantly higher in comparison to the Non-Disturbed Sleepers cluster. However a greater proportion of people reporting extremely severe to severe levels of depression, anxiety and stress were represented in the Problem Sleepers cluster. As indicated by the Non-Disturbed Sleepers it seems the majority of young adults seem to be functioning well with low reports of depression, anxiety, stress, substance use, yet there are a minority of young adults which are reporting greater psychological distress in terms of depression, anxiety, stress, and the use of illicit substances. Seventeen per cent of young adults in the current study reported depression levels rated as extremely severe to severe, levels which in a clinical setting would warrant attention (Lovibond & Lovibond, 1995). Of this proportion, 48.4% of the Problem Sleepers young adults fell within this depressed group. This suggests that young adults reporting more than one type of sleep disturbance are at an increased risk of experiencing depressive symptoms. Therefore, sleep disturbances may serve as an indicator of a young adults mental health profile, whereby young adults reporting either insomnia or a combination of hypersomnia, parasomnias and sleep apnoea are also likely to report greater symptoms of depression, anxiety and stress in comparison to young adults who report minimal disturbances to sleep.

The differences between the clusters regarding symptoms of depression, anxiety and stress may be related to the type and frequency of mood regulation strategies each cluster of young adults reported using. Findings from the current study indicated that the three clusters had somewhat distinct profiles in relation to which mood regulation strategies they reported most frequently using and those which they found most effective at changing a negative mood. Specifically, the Problem Sleepers reported more frequent use of physiological distraction, active pleasurable distraction and stress management to change a negative mood, than the Insomniacs and Non-Disturbed
Sleepers. This is consistent with the finding that the Problem sleepers reported significantly greater use of illicit substances in comparison to the Insomniacs and Non-Disturbed Sleepers, which may be a reflection of the greater perceived stress experienced amongst this cluster. It also suggests that young adults with several sleep disturbances may engage in mood regulation strategies which act to maintain the sleep disturbances. For example it is possible that the Problem Sleepers experience greater sleep disturbances than the other clusters due to their choice of mood regulating strategies, which may be initiating symptoms of sleep disturbance. These findings are consistent with research by Morin, Rodrigue, and Ivers (2003) who found that poor sleepers report using emotion oriented coping, which is intended to lessen the emotional distress, more frequently than good sleepers. This may go some way to explaining how sleep disturbances can be perpetuated by maladaptive coping strategies as this type of coping may maintain heightened physiological arousal at bed time, which is not conducive to promoting sleep. Individuals with adaptive coping skills may sleep better as a result of being able to lower their physiological arousal thereby facilitating sleep onset (Morin et al., 2003). The Insomniacs also tended to report more frequent use of active pleasurable distraction to change a negative mood than the Non-Disturbed Sleepers which is consistent with Le Blanc et al.’s (2007) groups who reported insomnia symptoms and insomnia syndrome. Le Blanc and et al. found that those reporting complaints of insomnia were found to perceive greater levels of stress in their lives and a tendency to use emotion-oriented coping more so than good sleepers (LeBlanc et al., 2007). The use of active pleasurable distraction seems to correspond with emotion oriented coping, as the goal is to alter the emotion rather than to problem solve. These findings may suggest that it is not necessarily the nature of the sleep disturbance that influences associated depression, anxiety and stress symptoms but may also implicate the type of mood regulation strategies that are used.

In addition to the differences between the clusters regarding the frequency of different mood regulation strategies, differences were also found in relation to the perceived effectiveness of different mood regulation strategies. The Problem Sleepers perceived physiological distraction to be more effective at changing a negative mood than the Non-Disturbed Sleepers yet did not differ from the Insomniacs. Further, the
Problem Sleepers also perceived behavioural management to be less effective at changing a negative mood in comparison to the other clusters. This is consistent with the finding that the Problem Sleepers reported significantly greater use of illicit substances than the Insomniacs and Non-Disturbed clusters, and may go some way to explain why physiological distraction was perceived to be more effective at changing a negative mood by the Problem Sleepers in comparison to the other clusters. Young adults reporting greater psychological distress have been found to be less likely to endorse negative beliefs regarding the health consequences of substance use (Yap, Reavley, & Jorm, 2011). Interestingly, Problem sleepers also reported greater use of stress management as a mood regulating strategy in comparison to the Insomniacs and Non-Disturbed Sleepers. The finding that Problem Sleepers use stress management techniques more frequently than the Insomniacs and Non-Disturbed Sleepers is consistent with previous research which has defined sleep as consistent with a theoretical framework for stress management and self-regulation (Hamilton, Nelson, Stevens, & Kitzman, 2007). Specifically, it is possible that the Problem Sleepers may need to compensate for the role sleep plays in stress management, given their sleep is impaired by the experience of several sleep disturbances.

There are also similarities between the clusters of young adults in the current study and the profiles described by Tandon et al. (2013). Tandon et al. (2013) found that a young adult sample of African Americans aged between 16 and 24, fell into three distinct clusters based on their use of coping strategies, social support and stress exposure. The largest cluster which comprised 65.2% of the sample was characterised by moderate to high adaptive coping strategies and were less likely to report within the range of elevated depressive symptoms. This group scored higher on active and support seeking coping strategies compared to avoidance and distraction strategies. Similarly to the current study, the Non-Disturbed sleepers were the largest cluster comprising 68.5% of the sample and this group was also characterised by lower levels of depression, anxiety, and stress. In contrast to Tandon et al.’s (2013) group, the Non-Disturbed sleepers reported less frequent use of mood regulating strategies, in relation to active pleasurable distraction and physiological distraction. Consistent with Tandon et al.’s (2013) research, the groups did not differ on age, sex composition, employment status.
and educational background. This implies that these demographic variables do not differentiate clusters of young people in regards to their use of mood regulation or coping strategies. Tandon et al. (2013) interpreted the findings as support for the notion that “one size does not fit all” (p.633) as there is a wide range of variation among young people regarding what coping strategies they use. Thus, through the use of person-oriented approach in the current study differences were recognised amongst the young adult cohort in relation to the experience of sleep disturbances, associated symptoms of psychological distress and mood regulation strategies. Increased recognition of these differences may lead to the development of targeted interventions which aim to concurrently address sleep and mood disturbances as well as to tailor treatment to the types of mood regulation strategies which may promote optimal mood regulation and sleep amongst young adults who are at risk (Tandon et al., 2013).

