Exploring the relationship between mental health and sleep in elite/pre-elite Australian athletes

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Abstracts Presented at Scientific Conferences

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Dedication

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Glossary of Key Terms

Elite athlete.	Someone who competes at the highest levels of their sport (e.g., Olympics/Paralympics), often representing their country or competing professionally.
Pre-elite athletes	Someone who is highly trained in the sport and currently competing at a national level.
Mental health.	A state of well-being where individuals realize their potential, cope with the normal stresses of life, work productively, and contribute to their community
Mental illness.	A condition that significantly disrupts a person's thinking, feeling, mood, or behaviour, impacting their ability to function in daily life.
Bedtime.	The time of day at which an individual goes to bed and attempts to sleep.
Sleep onset.	The time of day following bedtime at which sleep commences.
Sleep patterns.	The consistency or lack thereof in the sleep phase of an individual over consecutive days or weeks.
Sleep quality.	An individual's subjective experience of sleep. Sleep quality is typically focussed on problems initiating or maintaining sleep, or early morning awakening.
Sleep period.	Total time from sleep onset to wake time.

Wake time. The time of day at which the final awakening from a sleep period occurs.

Time in bed. The time elapsed between first getting into bed with the intention of sleeping to the final arising.

Wake after sleep onset (WASO). The amount of wakefulness accumulated between the first onset of sleep and the final awakening.

Total sleep time (TST). The total amount of time spent in bed asleep. Also known as sleep quantity and sleep duration.

Sleep onset latency. Time elapsed between bedtime or 'lights out' and sleep onset.

Sleep efficiency. A ratio with two measures of sleep quantity: total sleep time and time in bed. Sleep efficiency is expressed as a percentage of total sleep time and time in bed. In research, a sleep efficiency of 85% is sought (i.e., 85% of time in bed is spend asleep). Sleep efficiency is a key component of and measure of sleep quality.

Thesis Abstract

Over the past 15 years, there has been growing research attention on mental health and sleep in elite athletes. This research growth in mental health and sleep for elite athletes is exemplified by consensus statements on both topics published by prominent sporting organisations such as the International Olympic Committee. Research in elite athletes has either focused on mental health or sleep, however, little is known about the relationship between mental health and sleep in elite athletes. It is well established that mental health and sleep have a strong, bi-directional relationship within the general population, this relationship has not been confirmed in elite athletes. Therefore, this PhD thesis used a combination of mixed method approach to address two overarching aims: 1) explore the relationship between mental health and sleep in Australian elite/pre-elite athletes; and 2) design, implement, and evaluate the effectiveness of a pilot intervention aimed at improving athlete's sleep and/or mental health. In the first study of this thesis, a diagnostic interview and a self-report sleep quality assessment were used to establish the point prevalence of mental illness and symptoms in elite/pre-elite Australian athletes. This study found a lifetime prevalence of mental illness of 11.7% of athletes who met at least one diagnostic criteria for a mental illness, while it was found that one in five athletes reported subthreshold mental illness symptoms. Mental health and sleep quality were found to have a significant association in this study, with athletes experiencing mental illness/symptoms twice the odds of reporting poor sleep quality compared to athletes who were asymptomatic. Confirming that a bi-directional relationship exists in mental health and sleep in elite athletes, the second study of this thesis, addressed the identified research gaps regarding a lack of understanding at present about athletes' perspectives and lived experiences regarding mental health and sleep, and explores how the sporting ecosystem may support or hinder athletes' mental health and sleep. Six focus groups were conducted with nine athletes and 17 coaches/staff, audio recorded, transcribed verbatim and analysed using reflexive thematic analysis, which led to the generation of six primary themes: 1) my experience and understanding of mental health; 2) what is my social identity?; 3) coach(es) create the high-performance environment; 4) my environment defines my sleep; 5) what support do I have/what support do I need?; and 6) you monitor my wellbeing… but what happens with my data? The results underlined that mental health and sleep have a strong and complex relationship that has critical implications for optimal athletic performance and wellbeing. Informed by the first two studies in this thesis, a pilot study using the gold standard sleep intervention in the general population, Cognitive Behavioural Therapy for Insomnia (CBT-I) was chosen, and was the first known to implement and evaluate the effectiveness of a pilot CBT-I intervention in improving sleep quality and duration in elite adolescent athletes. Overall, the study's results showed no significant effect between pre- and post-intervention in self-report sleep measures across the primary and secondary outcome variables. This contrasted with what is observed when implemented in the general population and exploration of factors that contributed to the lack of significant change are explored in the discussion. The value of the CBT-I pilot intervention in elite athletes is promising with the post-evaluation survey revealing that as some participants in the study reported benefits from the CBT-I intervention. This PhD thesis sought to address an identified research gap on the relationship between mental health and sleep in elite athletes. Using mixed methods research, that then informed the identification and development of a pilot CBT-I intervention, this thesis has shown that mental health and sleep has an important relationship for elite/pre-elite athletes in Australia, and that this relationship has important implications related to athlete wellbeing, physical health, and performance.

Chapter 1 Thesis Overview

This chapter introduces the context and significance of the present PhD research, which explores the relationship between mental health and sleep in elite and pre-elite Australian athletes. It begins by providing background information on why mental health and sleep in elite athletes is a relevant topic to research, outlining the impact of mental health challenges and sleep disturbances within high-performance sport and highlighting the unique pressures faced by athletes. The chapter then provides an overview of current research on the bidirectional relationship between sleep and mental health, with particular attention to evidence drawn from the general population. Finally, the chapter concludes by presenting the overarching aims of the thesis: first, to investigate how sleep and mental health interact and influence wellbeing in this elite athletic population; and second, to develop and evaluate a pilot intervention designed to enhance sleep quality and mental wellbeing in elite athletes

1.1 Introduction

Historically, it was believed that only the mentally and emotionally strongest elite athletes could compete at the highest levels of competitive sport (Hammond, 2013; Moesch et al., 2018). Due to this belief, elite athletes were considered to be largely immune to experiencing psychological distress, including suffering from mental illness and symptoms (Markser, 2011). Consequently, little attention was given by researchers and clinicians regarding elite athletes' mental health. Over the past decade, however, a growing number of high-profile and successful elite athletes, such as Olympic Gold Medallists Michael Phelps (Hill, 2024), Victoria Pendelton (Cary, 2019), and Simone Biles (Kallingal, 2021), have spoken publicly about their struggles with mental illness(es) and symptoms during their sporting careers. These public self-disclosures of highly successful athletes indicated that elite athletes could experience mental illness and symptoms (Moesch et al., 2018), and still

achieve peak athletic success, contradicted previously held beliefs about elite athletes. These athlete disclosures have also coincided with a growing understanding and awareness of mental health in society more broadly, which has helped to reduce stigma about mental health within and outside sporting environments for people to seek medial support services.

In 2010, Reardon and Factor (2010) published a systematic review on sport psychiatry and examined diagnosis and treatment of mental illness in athletes. These authors noted that at the time, sport psychiatry was a field and research base in its infancy (Reardon & Factor, 2010). Since this publication, the number of elite athletes speaking publicly about their mental health struggles increased within the media, and so did the number of research articles on this topic. In a scoping review, Küttel & Larsen (2020) found that 81% of studies focusing on elite athlete mental health were published between 2013 and 2018. The rise of research and public discourse regarding mental health in elite sport culminated in publication of a position stand from the International Society of Sport Psychology in 2017 (Schinke et al., 2017), the first time a sporting organisation had produced such a publication.

Subsequently, more sporting organisations published their own position stands or consensus statements, including the International Olympic Committee in 2019 (Reardon et al., 2019), demonstrating how critical mental health in elite sport had become as a topic for researchers, clinicians, and sporting organisations. Not long after the International Olympic Committee consensus statement, another consensus statement from an international Think Tank on elite athlete mental health, initiated by the International Society of Sport Psychology was published (Henriksen et al., 2020). In this consensus statement, Henriksen et al. (2020) proposed that "mental health is a core component of a culture of excellence" (p. 554), and advocated for sporting organisations and practitioners to focus on supporting athletes' mental health within high-performance sporting environments. These consensus statements on elite athletes' mental health represented a perspective that had evolved significantly from the

earlier beliefs that elite athletes competing at the highest levels of competitive sport did not experience mental illness and symptoms.

While research attention on elite athletes' mental health has been increasing, so too was awareness on the importance of sleep for elite athletes. Like mental health, the role of sleep for elite athletes' health, wellbeing and performance has not historically been regarded with the same prominence that it is today. Indeed, a systematic review of literature on elite adult athlete by Silva et al., (2021) found that up until 2010 there were only three published research papers on adult athletes' sleep (i.e., Cardinali et al., 2002; Netzer et al., 2001; Tafti et al., 1992). Beyond the findings of Silva et al.'s (2021) systematic review, an earlier study by Taylor et al. (1997) examined the effects of training volume on the sleep and mood states of elite (National level) female swimmers. Outside of sport, myths existed that many adults only need five hours a night of sleep for general health, and that you can learn to adapt to function well with less sleep (Robbins et al., 2019). For athletes, this meant that more hours of training were often prioritised over opportunities for more hours of sleep, with late night and early morning training sessions commonly scheduled for many athletes. Anecdotally, some coaches and athletes believed that needing a lot of sleep was a sign of weakness, with sleep regarded as a luxury and the ability to endure insufficient sleep perceived as a strength (Simpson et al., 2017). Not all athletes espoused this view, with high-profile and successful elite athletes such as Roger Federer and LeBron James reported in the media to sleep for 12 hours (How To Academy, 2019) and 9+ hours per night (Davis, 2018), respectively.

Sleep has increasingly become a relevant and valuable area of inquiry for researchers and clinicians. Driven in part by increased knowledge and awareness regarding sleep as a critical component of public health (Silva et al., 2021), researchers began studying sleep and its importance for elite athlete's recovery and athletic performance, with much of this research coming from Australia (Lastella et al., 2020). It was suggested by Cook and Charest

(2023) that the sleep extension study with college basketball athletes by Mah et al. (2011) was the catalyst for the subsequent surge of research studies into sleep in athletes. Sleep is critical for athletes for a number of physiological and psychological reasons, including optimising physical performance, cognitive functioning, metabolic functioning, pain perception, memory, learning, immune system functioning, increased production of growth hormone, and regulation of mood states (Halson, 2008; Halson, 2014; Halson & Juliff, 2017; O'Donnell et al., 2018; Samuels, 2009). Anecdotally, sleep is now regarded by athletes and coaches as one of the most important strategies for optimising recovery from athletic training due to its restorative effects (Halson, 2013; Roberts et al., 2019; Samuels, 2009; Vitale et al., 2019). Today, sleep is recognised as crucial for physical health and well-being for all humans (Kroshus et al., 2019) and is a significant component of overall mental health (Kim et al., 2024).

This growing recognition on the importance of sleep for elite athletes led to the publication of consensus statements on this topic from leading sporting organisations such as the National Collegiate Athletics Association (Kroshus et al., 2019). Even the 2019 IOC consensus statement (Reardon et al., 2019) on elite athlete mental health recognised sleep as a critical feature of mental illnesses and symptoms and demonstrated links between mental health and sleep for athletes. Mental health and sleep are critically important for elite athletes for a myriad of reasons, including optimal physical (e.g., muscular strength, speed) and cognitive (e.g., decision-making, attention/focus) performance, which are essential components of optimal athletic performance (Charest & Grandner, 2020; Schinke et al., 2024). Additionally, both are fundamental for maintaining good physical health and reducing the likelihood of injury and illness (Charest & Grandner, 2020; Reardon et al., 2019). For instance, Drew et al., (2017) found that depressive symptoms were highly associated with reports of physical illness in the preceding month in a cohort of Australian Olympic-level

athletes, suggesting that there are links between mental health and physical health in the elite athlete population.