8.6 Implications of the Current Findings

The findings of the current study have a number of important implications for the health of young adults in Australia. Specifically, the finding that a unique combination of sleep, health and mood regulating variables differentially predicted depression, anxiety, stress and substance use, highlights the importance of recognising the complex relationship between sleep and mood. This finding suggests that to examine the relationship purely between sleep and mood variables, neglects an important part of the picture, given that physical health and mood regulation play a role in the relationship as well. A need has been identified in the literature to develop treatment guidelines for the increasing number of overlapping presentations of addiction and mental health disorders among youth (Crome, 2004). The findings of the current study make a contribution toward understanding the way in which different sleep disturbances, mental and physical health symptoms overlap among young adults. This idea is also emphasised by the identification of three distinct sleep disturbance clusters in the current study, which were distinguished based on their experience of insomnia, hypersomnia, sleep apnoea and parasomnias, yet also revealed differential relationships with a range of other emotional and physical health correlates. The findings of the current study have a number of implications for treatment considerations in clinical
practice. Firstly, the findings of the current study indicate that specific sleep disturbances and various components of sleep quality are uniquely associated with different aspects of emotional and physical health which implies that sleep is an important indicator of health amongst a non-clinical sample of young adults. There is limited previous research which has been conducted to examine sleep as an indicator of physical and emotional functioning of individuals between the ages of 18 and 27 years, a time when mood regulation skills are in the process of being developed (Graham & Streitel, 2010). It is thought that the profiles of sleep disturbed young adults and their emotional and physical health correlates identified in the current study may provide clinically relevant information regarding the conceptualisation of sleep disturbances as dimensional symptoms which are associated in different ways with mental health symptoms, physical health and substance use. The results of the cluster analysis indicate that a degree of variation exists among young adults during this period of their life, in relation to a variety of health domains, however future research is warranted to investigate groups of young adults from diverse socioeconomic and educational backgrounds to determine whether similar groups are identified among a sample that are not predominantly university students. To the author’s knowledge this is the first study to apply a profile approach to understanding sleep disturbances among young Australian adults.

As indicated in the current study, young adults who reported less frequent experience of sleep disturbances also reported lower levels of depression, anxiety and stress as well as better physical health. Those young adults reporting frequent sleep disturbances were more likely to belong to a cluster of young adults who tended to use distraction based mood regulation strategies and more frequent use of alcohol and illicit substances. Therefore, a proportion of young adults are reporting symptoms of numerous sleep disturbances in addition to a tendency to use mood regulation strategies such as substance use, which may perpetuate sleep disturbances and psychological distress. Young adults reporting greater disturbances to their sleep also reported greater symptoms of depression, anxiety, stress, as well as greater self-reported pain. This suggests that sleep may serve as a broader indicator of health among young adults, providing relevant information regarding specific emotional and physical health
correlates among those with sleep disturbances. Thus, examining sleep as a psychological resource in young adult mental health services may expand treatment approaches by increasing the attention paid to sleep quality and sleep disturbances among this age group in treatment services. The development of self-help and internet based sleep health treatment programs may provide an accessible resource for clinicians, families and young adults to address sleep disturbances and other aspects of health which may require clinical attention.

The second implication of the current findings is support for a positive relationship between sleep and mood disturbances. The current study, whilst albeit cross sectional, adds to the existing literature which has demonstrated a directional relationship between sleep disorders and mood throughout a variety of longitudinal research (Breslau et al., 1996; Ford & Kamerow, 1989; Roane & Taylor, 2008). This implies that the directional relationship between sleep and mood, which has largely been demonstrated with insomnia, also extends to a wider variety of sleep disturbances, such as parasomnias, and also applies to subthreshold symptoms among the general population. The current finding suggests that a degree of heterogeneity exists in the presentation of sleep disturbances and provides recognition of the mixed symptom pictures among young adults. For example, the Problem Sleepers cluster reported experiencing symptoms of parasomnias, hypersomnia and sleep apnoea, which indicates that a proportion of young adults are experiencing mixed symptoms of sleep disturbances. This holds implications for treatment considerations, given that there is a sparse evidence base and few guidelines for practitioners regarding the treatment of mixed symptom sleep disturbances. The broader implication of this finding relates to further consideration of a dimensional approach to the diagnosis and classification of psychopathology, whereby symptomatology is theoretically positioned on a continuum of graded severity (Clark et al., 1995). The findings of the current study provide an argument for a dimensional approach to classification as they indicate that a proportion of young adults experience symptoms of several sleep disturbances with varying frequency, suggesting that the symptoms may not meet diagnostic criteria for a diagnosis and are not of a chronic nature. Despite this, the current findings indicate that young adults reporting sleep disturbances were also reporting symptoms of depression,
anxiety, stress and substance use, which may indicate that the treatment of subthreshold sleep disturbances may provide an opportunity to reduce the risk of developing, or exacerbating mental health symptoms. Thus, a dimensional approach to classification may provide greater recognition of subthreshold symptoms and therefore treatment interventions for young adults with subthreshold sleep disturbances.

A third implication relates to the use of a mixed methods design in the current study. The use of both variable and person-oriented approaches revealed that the variable-oriented methodology, which was based on statistical comparisons to the average of the sample, may not have been as sensitive to the variation among different domains of young adults’ health during this stage of life. The person-oriented approach revealed a more fine-grained picture, with three distinct subgroups emerging with differing profiles of sleep disturbances and other physical and emotional health correlates. These findings suggest that future research would benefit from the inclusion of person-oriented approaches to complement variable-oriented methods, as they are able to reflect the complexity and dynamic nature of individuals (Bergman & Magnussen, 1997).

A practical implication relating to the relationship between sleep disturbances and mood pertains to treatment. An important finding which has been replicated throughout the existing body of research is that the treatment of sleep complaints, namely insomnia and hypersomnia, has been found to reduce symptoms of mood disturbances (Fong & Wing, 2007; Ford & Kamerow, 1989; Isaac & Greenwood, 2010). Whilst the findings of the current study are correlational, they provide some evidence to suggest that specific aspects of sleep quality and disturbances are associated with greater symptoms of depression, anxiety and stress. Thus, further longitudinal research is needed to determine whether sleep disturbances precipitate mood symptoms and furthermore, provide an opportunity for treatment intervention by improving sleep quality. Previous research has asserted that sleep disturbances should be treated first, when they co-occur with depressive symptoms (Issac & Greenwood, 2011). This suggests that sleep disturbances may act as a mechanism in the development of mood disturbances and that as such, treatment approaches need to be able to adequately address the prevention of sleep disturbances. The findings of the current study indicate
that a differential relationship exists between symptoms of depression, anxiety, stress, alcohol use and illicit substance use with specific components of sleep quality and sleep disturbances. Therefore, treatment programs that aim to address the prevention of sleep disturbances may be able to tailor the focus of the intervention to the associated mental health outcomes.

The findings of the current study indicate that parasomnias, an understudied sleep disturbance in the literature, are a significant predictor of a variety of symptoms including stress, anxiety, and substance use. Further longitudinal research is warranted to further understand the prevalence and epidemiology of this particular sleep disturbance and its impact on mental health. Therefore current treatment approaches, which have demonstrated efficacy for insomnia and hypersomnia, may need to expand to effectively address the treatment of parasomnias. In addition, treatment paradigms for sleep disturbances should also incorporate education around the use of mood regulation strategies to encourage the use of strategies that will complement individuals sleep, rather than to perpetuate and maintain sleep disturbances. Based on the current findings, interventions should be tailored to specific subgroups. For example, the findings of the current study revealed that one cluster of young adults reported more frequent symptoms of parasomnias, hypersomnia and sleep apnoea, and more frequent use of substances and physiological distraction to change a negative mood. Thus, interventions which are developed to address the range of emotional and physical health symptoms that are uniquely associated with different sleep disturbances may be effective at providing a tailored, holistic approach to treatment for subgroups of young adults.

Furthermore, the current findings may inform the development of preliminary screening pro formas for the assessment of sleep disturbances, which also screen physical health, substance use, mood and the use of mood regulating strategies, in order to obtain a comprehensive understanding of other factors which may be maintaining the disturbance. The findings of the current study revealed that young adults who reported more frequent symptoms of sleep apnoea, hypersomnia and parasomnias also reported having poorer physical health, more severe symptoms of depression, anxiety and stress and reported using illicit substances more frequently. Thus, these findings indicate that young adults reporting sleep disturbances are also likely to have a range of other
associated health correlates. Knowledge regarding the associated health correlates of sleep disturbances among young adults may be of value in developing holistic treatment interventions that address the sleep disturbance symptoms as well as the associated health correlates which may act to perpetuate the sleep disturbance and mood symptoms.

Another practical implication relates to the finding that the majority of young adults in the current study reported minimal disturbances to their sleep; however a proportion of young adults reported more frequent sleep disturbances than others. Previous research examining one component of sleep quality in Australia presents mixed findings whereby some data indicates there is a larger proportion of people reporting they are sleeping longer compared to several decades ago, in contrast to several other Australian studies that argue sleep duration has been declining among young people (Dollman et al., 2007; Glozier et al., 2010; Olds et al., 2010). Regardless of these contradictory reports, it seems that a proportion of young people in the current study experience a range of heterogeneous sleep disturbances and present a mixed symptom picture in regards to depression, anxiety, stress and use of substances. It is unclear whether compromised sleep among young people relates to the broader societal context, whereby modern lifestyles are promoting the deterioration of sleep quality for some, more so than others (Roberts et al., 2000). The findings of the current study reflected no differences in terms of socio-demographic variables between the clusters which differed significantly regarding their reported symptoms and frequency of sleep disturbances. This may imply that a broader range of socio-demographic variables need to be examined. Future research may benefit from examining variables such as socio-economic status, employment type (e.g. shift work), relationship status and new parent status, as an examination of these variables may further explain the role of societal and lifestyle factors in sleep quality. Previous research has suggested that implementing changes such as delaying school start times, restricting technology access at night and prolonging sleep duration may assist in promoting the importance of sleep and improved sleep quality amongst young people (Roberts et al., 2000). Promoting health education programs in schools and universities alike may provide young people with better access to information and resources regarding their health. This in turn may
prepare young adults to make more health conscious decisions such as recognising the 
importance of sleep and balancing optimal sleep with lifestyle choices as well as the use 
of strategies which regulate emotional distress without compromising sleep quality 
(Gruber, 2013; Roberts et al., 2000).

An important issue emerging from these findings is the indication that a 
proportion of young adults tend to rely on mood regulating strategies intended to reduce 
the physiological tension associated with a negative mood, such as with the use of illicit 
substances, alcohol, sex, caffeine and cigarettes. These young adults are also likely to 
report greater sleep disturbances, poorer physical health and symptoms of depression, 
anxiety and stress. A practical implication of this relates to the influence these mood 
regulating strategies may have on perpetuating health problems such as sleep 
disturbances and other aspects of physical health. It may be the case that in the general 
population, young adults are unfamiliar with the impact of using particular mood 
regulating strategies on other aspects of their health such as sleep and physical health. 
Thus, these findings imply that there is a need for education around mood regulation 
and the consequences of relying on strategies which potentially perpetuate mood 
dysregulation and increase their risk of other health conditions. In addition, findings of 
the current study indicate that there are differences between the strategies young adults 
reported most frequently using to change their mood and the strategies they perceived to 
be most effective in this regard. This disparity further substantiates the need for further 
education among young people regarding the use of mood regulation strategies. Placing 
increased emphasis on the development of skills related to mood regulation as well as 
practical guidance throughout primary and secondary schooling may provide young 
people with the resources needed to effectively regulate their emotional state and 
prevent some from going on to experience heightened psychological distress throughout 
young adulthood. Implementing cognitive and emotional intervention programs may 
provide those young adults who are identified as being at particular risk, with the 
problem solving skills necessary for the use of mood regulating strategies which are 
conducive to promoting sleep.
8.7 Limitations of the Current Study and Suggestions for Future Research

Several limitations in the current study warrant discussion. Firstly, sleep quality and disturbances were determined on the basis of a one-off, self-report questionnaire. Lauderdale et al. (2006) reported that the relationship between self-reported sleep data and objectively measured data using actigraphy was moderate at best, and is biased. While other research which has compared self-report sleep data to polysomnography data, indicated that individuals are reasonably accurate in recognizing objective changes of sleepiness (Short, Lack, & Wright, 2010). As self-report measures were used to identify sleep disturbances in the current study, the data do not objectively indicate the presence of distinct sleep disturbances, but rather the perceived experience of young adults. The somewhat restricted range of scores measured by the Pittsburgh Sleep Quality Index may have contributed to the lack of findings in relation to different components of sleep quality in the regression analyses. It is strongly recommended that future researchers use a variety of individual measures of sleep disorders and disturbances to obtain valid data with a broader range of scores.