As athletes are subject to intense physical and psychological demands during training and competition, understanding how mental health and sleep interact in these highly pressurised environments is vital. Although mental health and sleep have both become relevant and growing areas of research, currently there remains a lack of research that has examined the relationship between mental health and sleep within the elite athlete population (Kim et al., 2024; Montero et al., 2022). Consequently, at present much of what we know about this relationship and how it may affect elite athletes is drawn from research with the general population

1.2 Mental health and sleep in the general population

The World Health Organisation (WHO) estimates that in 2019, one in eight people globally lived with a mental illness, making it one of the leading contributors to the global burden of disease (World Health Organisation, 2022). The most recent population survey data from 2020-22 indicates that approximately one in five Australians aged 16-85 years self-reported that they had a current (within the past 12 months) mental illness, and more than two in five Australians aged 16-85 had experienced a mental illness at some point during their life (Australian Institute of Health and Welfare, 2025b). This data illustrates that Australia has one of the highest self-reported rates of mental illness of all countries in the world, and highlights the need to address mental illness among Australians (Institute for Health Metrics and Evaluation, n.d).

The most prevalent mental illnesses in the Australian population are anxiety disorders and affective disorders (such as depression), affecting an estimated 17% and 8% of the population, respectively (Australian Institute of Health and Welfare, 2025b). A common feature of these mental illnesses is sleep disturbances, which may include impaired sleep

quality, changes in sleep duration (both increased and decreased), and insomnia (American Psychological Association, 2022; Anderson & Bradley, 2013). Indeed, Asplund and Chang, (2020) highlighted that sleep disturbances are associated with almost every known mental illness, which demonstrates the strong relationship that mental health and sleep have. For example, in mood disorders such as major depressive disorder, insomnia and/or hypersomnia (i.e., excessive daytime sleepiness despite getting an adequate amount of sleep) are part of the diagnostic criteria (American Psychological Association, 2022). In other mental illnesses, such as manic episodes and Bipolar disorders, the diagnostic criteria include a decreased need for sleep, such as feeling rested after only three hours sleep (American Psychological Association, 2022). The relationship between mental health and sleep is complex to say the least!

Insomnia is a sleep disorder that is characterised by frequent difficulty either falling asleep and/or staying asleep and crucially, results in impaired daytime function (Krystal et al., 2021). As well as being a key symptom in many mental illnesses, chronic insomnia is associated with physical health problems including cardiovascular disease, metabolic disease, and cognitive impairments such as memory problems, difficulty concentrating, and inattention (Fernandez-Mendoza & Vgontzas, 2013). According to the most recent population survey data in Australia, more than 50% of adults aged 18 years and older self-reported regularly experiencing at least one chronic sleep symptom (e.g., difficulty falling or staying asleep), while 12.2% met diagnostic criteria for chronic insomnia disorder based on DSM-V diagnostic criteria (Reynolds et al., 2019). Evidently, sleep disturbances and insomnia are common health challenges faced by Australians, with associations between them and adverse physical and mental health outcomes known (Reynolds et al., 2019). Supporting people to improve their sleep is therefore likely to have significant health benefits to our community and athletes.

Mental health care has traditionally considered sleep disruption (including insomnia) to be a secondary symptom to mental illnesses, and as noted above, insomnia is a diagnostic symptom for several mood and anxiety disorders (Ancoli-Israel, 2006; Harvey, 2001). Historically, treatment was targeted at resolving the mental illness such as major depressive disorder, with a belief that sleep disturbance would resolve because of improving mental health (Lancel et al., 2021). Research has shown, however, that sleep disturbance often precedes depression. A meta-analysis by Baglioni et al., (2011) demonstrated that insomnia is a predictive factor for the subsequent development of depression, with non-depressed people with insomnia having a twofold risk to develop depression compared to people with no sleep difficulties. Research has also indicated that insomnia often persists after standard treatment to resolve depression, and insomnia is also considered a key predictor of depression relapse (Benca & Peterson, 2008; Chen et al., 2017). Evidently, this relationship between sleep and mental illness and symptomology is not a simple cause-effect relationship (Fang et al., 2019), but rather a complex, strong, interdependent, and bi-directional one (Del Rio João et al., 2018; Kroshus et al., 2019)

1.3 The relationship between mental health and sleep

To help understand the relationship between mental health and sleep, different theoretical models have been proposed, with many of them linked to stress and psychological factors (Fernandez-Mendoza & Vgontzas, 2013). Of these there are two main theoretical models used within the literature. The first theoretical model that has attracted attention within the literature to explain this relationship is the reciprocal model of mental health and sleep (e.g., Lancel et al., 2021; Wang et al., 2021). This reciprocal model suggests that a bi-directional relationship exists between mental health and sleep, whereby sleep disturbance(s) can be a symptom of or exacerbate mental illness and symptoms, such as major depressive disorder and anxiety disorders. Equally, stress and mental illness symptoms can reduce sleep

duration and quality (Charest & Grandner, 2020; Neckelmann et al., 2007). Regarding associations between insomnia and mental illness, insomnia has been linked to activation of the stress system, including cognitive-emotional arousal (e.g., cognitive rumination) and heightened emotional regulation or internalised coping (Fernandez-Mendoza & Vgontzas, 2013).

The second theoretical model that can help explain the relationship between mental health and sleep is the biopsychosocial model. Becker et al. (2015) proposed a biopsychosocial and contextual model of sleep for adolescents. In the model, they suggested that sleep is interconnected with biological factors such as genetic factors, biochemical pathways, connections between brain regions, and sleep architecture (Fang et al., 2019; Lancel et al., 2021); psychological factors such as mental health and coping mechanisms (e.g., mental illness and symptoms; internalised vs externalised coping skills; (Fernandez-Mendoza & Vgontzas, 2013); social factors such as family, friends, and education (for athletes this may also include coaches, teammates, and sporting environments); and contextual factors (e.g., electronic devise use, school start times; Becker et al., 2015). This biopsychosocial and contextual model of adolescent sleep is similar to Bronfenbrenner's (1992) ecological systems model, and emphasises that adolescent sleep is complex and influenced by an array of intertwined biological, psychological, and social factors. The combination of biological, psychological, social, and contextual factors can all impact on adolescents' sleep independently, and in combination, and understanding these factors is required in order to provide targeted and effective preventative and intervention strategies to support optimal sleep for adolescents. Given the array of factors identified to impact athletes' sleep (explained in greater detail in Chapter 2), the biopsychosocial and contextual model may be appropriate to adopt for greater understanding of elite athletes' sleep.