It is possible that the findings reflect somewhat inflated or deflated associations between variables which may have influenced the relationships between variables in this study. Despite this, self-report data is reflective of individuals’ perceived experience and therefore is of value in its own right, with some research arguing that the importance of subjective data has been overlooked in the sleep literature (Mayers et al., 2009). Therefore, the findings of the current study are of value when considering the way in which Australian young adults perceive their quality of sleep. This value is particularly evident when examining the three distinct clusters which emerged revealing three subgroups of young adults each reporting a different experience of sleep disturbances. The clusters were named according to their distinct symptom profile and it should be noted that the names given to each cluster were not intended to pathologise the subthreshold symptoms reported by the current non-clinical sample but were chosen to characterise the frequency and type of symptoms reported by each cluster of young adults. Secondly, differences between typical sleep-related data during the week compared to the weekend or occupational information relating to shift work and night shift were not measured in the current study. The use of sleep diaries may have
facilitated the collection of more detailed data in relation to young adults’ sleep and lifestyle patterns. Given the sample comprised young adults, lifestyle and employment factors may have impacted their self-reported sleep data, which may have contributed to distinguishing additional sleep profiles. Therefore, while the demographic variables in the current study were not distinguishing factors across clusters, other demographic variables which were not measured in the current study, such as lifestyle factors, employment factors and socioeconomic status may distinguish different clusters.

Secondly, the sample used in the present study was fairly restricted. Participants were predominantly recruited from one faculty of the university’s academic portal, and as a result the majority were female, undergraduate psychology students. While De Visser et al.’s (2006) findings suggested that health risk behaviour is not consistently associated with education, employment, or income, it was also evident that measuring socioeconomic status among young adults was not necessarily an accurate reflection of their own or their family’s access to social and economic materials, given that many young adults are transitioning to independence (De Visser et al., 2006). Therefore, future research would benefit from the use of a longitudinal examination of potential differences among young adults from a range of diverse educational and occupational backgrounds regarding different sleep quality, psychological distress and mood regulating strategies.

The current study did not find any significant differences in sleep disturbances across age, education, employment, or student status; which may be a result of the sample largely comprising higher education students as the variation in these demographic variables may be limited. Therefore, future research examining differences among young adult cohorts from varying socioeconomic backgrounds may provide more comprehensive data on the experience of sleep disturbances among young adults and the identification of groups at higher or lower risk of sleep disorders.

Thirdly, as the current study was cross-sectional, causality of the relationships between variables could not be determined. Thus, it is possible that sleep disturbances reported in the current study were symptoms of depression, anxiety, stress and substance use. Future longitudinal research is warranted to extend upon the current findings in order to explore the bi-directional relationship between sleep disturbance
and symptoms of psychological distress over time. In particular, further research is
recommended to explore the role of parasomnias in mental health. This would assist in
differentiating factors that may contribute to determining how a young adult is
experiencing sleep and functioning in terms of physical and emotional health, during
this transitional stage of life.

In addition, De Visser et al. (2006) suggests that a lack of differences exist
between male and female young adults on risky health behaviours and that this may
reflect a change in society’s perception of gender roles. In contrast, the current study
found several significant differences, which indicate that on average, females reported
more frequent symptoms of insomnia than males, and males reported greater alcohol
use than females. In addition, several non-significant trends emerged indicating females
reported greater stress symptoms and males reported greater illicit substance use. These
findings, whilst limited, suggest that differences may currently exist between male and
female young adults in relation to substance use and mood disorders.

The Australian Bureau of Statistics Survey of Mental Health and Wellbeing
(1997; 2007) indicated that the prevalence of substance use disorders is substantially
higher among males aged 18 to 24 years, in comparison with females in the same age
range, whereas the prevalence of mood disorders among females in this age range are
three times higher in comparison with males. These differences between males and
females have been explained as a potential reflection of a difference in the way males
and females regulate emotional distress, with males more likely to “self-medicate”
(Sawyer et al., 2012, p.11) by using substances.

Findings of the current study are consistent with this explanation, with males
reporting more frequent use of physiological distraction to change a negative mood than
females. This suggests that males and females are socialised to use different mood
regulating strategies. These differences in the use of mood regulation strategies among
males and females may also play a role in maintaining sleep disturbances, however the
only significant difference found between males and females regarding sleep
disturbances indicated females reported more frequent insomnia symptoms. The smaller
proportion of male participants in the present study may have contributed to the absence
of more significant gender effects. Alternatively, the findings may reflect an absence of
genuine gender differences. De Visser et al. (2006) explained the absence of sex
differences in health risk profiles among young adults as a reflection of a sociological
change whereby in modern society, females are just as likely as men to engage in
behaviours with health risks. These preliminary findings of gender differences in the
current study warrant further investigation as to whether they reflect genuine differences
which exist among the wider young adult cohort in Australia or whether gender
differences are being mitigated by a 24/7 society which may be altering perceptions of
gender roles and hence behaviour.

It is important that a wider range of risk factors for the development of
symptoms of mood and anxiety disorders are examined in future research to recognise
the associated profile of emotional and physical health among young adults who are
experiencing specific sleep disturbances. As indicated by findings of the current study,
those reporting predominantly insomnia symptoms or a combination of sleep apnoea,
hypersomnia and parasomnias symptoms, also reported greater psychological distress
and substance use as well as poorer perceived physical health and greater pain. Thus,
poor sleep health seems to be one risk factor for symptoms of depression, anxiety and
risky health behaviour such as substance use.

Another factor to be considered regarding risky health behaviour such as
substance use is that of sexual orientation (De Visser et al., 2006). Young adult groups
identifying as non-heterosexual, have been found to be at higher risk of partaking in
risky health behaviours (De Visser et al., 2006). Therefore, sexual orientation may be an
indicator of a young adults’ vulnerability to engage in risky health behaviours. Young
adulthood is recognised as a developmental period during which young people negotiate
their identity, including the development of a sexual identity (Arnett, 2000). As such,
the examination of a wider range of risk factors such as sexuality, may capture the
different experience of young adults at particular risk.

8.8 Conclusion

The present study provides clinically relevant information regarding the profile
of a sample of sleep disturbed young adults in Australia and has made several important
contributions to the literature which can be summarised as follows. Firstly, the findings
provide evidence to support a positive unique relationship between different components of sleep quality, sleep disturbance and symptoms of depression, anxiety, stress and substance use amongst young adults. Secondly, the findings emphasise the importance of recognising subthreshold sleep disturbances given that a proportion of young adults in the current study who reported experiencing subthreshold disturbances to their sleep also reported poorer physical and mental health outcomes. Thirdly, the findings support the importance of implementing person-oriented approaches when examining sleep disturbances by revealing distinct sleep disturbance profiles amongst young adults. Furthermore, the findings promote the value in conceptualising sleep as a psychological resource among young adults with mental and physical health symptoms.

These contributions add to the existing body of research, which together highlight the importance of sleep for maintaining healthy functioning amongst young adults. Specifically, these contributions add to the current understanding of sleep and various other components of health during an important period of development, which has become increasingly recognised as distinct from other developmental stages in today’s society (Arnett, 2000). Specifically, these findings add to the current understanding of sleep by providing a snapshot of what sleep looks like amongst the young adult cohort. The findings reflect that for some, a degree of mixed symptom heterogeneity exists in relation to the experience of sleep disturbances and the associated symptoms of depression, anxiety, stress, substance use, mood regulating strategies and physical health.

The current research was the first known study to use a mixed methods design using both variable and person-oriented approaches to explore sleep disturbances among young Australian adults. The variable-oriented approach facilitated understanding of the average effect of sleep related variables in predicting depression, anxiety, stress and substance use; while, the person-oriented approach provided the potential to explore patterns among individuals with regard to distinct sleep profiles and associated correlates of emotional and physical functioning. Therefore, the findings of the current study make an original contribution, by increasing the recognition given to alternative ways of exploring sleep quality and disturbances. In the current research an alternative methodology to the way in which sleep has traditionally been explored in the literature
was used. By using a person-oriented approach the current study was able to identify patterns of sleep disturbances among clusters of young adults, leading to a richer understanding of individuals’ experience of sleep quality and disturbances. This approach captures the range of variation of sleep disturbance symptoms experienced by young adults during this period of their life.

The results differentiated between three distinct sleep disturbance clusters of young adults, indicating that for a large proportion of young adults the years between the late teens and mid to late twenties are experienced with minimal disruption to sleep, minimal symptoms of depression, anxiety, stress, relatively low use of substances and positive perceptions of physical health. It seemed that for these young adults, their need to employ mood regulation strategies was low and therefore they reported infrequent use of behaviours intended to change their mood. However, in the current study two clusters of young adults were identified who reported more frequent symptoms of a variety of sleep disturbances, greater symptoms of depression, anxiety, stress, and more frequent use of substances in comparison with those young adults reporting relatively better sleep quality. These two clusters reported sleep disturbances on a more frequent basis than the Non-Disturbed cluster, and also reported using mood regulating strategies to change a bad mood more frequently than the Non-Disturbed cluster. This suggests that for young adults with compromised sleep quality, the increased use of mood regulation strategies may reflect a compensatory effort to reduce psychological distress. Therefore, education programs which promote awareness among young people regarding how to regulate mood without impacting upon sleep quality, are needed in Australian schools. Providing psycho-education to school children about the benefits of sleep and how to optimally regulate their mood in ways which can be adopted as part of their lifestyle, rather than an immediate “quick fix” may facilitate early intervention efforts to reduce the prevalence of mental health symptoms among young people.

Sleep, “Chief Nourisher in Life’s Feast” (Shakespeare, trans. 1993, 2.2.3), provides an important health resource for young people in modern society. The contribution of the current thesis promotes further consideration of the way in which the dimensional nature of sleep disturbances relate to mental and physical health outcomes, in clinical practice.
References


Doi:10.1177/1090198112451266


Turek, F. W. (2005). Insomnia and depression: If it looks and walks like a duck... Sleep, 28(11), 1457-1464.


World Health Organisation (2001). *The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Care (2nd ed).*

Wilkinson, K., & Shapiro, C. (2012). Nonrestorative sleep: symptom or unique diagnostic entity? *Sleep Medicine, 13*(6), 561-569.


Appendix A: Ethics Approval

Dear Dr Hardie,

SUHREC Project 2010/180 Sleep Quality and Mood Regulation Strategies among Young Adults
Dr Elizabeth Hardie, FLSS/Ms Zoe Woodruff
Approved Duration: 15/11/2010 To 15/03/2012 [Adjusted]

I refer to the ethical review of the above project protocol undertaken on behalf of Swinburne's Human Research Ethics Committee (SUHREC) by SUHREC Subcommittee (SHESC2) at a meeting held on 20 August 2010. Your response to the review as e-mailed on 25 October 2010 was put to a nominated SHESC2 delegate for review.

I am pleased to advise that, as submitted to date, the project has approval to proceed in line with standard on-going ethics clearance conditions here outlined.

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the National Statement on Ethical Conduct in Human Research and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/ clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.

- A duly authorised external or internal audit of the project may be undertaken at any time.

Please contact me if you have any queries about on-going ethics clearance. The SUHREC project number should be quoted in communication. Chief Investigators/Supervisors and Student Researchers should retain a copy of this e-mail as part of project record-keeping.
Best wishes for the project.

Yours sincerely

Kaye Goldenberg
Secretary, SHESC2

---------------------------------------------------------------

Kaye Goldenberg
Administrative Officer (Research Ethics)
Swinburne Research (H68)
Swinburne University of Technology
P O Box 218
HAWTHORN VIC 3122
Tel +61 3 9214 8468
Appendix B: Information Statement and Survey
Sleep Quality and Mood Regulation Strategies Among Young Adults

Zoë Woodruff - Doctoral Candidate
Dr Elizabeth Hardie- Supervisor

The present study aims to investigate the ways in which sleep quality impacts upon mood states and how negative moods are regulated among young adults. Sleep quality has been associated with various aspects of emotional and physical health. The present study is primarily interested in investigating sleep quality, mood regulation strategies as well as emotional and physical health.

Participation involves completing a series of questions that will ask about your quality of sleep, sleep knowledge, the ways in which you regulate mood as well as emotional and physical aspects of health. There are also some personal questions in relation to substance use and mental health. Participation will take approximately 15-20 minutes. To ensure that results remain valid, please answer each question honestly. Participation is completely anonymous and confidential.

If you would like to participate in the following research please be alert to any local or government restrictions involved in foreign research if you reside in a country other than Australia.

Completing the following questionnaire will be viewed as informed consent. Your participation is voluntary. If however you find any of the questions distressing or confronting, you may withdraw your participation at any time. If participation in this research causes any discomfort or distress please speak to your local general practitioner. Australian participants can also contact the Swinburne Psychology Clinic on (03) 9214 8653 (a low-cost service), Swinburne Counselling Services on: 03 9214 8025 (Hawthorn) or 03 9215 7101 (Lilydale), or Lifeline on 13 11 14. International participants can contact the Lifeline International 24 hour telephone counselling service, details regarding this service in your home country can be found by accessing their website: http://www.lifeline-international.org/looking_for_help.