Both the reciprocal model and the biopsychosocial model are useful for understanding the relationship between mental health and sleep in elite athletes. The reciprocal model emphasises that sleep and mental health have a bi-directional relationship, and this interconnectedness is important to understand to facilitate appropriate interventions that can target both sleep and mental health. The biopsychosocial model is also useful for understanding the relationship between mental health and sleep in elite athletes, given the unique and challenging environments that these athletes exist within, and how these environmental and contextual factors can impact athletes' mental health and sleep.

1.4 Mental health and sleep in the athlete population

Elite athletes operate in unique and challenging environments that place significant physical and psychological demands on them (Bruner et al., 2008; Noblet et al., 2003). These demands include: excessive physical/training loads, which can lead to overtraining, injury, and/or burnout, and that are all associated with increased symptoms of anxiety and depression (Peluso & de Andrade, 2005); frequent travel (Doherty et al., 2023); injury and illness (Drew et al., 2018); performing under pressure (Rice et al., 2016); competition/performance outcomes (Hammond, 2013); media and public scrutiny around their athletic performances (Faustin et al., 2022); lack of job security and concerns over selection/deselection (Noblet et al., 2003); and financial stressors (Fletcher & Hanton, 2003). These competing demands can impact elite athletes' mental health and sleep, and can increase the vulnerability to athletes in developing mental illness(es) and symptoms, inadequate sleep duration, and/or increased sleep disturbances and poor sleep quality (Gulliver et al., 2015; Gupta et al., 2017; Rice et al., 2016; Roberts et al., 2019; Wolanin et al., 2015). Therefore, understanding how physical and psychological demands can impact elite athletes' mental health and sleep is important to ensure that elite athletes can be adequately supported to cope with these demands, including

the development of specific interventions to help elite athletes attain optimal physical and mental health (Simpson et al., 2017).

Sleep quality appears to have a direct relationship with mood states in athletes. Athletes who experienced disrupted sleep have reported lower rates of vigour and increased rates tension and fatigue, and these mood states are linked to diminished performance (Brandt et al., 2016; Lastella et al., 2014). Brandt et al. (2016) conducted a study with 576 Brazilian elite athletes and found that better perceived sleep quality was associated with increased vigour and decreased tension, depression, anger, fatigue, and confusion. Similarly, Biggins et al. (2018) explored sleep and subjective wellbeing in a cross-sectional study with 69 elite Gaelic athletes. Just under half (47.8%) of the athletes were identified as being poor sleepers, and poor sleep was significantly correlated with increased stress and increased confusion (Biggins et al., 2018).

There appears to also be a link between levels of anxiety and decreased sleep quality in athletes (Lastella et al., 2014). Athletes who do not obtain sufficient sleep per day consistently report higher rates of anxiety (Erlacher et al., 2011). Higher anxiety may be both a causal factor of sleep disturbance and be caused by disturbed sleep, which demonstrates the bi-directionality of this relationship (Narmandakh et al., 2020; Peng et al., 2024). For athletes, they are prone to heightened anxiety in relation to an upcoming competition, and this anxiety is a known cause of sleep disturbance in athletes (Juliff et al., 2015). In a study with 283 elite Australian athletes, Juliff et al. (2015) found that almost two-thirds of athletes had experienced worse sleep at least once in the nights prior to competition in the preceding 12 months, with difficulties falling asleep the main sleep problem identified (82.1%) and thoughts about the competition (83.5%) the most prominent reason for the identified sleep disturbance. It is important, however, to acknowledge that pre-competition anxiety is often a

normal experience for elite athletes and is not always indicative of underlying mental illness or symptomology.

Although there is evidence to suggest that a relationship between mental health and sleep exists elite athletes, to date this relationship has been largely unexamined (Montero et al., 2022), despite growing research interest separately across both of these areas. Additionally, the research that has been conducted on mental health and sleep together has been limited by the different conceptualisations of mental health and sleep adopted across studies, which has resulted in the use of inconsistent and imprecise measures used (Kim et al., 2024). Studies in this area have often relied on asking one to three questions of athlete participants about their sleep. For example, the study by Brandt et al. (2016) used a single question (i.e., "How would you evaluate the quality of your sleep in the last few days?") to measure perceived sleep quality. The lack of reliable and valid subjective measures such as sleep questionnaires (e.g., Pittsburgh Sleep Quality Index [PSQI]; see Buysse et al., 1989); Athlete Behaviour Sleep Questionnaire [ABSQ]; see Driller et al., 2018) and objective measures (e.g., actigraphy) greatly limits the applicability of these findings. Furthermore, research in this area has often assessed mood states via questionnaires, which can be helpful for understanding precompetitive predictive factors of sports performance (Keikha et al., 2015), but it is not the same as measuring mental illness or symptoms. For example, studies exploring sleep and mood states by Brandt et al. (2016) and (Biggins et al., 2018) used the Profile of Mood States (POMS; see McNair et al., 1971) questionnaire. While this questionnaire is useful for measuring mood states and has applicability regarding athletic performance (e.g., Beedie et al., 2000), it does not measure clinical symptoms of mental illness or provide diagnostic data on mental illnesses. To enhance the current knowledge, future research should look to measure mental illness and symptomology and sleep in elite athletes, rather than focus on mood states and sleep. It also should include valid and reliable

subjective sleep measures, and/or objective sleep measures like actigraphy. This data will enhance the current understanding regarding the relationship between mental health and sleep in elite athletes.

With a limited number of studies to date, additional research is required to determine the bi-directional relationship between sleep and mental health in elite athletes (Charest & Grandner, 2022); Kim et al., 2024; Montero et al., 2022). Future research needs to utilise higher quality subjective and objective measures of mental health and sleep, such as validated questionnaires and clinical diagnostic interviews, to further assess the relationship between sleep quality and mental health in elite athletes. Additionally, qualitative research would be useful to capture perspectives from athletes about their own experiences of mental health and sleep, and what they believe would help inform interventions to support their health and wellbeing. A better understanding of the relationship between sleep and mental health in elite athletes will help enable interventions to be designed and implemented to address the barriers and facilitators as an athlete, which may contribute to improvements in athlete health and athletic performance outcomes (Charest & Grandner, 2022).