The completion of this research project is part of a Doctor of Clinical Psychology degree. Should results from the research be published, data will be published in group format, not examining individual responses, thus maintaining anonymity. A copy of the data will be made and saved onto a password protected USB drive and CD disk for seven years, after which they will be destroyed. If you have any general enquiries about this study, please contact:

Zoë Woodruff
Tel (03) 9214 4523 or +61 3 9214 4523

This project has been approved by or on behalf of Swinburne's Human Research Ethics Committee (SUHREC) in line with the National Statement on Ethical Conduct in Research Involving Humans. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Swinburne Research (H68),
Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122.
Tel (03) 9214 5218 or +61 3 9214 5218 or resehtics@swin.edu.au
DEMOGRAPHIC QUESTIONNAIRE

1. Age: _______

2. Gender:
   Male       Female

3. Please circle the highest level of education you have completed:
   Year 10 or lower  Year 11  VCE (completed year 12)
   Commenced university/TAFE  Graduated with a diploma  Graduated with degree
   Commenced postgraduate studies  Completed post graduate studies.

4. Please circle the employment status that currently applies to you:
   Unemployed       Employed full time       Employed part time
   Employed casually

5. Are you currently studying?
   No  Yes, Full time student  Yes, Part time student

6. Please circle your country of residence:
   Australia  Africa  America/Canada
   Asia  Europe  Middle East  Other

7. Do you have a sleep disorder? Please give detail below:
   ____________________________________________________________________
The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

8. During the past month, what time have you usually gone to bed at night?
   
9. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
   
10. During the past month, what time have you usually gotten up in the morning?
    
11. On average, during the past month, how many hours of actual sleep did you get per night? (This may be different to the number of hours you spent in bed.)
    
   For each of the following questions, check the response that best applies to you. Please answer all questions.

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

12. Cannot get to sleep within 30 minutes
    - Not during the past month
    - Less than once a week
    - Once or twice a week
    - Three or more times a week

13. Wake up in the middle of the night or early morning
    - Not during the past month
    - Less than once a week
    - Once or twice a week
    - Three or more times a week

14. Have to get up to use the bathroom
    - Not during the past month
    - Less than once a week
    - Once or twice a week
    - Three or more times a week

15. Cannot breathe comfortably
16. Cough or snore loudly
   ☐ Not during the past month
   ☐ Less than once a week
   ☐ Once or twice a week
   ☐ Three or more times a week

17. Feel too cold
   ☐ Not during the past month
   ☐ Less than once a week
   ☐ Once or twice a week
   ☐ Three or more times a week

18. Feel too hot
   ☐ Not during the past month
   ☐ Less than once a week
   ☐ Once or twice a week
   ☐ Three or more times a week

19. Had bad dreams
   ☐ Not during the past month
   ☐ Less than once a week
   ☐ Once or twice a week
   ☐ Three or more times a week

20. Have pain
   ☐ Not during the past month
   ☐ Less than once a week
   ☐ Once or twice a week
   ☐ Three or more times a week

21. During the past month, how would you rate your sleep quality overall?
   ☐ Very good
   ☐ Fairly good
22. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?
- Not during the past month
- Less than once a week
- Once or twice a week
- Three or more times a week

23. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
- Not at all a problem
- Only a very slight problem
- Somewhat of a problem
- A very big problem

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

25. In the last month (30 days) how often did you suffer from one or more of the following sleep problems?
- Did you take more than half an hour to fall asleep?
- While sleeping do you wake up often or do you remain awake for more than 30 min?
- Have you woken up early, that is, more than an hour before you expected?
- Have you had non restorative sleep, that is as if you haven’t slept at all?
- Did you have problems staying awake during the day?
- Did you have irresistible sleep attacks during the day?
- Have you had an excessive need to sleep (10 hours weren’t enough)?
- Have you realised or has someone told you that...
you stop breathing for a few seconds while you're sleeping?
Do you have nightmares or dreams that cause a lot of anxiety?
Have there been episodes of sleep walking or of any other unusual behaviour during sleep?
Do your sleep problems interfere with your ability to function, to study or at work?
Have your sleep problems a negative effect on your social, personal or family life?
Do your sleep problems worsen your mood or behaviour?

26. How long have you had these sleep problems?
☐ Not Applicable
☐ Only in the last month
☐ More than 1 month, but less than 3 months
☐ More than 3 months, but less than 6 months
☐ More than 6 months

27. In general, would you say your health is:
☐ Excellent
☐ Very Good
☐ Good
☐ Fair
☐ Poor

28. Compared to one year ago, how would you rate your health in general now?
☐ Much better now than one year ago
☐ Somewhat better now than one year ago
☐ About the same
☐ Somewhat worse now than one year ago
☐ Much worse now than one year ago

29. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports

Moderate activities, such as moving a table,
pushing a vacuum cleaner, bowling, or playing golf
Lifting or carrying groceries
Climbing several flights of stairs
Climbing one flight of stairs
Bending, kneeling, or stooping
Walking more than 2km
Walking several blocks
Walking one block
Bathing or dressing yourself

30. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Yes</th>
<th>No</th>
</tr>
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<tbody>
<tr>
<td>Cut down the amount of time you spent on work or other activities</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Accomplished less than you would like</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Were limited in the kind of work or other activities</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Had difficulty performing the work or other activities</td>
<td>☐</td>
<td>☐</td>
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</tbody>
</table>

31. How much bodily pain have you had during the past 4 weeks?

- None
- Very mild
- Mild
- Moderate
- Severe
- Very severe

32. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- Not at all
- A little bit
- Moderately
- Quite a bit
- Extremely

33. Below are a list of strategies people use to change a bad mood. Please use the following rating columns in answering how often you use these strategies to change a bad mood and how effective you find each strategy to be at changing a bad mood.