1.5 Definition of Key Terms

1.5.1 Mental health versus Mental Illness.

Mental health is defined as *"a state of wellbeing in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community"* (World Health Organisation, 2001). This definition recognises that mental health includes wellbeing and the realisation of individual's potential, rather than the absence of disease or disorder (World Health Organisation, 2001).

Although widely cited in sport psychology literature, there is understanding that the World Health Organisation definition of mental health is targeted towards the general

population, and may not be sensitive enough to capture the unique experiences of athletes within elite sport (Schinke et al., 2024). To overcome this limitation, Küttel and Larsen (2020) proposed an athlete specific definition of mental health:

"Mental health is a dynamic state of wellbeing in which athletes can realise their potential, see a *purpose and meaning in sport and life, experience trusting personal relationships, cope with common life stressors and the specific stressors in elite sport, and are able to act autonomously according to their values."* (p. 23)

Mental illness is defined as "*a syndrome characterised by clinically significant disturbance in an individual's cognition, emotion regulation, or behaviour that reflects a dysfunction in the psychological, biological, or development processes underlying mental functioning"*(American Psychological Association, 2022). Mental illness refers to diagnosed psychiatric conditions such as major depressive disorder, anxiety disorders (e.g., generalised anxiety disorder, panic disorder, specific phobias, etc.), alcohol and other substance use disorders, eating and feeding disorders, and sleep disorders (American Psychological Association, 2022).

Mental health is a multidimensional health issue that has been subjected to conjecture for many years, especially in relation to how mental health and mental illness should be understood and conceptualised in psychology (Clark et al., 2017). Within the literature, there have been inconsistencies with terminologies used when describing 'mental health'. Terms such as mental illness, mental health disorders, mental health symptoms, psychiatric disorders, and mood states have all been used interchangeably, and often used to describe elite athlete mental health. For instance, Appaneal et al., (2009) noted that sport science literature has used the term *depression* interchangeably to mean both a mood state (i.e., depressed mood) and a mental illness (i.e., major depression). Understanding the differences between depressed mood (i.e., a temporary state of feeling low or sad) and major depression

(i.e., a medical condition involving multiple symptoms beyond depressed mood) is an important consideration in mental health research. Diagnosing a mental illness such as major depressive disorder should be undertaken through a clinical interview to determine whether criteria from a diagnostic manual such as the DSM-V-TR (American Psychological Association, 2022) have been met (Soleimani et al., 2011). In contrast, mental illness symptoms and mood states are often measured through self-report measures such as symptom checklists (Appaneal et al., 2009). To help understand the differences between mood states and mental illness, Lardon and Fitzgerald (2013) suggested that mental health should be viewed as a continuum, rather than a discrete fixed state of mind or mood (see

Figure 1-1). This continuum model of mental health has been advocated for by the International Society of Sport Psychology as a helpful way to conceptualise elite athletes' mental health experiences (Schinke et al., 2024).

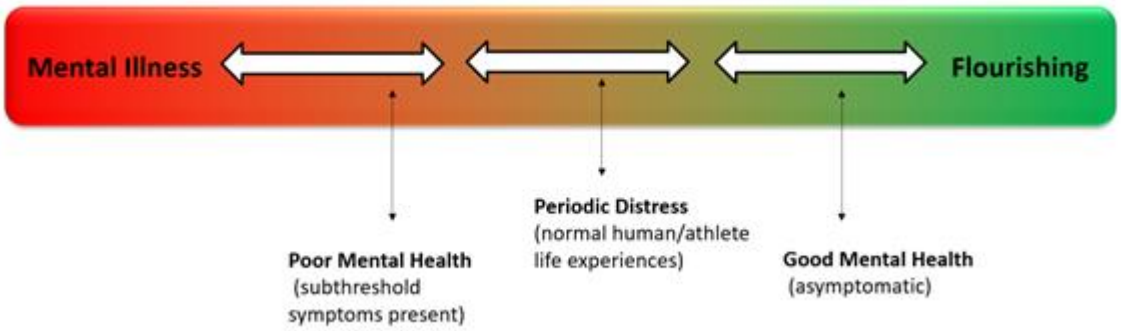

Figure 1-1. *Mental Health Continuum Ranging from Mental Illness to Flourishing (adapted from Lardon & Fitzgerald, 2013).*

Along the mental health continuum, one end represents diagnosed mental illness (i.e., left end), and the other end (i.e., right end) represents flourishing including wellness and optimal functioning (Lardon & Fitzgerald, 2013; Schinke et al., 2017). In between extremes of mental illness and flourishing, other psychological states exist along the continuum. People

can experience mental health symptoms (e.g., subthreshold symptoms), that while may not be sufficient to reach diagnostic threshold for a mental illness, can be psychologically distressing and impair normal functioning (Schinke et al., 2024). For athletes, subthreshold mental health symptoms can detrimentally impact athletic performance (Gulliver et al., 2012). Further along the continuum exist states of periodic distress (e.g., occasional symptoms; Schinke et al., 2024) that reflect a normal part of both the human condition (i.e., periodic experiences of adversity such as difficult thoughts and emotions throughout the lifespan). These psychological states of periodic distress also include challenges encountered by elite athletes (i.e., periodic experiences of distress such as performance pressure as the result of pursuing athletic endeavour; Henriksen et al., 2019). In states of periodic distress, transient symptoms may be present that are normal responses to adverse or atypical situations (e.g., despair due to performance outcome). If this distress becomes more persistent or problematic over time, an individual may move to a state of subthreshold symptoms, or even mental illness should distress become severe and disruptive. Further along the continuum away from periodic distress is good mental health (asymptomatic), where there is total absence of symptomology. The final state on the continuum is a state of flourishing or wellness exists (Keyes, 2002); Schinke et al., 2017), and where peak performance experiences (i.e., flow; Jackson & Csikszentmihalyi, 1999) are more likely to occur. An investigation of flourishing, and flow states, is beyond the scope of this PhD.

1.5.2 Elite athlete

Historically, there has been inconsistencies and confusion in sport psychology research in the definition of ‘elite athlete’, which has limited the validity and generalisability of research findings in this field (Swann et al., 2015). For instance, Swann et al. (2015) found in their systematic review that literature had included eight different categories of elite/expert

athletes, which ranged from Olympic champions to regional/provincial athletes, and included athletes who had been competing for as little as two years in their sport. In Australia, the Australian Institute of Sport developed the Foundations, Talent, Elite, and Mastery (FTEM; (Sport Australia, n.d.) framework in about 2011/12 (NSW Office of Sport, 2020) for classifying athletes in the Australian high-performance sport system talent pathway. Based on this framework, athletes classified in the Talent category would be considered 'pre-elite' and athletes in the Elite or Mastery categories would be considered 'elite'(Sport Australia, n.d.).

To aid clarity with defining what constitutes an elite athlete, McKay et al., (2022) recently developed a framework for classifying athletes. The framework consists of six tiers to classify individual participants in studies containing exercise/training and/or sport performance outcomes. The first tier, Tier 0 (sedentary), represents individuals who do not meet the World Health Organisation's minimum weekly physical activity guidelines for adults. The second tier, Tier 1 (recreationally active), includes individuals who do meet these physical activity guidelines, and who may participate in organised sports or other forms of activity. The third tier, Tier 2 (trained/developmental), encompasses to individuals who are committed to sport-specific training and intend to compete in their chosen sport(s). The fourth tier, Tier 3 (highly trained/national), is the first tier that defines performance standards. To be classified in Tier 3, individuals (now considered athletes) need to be competing at a national level and includes college athletes in division II and III programs of the National Collegiate Athletic Association. The fifth tier, Tier 4 (elite/international), includes athletes competing at an international level in their chosen sport, or the equivalent to the division I program of the National Collegiate Athletic Association. Athletes classified at Tier 4 are highly proficient in their sport. Lastly, the sixth tier, Tier 5 (world class), comprises of athletes who are Olympic/World Championship medallists or finalists, and are considered to be at or very close to the top rankings in their chosen sport (McKay et al., 2022).

It is this framework by McKay et al. (2022) that will be used to conceptualise athletes in this thesis. For this thesis, athletes considered to be at Tier 3 are called 'pre-elite', and athletes considered to be at Tiers 4 and 5 are called 'elite'. Given the uniqueness of this population as outlined previously in this chapter, and the challenges faced by pre-elite/elite athletes that can impact their mental health and/or sleep, the focus of this thesis and the relevant literature is on those athletes competing at levels that would classify them between Tiers 3-5.

1.6 Thesis Aims

There were two overarching aims of this PhD thesis. The first overarching aim was to explore the relationship between mental health and sleep in Australian elite/pre-elite athletes (Aim 1). This aim was investigated through two studies (see Chapter 3 and Chapter 4). The second overarching aim of this thesis was to design, implement, and evaluate the effectiveness of a pilot intervention aimed at improving athlete's sleep and/or mental health (Aim 2). The second aim of this PhD (Aim 2) was informed by the findings of the Aim 1 studies (see Chapter 3 and Chapter 4). These two aims were investigated through three independent studies, with subsequent research objectives:

Study 1 – Aim 1

A. Establish the point prevalence of mental illness in elite/pre-elite Australian athletes using a diagnostic interview.
B. Explore the relationship between mental illness and symptomology and sleep quality in elite/pre-elite Australian athletes

Study 2 – Aim 1

A. To explore how athletes, coaches, and support staff experienced mental health, the relationship between mental health and sleep, and how this relationship might affect athletic performance
B. To explore barriers and facilitators to elite athletes' mental health and sleep as perceived by different stakeholders within the high-performance sporting ecosystem in Australia.

Study Three – Aim 2

A. Informed by the findings of Study 1 and 2 an intervention was identified that aimed at improving athlete's sleep and/or mental health. Therefore, this aim was to evaluate the effectiveness of Cognitive Behavioural Therapy for Insomnia (CBT-I) in improving sleep quality, duration, and mental health in elite athletes

1.7 Overview of Thesis/Thesis Structure

This thesis is a combination of thesis chapters as well as manuscripts that have been prepared with publication in mind. This thesis comprises six chapters.

Chapter 1 (the current chapter) provides a brief introduction to the relationship between mental health and sleep in elite athletes, as well as defining key terminology and presenting the research questions for this thesis.

Chapter 2 (Literature Review) discusses the available literature to date on mental health and sleep in elite athletes to provide the reader with an understanding of the current evidence base and literature gaps.

Chapter 3 (Study 1) presents the prepared manuscript and empirical study establishing the point prevalence of mental illness and symptomology, and the association between mental illness and symptomology and sleep quality, in elite/pre-elite Australian athletes.

Chapter 4 (Study 2) presents the prepared manuscript and empirical study exploring Australian athletes', coaches' and support staff lived experiences of mental health, the relationship between mental health and sleep, and identified barriers and facilitators to elite athletes' mental health and sleep as perceived by different stakeholders within the high-performance sporting ecosystem in Australia.

Chapter 5 (Study 3) implements the findings of Chapters 3 and 4, to undertake a pilot clinical trial sleep intervention study that utilises Cognitive Behavioural Therapy for Insomnia (CBT-I) to help support and improve sleep quality, sleep duration, sleep behaviours, and mental wellbeing in athletes.

Chapter Six (Discussion) summarises the findings of this thesis, including strengths and limitations of the thesis, directions for further research, and conclusions.

1.8 Significance and Originality of the Thesis

This thesis is significant in a number of ways. Firstly, although there has been increased research attention given to both mental health (e.g., Rice et al., 2016; Reardon et al., 2019) and to sleep (e.g., Gupta et al., 2017; Walsh et al., 2021) in elite athletes, there is currently a lack of research that has focused on both mental health and sleep together (Kim et al., 2024). This is reflected by only one published literature review to date on the topic (Montero et al., 2022). As a result of the limited attention that has been given to the bi-directional relationship between mental health and sleep in elite athletes, it is not yet clear how this relationship may impact athletes' health and wellbeing. The

small number of studies that have explored this relationship to date are discussed above in section 1.4. One theme of this literature review, which is considered in Chapter 2, has been the conceptualisation and measurement of mental health in research with elite athletes. To enhance this knowledge, it has been recommended that research should utilise diagnostic interviews with athletes to determine prevalence of mental illnesses in this population (Gorczynski et al., 2017) rather than self-reported questionnaires. Despite these recommendations, to date only five published studies have used diagnostic interview with athletes (Appaneal et al., 2009; Hammond et al., 2013; Oevreboe et al., 2023; Rogers et al., 2021; Schaal et al., 2011). The first study in this thesis (Study 1 - Chapter 3) has added to this small body of research by using a diagnostic interview for assessing mental illness and symptomology with elite and pre-elite Australian athletes and is the first study to compare diagnostic interview data with a sleep quality measure.