<table>
<thead>
<tr>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>N/A</th>
<th>Very</th>
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<td>Avoid the cause</td>
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<td>Call, talk, or be with someone</td>
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<td>Change location</td>
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<td>Control thoughts</td>
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<td>Drink alcohol</td>
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<td>Engage in pleasant activities</td>
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<td>Drink coffee or other</td>
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<td>caffeinated beverage</td>
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<tr>
<td>Exercise</td>
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<td>Engage in a hobby</td>
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<td>Smoke cigarettes</td>
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<td>Engage in stress management</td>
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<td>Go</td>
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<td>shopping</td>
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<td>Listen to music</td>
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<td>Put feelings in perspective</td>
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<td>Rest, take a nap, sleep</td>
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<td>Use</td>
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<td>relaxation techniques</td>
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<td>Try to be alone</td>
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<tr>
<td>Take a shower, bath, or splash water</td>
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Below is a list of different types of drugs:

**Stimulants**
- Amphetamines
- Caffeine
- Cocaine
- Diet Pills (Anorectic Drugs)
- Methamphetamines

**Depressants**
- Barbiturates
- Benzodiazepines

**Hallucinogens**
- Psilocybin ("Shrooms")
- DMT
- LSD
- Peyote and Mescaline
- PCP

**Narcotics**
- Codeine
- Heroin
- Opium
- Morphine
This next section is going to ask you five questions about your drug use. For each of the five questions we want you to circle the most appropriate response for you. Your answers will remain confidential so please be honest.

Please note alcohol is not listed above. There will be a separate section asking questions relating to alcohol use.

34. Do you think your drug use is out of control?
   - Never/Almost never
   - Sometimes
   - Often
   - Always/nearly always

35. Does the prospect of mixing a fix (or dose) make you anxious or worried?
   - Never/Almost never
   - Sometimes
   - Often
   - Always/nearly always

36. Do you worry about your use of drugs?
   - Never/Almost never
   - Sometimes
   - Often
   - Always/nearly always

37. Do you wish you could stop?
   - Never/Almost never
   - Sometimes
   - Often
   - Always/nearly always

38. How difficult do you find it to stop or go without drugs?
   - Not difficult
   - Quite difficult
   - Very difficult
   - Impossible

The following section will ask some questions about your use of alcohol. Your answers will remain confidential so please be honest.

39. How often do you have a drink containing alcohol?
40. How many drinks containing alcohol do you have on a typical day when you are drinking?
   ☐ 1 or 2
   ☐ 3 or 4
   ☐ 5 or 6
   ☐ 7 to 9
   ☐ 10 or more

41. How often do you have six or more drinks on one occasion?
   ☐ Never
   ☐ Less than monthly
   ☐ Monthly
   ☐ Weekly
   ☐ Daily/Almost daily

42. How often during the last year have you found that you were not able to stop drinking once you had started?
   ☐ Never
   ☐ Less than monthly
   ☐ Monthly
   ☐ Weekly
   ☐ Daily/Almost daily

43. How often during the last year have you failed to do what was normally expected of you because of drinking?
   ☐ Never
   ☐ Less than monthly
   ☐ Monthly
   ☐ Weekly
   ☐ Daily/Almost daily

44. How often during the last year have you needed a first drink in the morning to get
yourself going after a heavy drinking session?
☐ Never
☐ Less than monthly
☐ Monthly
☐ Weekly
☐ Daily/Almost daily

45. How often during the last year have you had a feeling of guilt or remorse after drinking?
☐ Never
☐ Less than monthly
☐ Monthly
☐ Weekly
☐ Daily/Almost daily

46. How often during the last year have you been unable to remember what happened the night before because of your drinking?
☐ Never
☐ Less than monthly
☐ Monthly
☐ Weekly
☐ Daily/Almost daily

47. Have you or someone else been injured because of your drinking?
☐ No
☐ Yes, but not in the last year
☐ Yes, during the last year

48. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?
☐ No
☐ Yes, but not in the last year
☐ Yes, during the last year

49. Please read each statement and select a response which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

Did not apply to me at all
Applied to me to some degree
Applied to me to a considerable degree
Applied to me very much, or most of the time

0

2
<table>
<thead>
<tr>
<th>Item</th>
<th>time 1</th>
<th>time 2</th>
<th>time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I found it hard to wind down</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was aware of dryness of my mouth</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I couldn't seem to experience any positive feeling at all</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I experienced breathing difficulty (e.g., excessively rapid</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>breathing, breathlessness in the absence of physical exertion)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found it difficult to work up the initiative to do things</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I tended to over-react to situations</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I experienced trembling (e.g., in the hands)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt that I was using a lot of nervous energy</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was worried about situations in which I might panic and make a</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>fool of myself</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt I had nothing to look forward to</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I found myself getting agitated</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I found it difficult to relax</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt down-hearted and blue</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was intolerant of anything that kept me getting on with what I</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>was doing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt I was close to panic</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was unable to become enthusiastic about anything</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt I wasn’t worth much as a person</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt that I was rather touchy</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was aware of the action of my heart in the absence of physical</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>exertion (e.g., sense of heart rate increase, heart missing a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>beat)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt scared without any good reason</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt that life was meaningless</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
50. How long have you felt this way?
   □ Not Applicable
   □ One month or less
   □ More than 1 month, but less than 3 months
   □ More than 3 months, but less than 6 months
   □ More than 6 months
Appendix C: Participant Recruitment Advertisements
Sleep Quality and Mood Regulation Strategies among Young Adults.

Do you wonder whether you need too much sleep? Don’t get enough sleep? Or maybe you have perfect sleep!

If you are between the ages of 18 and 26 and would like to participate in an online psychological research project on sleep quality please follow the link to:

http://opinio.online.swin.edu.au/s?s=9488

The primary purpose of this study is to investigate young adults’ quality of sleep. In particular, the current study is interested in the influence sleep quality may have on one’s moods and the ability to regulate mood states.

If you choose to participate, it will involve the completion of a short online questionnaire that will take approximately 15-20 minutes of your time.

Please forward the link to anyone who may also be interested in participating. Your participation is very important to the study and is greatly appreciated.

Thank you for your time and assistance!!

Any questions regarding this research can be directed to Zoë Woodruff at zwoodruff@swin.edu.au or 03 9214 4523
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This project has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC) in line with the National Statement on Ethical Conduct in Research Involving Humans. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Swinburne Research (H68), Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122. Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au
Sleep Quality and Mood Regulation Strategies among Young Adults.

Researcher: Zoë Woodruff

Participation Time: 15-20 minutes

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Appendix D: Factor Analysis of the Self-Regulating Strategies of Mood Questionnaire

The 29 items of the Self-Regulating Strategies of Mood questionnaire (Thayer, 2000) were factor analysed using principal components analysis (PCA) using SPSS version 15, to support the original structure with an Australian young adult sample. Prior to conducting the PCA, the data were analysed for suitability. The correlational matrix revealed many coefficients above .3 and spot checks of scatterplots did not indicate multicollinearity. The Kaiser-Meyer-Olkin value was .81 and Bartlett’s test of sphericity was significant ($\chi^2 (300) = 2091.18, p < .001$), therefore indicating the sample was appropriate for factor analysis.