Study 2 (Chapter 4) is both significant and original to the field. Most of the research conducted in both mental health and sleep in elite athletes has utilised quantitative approaches to measure both areas. Less is known, however, about athletes lived experiences regarding this bi-directional relationship between mental health and sleep, nor their perspectives on how this relationship may impact them. In addition, limited qualitative research has previously been conducted on sleep in elite athletes, so Study 2 helps to reduce this research gap. Study 2 also captured perspectives from coaches and staff working in high-performance sport on their lived experiences and beliefs about mental health and sleep, and how they perceive that this relationship may impact athletes. These populations have had limited attention in research to date, despite being highly influential for athletes' mental health and sleeping habits.

Finally, Study 3 (Chapter 5) is the first study that has utilised Cognitive Behavioural Therapy for Insomnia (CBT-I) with elite athletes. CBT-I is recognised as the

gold standard psychological treatment for insomnia, and can also improve symptoms of mental illnesses including mood and anxiety disorders (Muench et al., 2022). Elite athletes report poor sleep quality and/or insufficient sleep duration (Walsh et al., 2021), despite recognition that sleep is crucial for optimal physical performance, cognitive functioning, and recovery (Charest & Grandner, 2022; Cook & Charest, 2023). Although empirical studies have used sleep interventions with athletes, none of these intervention studies have included CBT-I. The use of CBT-I with athletes represents a significant advancement in this field.

Chapter 2 Literature Review

2.1 Chapter Overview

This chapter will provide the reader with important background information on mental health and sleep in elite athletes. It will provide an overview on the current state of literature and research related to mental health and elite athletes, and sleep and elite athletes., Gaps in the existing literature will be highlighted, and the information contained in this chapter builds upon the information detailed in Chapter 1 regarding the relationship between mental health and sleep, and provides the foundation to underpin the rationale of the studies in the subsequent chapters.

2.2 Introduction

In 2017, the International Society of Sport Psychology published the first position statement on elite athlete mental health (Schinke et al., 2017). This paper represented a significant advancement in the field of elite athlete mental health research, as for the first time, a prominent organisation had published a position paper or consensus statement as to why mental health is so important for athletes, and why protecting and promoting good mental health for elite athletes is paramount for sport.

This growing recognition of the important of elite athlete mental health was further emphasised by the publication of other position and consensus statements by international, professional organisations, including the International Olympic Committee (Reardon et al., 2019), the European Federation of Sport Psychology (Moesch et al., 2018) and subsequent position papers from the International Society of Sport Psychology (Henriksen et al., 2020), including a recent update to their original position paper (Schinke et al., 2024). This update was developed to reflect advancing knowledge and research trends on athlete mental health, including clinical considerations of athlete mental health, impact of career development,

cultural considerations, effective monitoring and treatment, and the role of the sporting environment on athlete mental health (Schinke et al., 2024). In total, there are currently 13 position statements on athlete mental health from sporting organisations, all published within the last 10 years (Vella et al., 2021), emphasising this increased research attention.

Stemming from these position papers, it was first recommended by the International Society of Sport Psychology who have stated that any responsible culture of excellence must consider athlete mental health as a core component of that culture (Henriksen et al., 2020), demonstrating the importance of the sporting environment to athlete mental health. Additionally, the International Olympic Committee advocated for mental health to be better defined in sport and to develop a better understanding of mental health epidemiology in elite athletes (Reardon et al., 2019). The European Federation of Sport Psychology presented models of service provision for athlete mental health in six European countries (Moesch et al., 2018). Among their recommendations from their position statement, Moesch et al. (2018) advocated for improving the quality and validity of mental health diagnostic measures with elite athletes, promote education and help-seeking behaviour in sport, and developing and enhancing current treatment approaches to mental illness and symptoms of poor mental health in elite athletes (Moesch et al., 2018). Similarly, Henriksen et al. (2020) called for a clear definition of mental health in sport and the development of sport-specific measures of mental health

At present, most of the knowledge of athlete mental health has focused on the individual athlete (or coach) when investigating occurrence of mental illness and symptoms, and determinants of athlete mental health (Schinke et al., 2024). It is now understood, however, that mental health is the result of complex and dynamic interactions between individuals and their environment (Henriksen et al., 2024). As knowledge of athlete mental health has grown, researchers have become increasingly interested in how sporting

environments influence athlete mental health, which led to Purcell et al. (2019) developing an ecological systems framework for understanding elite athlete mental health. In the framework, Purcell et al. (2019) proposed that athletes exist within an ecological system that includes the individual athlete (e.g., their beliefs, attitudes, or coping skills); the microsystem, which comprises coaches, teammates, significant others, and high-performance support staff; the exosystem created by the wider sporting environment (e.g., the rules of the athlete's individual sport); and the macrosystem that includes the athlete's National Sporting Organisation or international governing body, media, and general public. This ecological systems model emphasises that elite athlete mental health research needs to consider how the broader ecological systems that athletes exist within influence elite athlete mental health (Purcell et al., 2019).

While awareness was increasing about elite athlete mental health, attention was also growing in sport psychology and sport science research on sleep in elite athletes (Charest & Grandner, 2022; Walsh et al., 2021). Emphasising the increasing attention on sleep and elite athletes, position statements from the IOC (Reardon et al., 2019) and National Collegiate Athletics Association (Kroshus et al., 2019) were published that both recognised the importance of sleep to athletic performance, mental, and physical health.