Examination of the scree plot from the initial Principal Components Analysis (PCA) revealed seven factors with Eigenvalues above one. Three items were removed from the analysis as they did not have a factor loading of .45 or above or did not conform to simple structure. The item “change location” had loadings of .4 on both Active Pleasurable Distraction and Behavioural Management. The item “use humour” had a primary loading of .54 on Active Cognitive Management yet also had cross loadings between .30 and .40 on Active Pleasurable Distraction and Active Behavioural Management. The item “engage in self-gratification” had loadings between .36 and .50 on Physiological Distraction, Behavioural Management and Active Cognitive Management, respectively. A second PCA was conducted requesting six factors using oblimin rotation. A six factor solution was the most appropriate fit for the data. The Eigenvalues for the six components explained 22.08%, 8.58%, 6.86%, 5.71%, 5.28%
and 4.59% of the variance, respectively, accounting for a total of 53.10% of the variance. Table 18 shows the factor loadings for each of the six factors.
### Table 21

**Factor Loadings for Items from the Self-Regulating Strategies of Mood Questionnaire**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid the cause</td>
<td>.19</td>
<td>.01</td>
<td>.11</td>
<td>.04</td>
<td>.61</td>
<td>.12</td>
</tr>
<tr>
<td>Call, talk, or be with someone</td>
<td>.41</td>
<td>-.06</td>
<td>.23</td>
<td>.23</td>
<td>-.52</td>
<td>.06</td>
</tr>
<tr>
<td>Control thoughts</td>
<td>-.15</td>
<td>.00</td>
<td>.70</td>
<td>.07</td>
<td>.12</td>
<td>.02</td>
</tr>
<tr>
<td>Drink alcohol</td>
<td>.12</td>
<td>.75</td>
<td>-.07</td>
<td>.00</td>
<td>.10</td>
<td>.17</td>
</tr>
<tr>
<td>Engage in pleasant activities</td>
<td>.14</td>
<td>.05</td>
<td>.18</td>
<td>.59</td>
<td>.00</td>
<td>.35</td>
</tr>
<tr>
<td>Drink coffee or other caffeinated beverage</td>
<td>.12</td>
<td>.53</td>
<td>-.05</td>
<td>.20</td>
<td>.02</td>
<td>.19</td>
</tr>
<tr>
<td>Exercise</td>
<td>-.01</td>
<td>-.04</td>
<td>-.20</td>
<td>.78</td>
<td>-.03</td>
<td>-.19</td>
</tr>
<tr>
<td>Engage in a hobby</td>
<td>-.14</td>
<td>.01</td>
<td>.11</td>
<td>.79</td>
<td>.01</td>
<td>-.05</td>
</tr>
<tr>
<td>Smoke cigarettes</td>
<td>-.15</td>
<td>.75</td>
<td>.11</td>
<td>-.11</td>
<td>-.01</td>
<td>-.05</td>
</tr>
<tr>
<td>Engage in stress management</td>
<td>.13</td>
<td>.15</td>
<td>.15</td>
<td>.08</td>
<td>.05</td>
<td>-.67</td>
</tr>
<tr>
<td>Go shopping</td>
<td>.67</td>
<td>.16</td>
<td>-.01</td>
<td>-.10</td>
<td>-.20</td>
<td>-.11</td>
</tr>
<tr>
<td>Listen to music</td>
<td>.45</td>
<td>-.01</td>
<td>.15</td>
<td>.08</td>
<td>.23</td>
<td>.27</td>
</tr>
<tr>
<td>Put feelings in perspective</td>
<td>.08</td>
<td>-.08</td>
<td>.81</td>
<td>-.06</td>
<td>-.05</td>
<td>-.16</td>
</tr>
<tr>
<td>Rest, take a nap, sleep</td>
<td>.51</td>
<td>.03</td>
<td>.04</td>
<td>.12</td>
<td>.11</td>
<td>-.07</td>
</tr>
<tr>
<td>Use relaxation techniques</td>
<td>.15</td>
<td>.01</td>
<td>.16</td>
<td>.26</td>
<td>.11</td>
<td>-.62</td>
</tr>
<tr>
<td>Try to be alone</td>
<td>.23</td>
<td>-.01</td>
<td>-.02</td>
<td>-.05</td>
<td>.71</td>
<td>-.16</td>
</tr>
<tr>
<td>Take a shower, bath, or splash water on face</td>
<td>.60</td>
<td>-.00</td>
<td>-.02</td>
<td>.05</td>
<td>.02</td>
<td>-.31</td>
</tr>
<tr>
<td>Eat something</td>
<td>.67</td>
<td>.06</td>
<td>.05</td>
<td>-.08</td>
<td>.17</td>
<td>.06</td>
</tr>
<tr>
<td>Watch TV</td>
<td>.61</td>
<td>-.05</td>
<td>.01</td>
<td>-.01</td>
<td>.14</td>
<td>.06</td>
</tr>
<tr>
<td>Use humour</td>
<td>.18</td>
<td>.17</td>
<td>.40</td>
<td>.16</td>
<td>.04</td>
<td>.15</td>
</tr>
<tr>
<td>Engage in self-gratification</td>
<td>-.01</td>
<td>.17</td>
<td>.32</td>
<td>.17</td>
<td>.13</td>
<td>-.31</td>
</tr>
<tr>
<td>Use drugs (other than alcohol, cigarettes or coffee)</td>
<td>-.10</td>
<td>.68</td>
<td>.00</td>
<td>-.11</td>
<td>.11</td>
<td>-.27</td>
</tr>
<tr>
<td>Have sex</td>
<td>.15</td>
<td>.58</td>
<td>-.04</td>
<td>.07</td>
<td>-.23</td>
<td>-.19</td>
</tr>
<tr>
<td>Analyse the situation</td>
<td>.04</td>
<td>-.02</td>
<td>.83</td>
<td>-.12</td>
<td>-.11</td>
<td>-.03</td>
</tr>
</tbody>
</table>

**Note.** *N*=327. Factor 1-Active Pleasurable Distraction (Eigenvalue=5.52); Factor 2-Physiological Distraction (Eigenvalue=2.15); Factor 3-Active Cognitive Management (Eigenvalue=1.72); Factor 4-Behavioural Management (Eigenvalue=1.43); Factor 5-Avoidance (Eigenvalue=1.32); Factor 6- Stress Management (Eigenvalue=1.15)
Appendix E: Image of the Dendogram

Figure 2. Dendogram representing a hierarchical cluster analysis of the SDQ variables using Ward’s method and squared Euclidean distance.