The relationship between sleep and general health in elite athletes is not as well understood as it is in the general population (Halson & Juliff, 2017), and this still remains largely the case today. In the general population, sleep is important for a number of physiological and psychological reasons, including optimising physical performance, cognitive functioning, metabolic functioning, pain perception, memory, learning, immune system functioning, increased production of growth hormone, and regulation of mood states (Halson, 2008; Halson, 2013; Halson & Juliff, 2017; O'Donnell et al., 2018; Samuels, 2009). These factors that sleep affect in the general population are also important for athletic

performance, recovery, and wellbeing (Charest & Grandner, 2022; Halson, 2013). Consequently, optimising sleep is likely to have a significant impact for elite athlete's health, wellbeing and athletic performance (Simpson et al., 2017).

Most of the research to date exploring sleep and performance has utilised non-athletes and has focused on the effects of severe sleep deprivation, such as not sleeping at all in a 24-hour period (Halson, 2014). Severe sleep loss has been reported to have a detrimental impact on an individual's cognitive and physical performance (Bonnar et al., 2018; Fullagar et al., 2015). These diminished performance results, however, are not likely to be reflective of the sleep disturbances that elite athletes typically experience (Halson & Juliff, 2017; Juliff et al., 2015), which is more likely to be partial sleep deprivation over several nights or an extended period of time rather than severe sleep deprivation (Halson, 2014). Nonetheless, sleep deprivation (whether partial or severe) is associated with poorer physical and cognitive performances for elite athletes (Fullagar et al., 2015; Halson & Juliff, 2017; Vitale et al., 2019). Sleep deprivation in elite athletes is also associated with reduced mental health and wellbeing (Biggins et al., 2018; Biggins et al., 2021). As both sleep and mental health can impact physical health and athletic performance (Charest & Grandner, 2022; Kroshus et al., 2019), further research to help better understand the relationship between sleep and mental health in elite athletes is likely to have important implications for developing targeted and effective interventions to help improve athlete physical health, mental health, and athletic performance outcomes.

Published systematic reviews on elite athletes' mental health (e.g., Gouttebarge et al., 2019; Rice et al., 2016), sleep (e.g., Walsh et al., 2021), along with a recent review by Montero et al. (2022) that examined the literature on the relationship between mental health and sleep in current and former athletes already exist. The purpose of this literature review is not to systematically review the available literature, rather, this literature review will help the

reader understand the relationship between mental health and sleep in elite athletes by critically appraising the relevant research that has been conducted with elite athletes on both mental health and sleep separately, and building upon the information provided in Chapter 1, subsequently linking these two bodies of literature together.

2.3 Prevalence of Mental Illness and Symptoms in Elite Athletes

A key area of interest for researchers in athlete mental health is the prevalence of mental illness and symptoms that elite athletes experience. Prevalence is the proportion of a particular population found to be affected by a medical condition (i.e., mental illness) at a specific time (National Institute of Mental Health, n.d.). Prevalence is a measure of the burden of disease (Ford, 2020). As mental illness is a burden of disease (Vigo et al., 2019), prevalence should be used when describing mental illness. A substantial body of evidence now exists that has explored prevalence and occurrence of mental illness and symptoms across a number of disorders, including depression (Golding et al., 2020), anxiety (Rice et al., 2019), alcohol and substance use (McDuff et al., 2019), and eating disorders (Sundgot-Borgen & Torstveit, 2004). This substantive evidence is underscored by the systematic review and meta-analysis Gouttebarge et al. (2019) conducted on the occurrence of mental health disorders (i.e., mental illnesses) and symptoms in current and former elite athletes. In this meta-analysis, Gouttebarge et al. (2019) found a prevalence of 19% for alcohol misuse and 34% for anxiety and depression for current elite athletes, demonstrating the significant rates that elite athletes experience mental illness and symptoms during their athletic careers.

One of the first studies to examine prevalence of mental illness in elite athletes was Schaal et al. (2011).Using clinical interviews as part of an annual athlete health evaluation in a representative sample of 2067 elite French athletes, the study found 15.1% of elite athletes aged 17 years or younger presented with at least one diagnosable mental illness, compared with 13.1% of athletes aged 18-21 and 10.4% of athletes 22 years and older (Schaal et al.,

2011). Later, Gulliver et al. (2015) found in their cross-sectional survey that almost half (46.4%) out of a cohort of 224 Australian elite athletes self-reported mental health symptoms (e.g., symptoms of depression or anxiety), significantly higher than the previous findings from Schaal et al. (2011). These findings suggest that Australian elite athletes are vulnerable to experiencing psychological distress and that the prevalence of mental illness and symptoms in these athletes may be at a level that is concerning.

Evidence suggests that elite athletes experience prevalence of symptoms of mental illnesses and symptoms such as mood disorders, anxiety disorders, and eating disorders, comparable to the general population (Reardon & Factor, 2010; Wolanin et al., 2015; Yang et al., 2007). For example, a meta-analysis by Gorczynski et al. (2017) examined five articles with more than 3,000 total participants (elite athletes and non-athletes) and found that rates of depressive symptoms were comparable between elite athletes and non-athletes (OR=1.15, 95% CI=0.954 to 1.383, p=0.145). Given the pervasive cultures (e.g., mental toughness) and stigma that can exist in elite sport regarding mental health (e.g., reluctance for help seeking behaviour), it is possible that prevalence rates of poor mental in elite athletes are under-reported (Gouttebarge et al., 2015; Roberts et al., 2016). Hammond et al. (2013) examined the prevalence of failure-based depression using a combination of diagnostic interview and self-report measure with 50 elite Canadian swimmers. Sixty-eight percent of participants met criteria for major depressive disorder (i.e., mental illness) prior to the national swimming trials in the preceding three years. The authors attributed the higher prevalence of depression compared to previous research to the use of a diagnostic clinical interview that assesses mental illnesses, rather than self-reported measures that assess symptoms of poor mental health. The prevalence of depression in Hammond et al.'s (2013) study is significantly higher than the general population lifetime frequency of depression for 19–34-year-olds (Australian

Bureau of Statistics, 2023), and higher than prevalence reported in other studies for depressive symptoms in elite athletes (e.g., (Gorczynski et al., 2017).

Rates of mental illness and symptoms in elite athletes have been explored across different cultures, albeit generally Western or European countries. In a cross-sectional study with Dutch current and former elite athletes, Gouttebarge et al. (2017) used self-report measures and found a four-week prevalence of symptoms of common mental illnesses (i.e., depression, anxiety) ranged from 6% for alcohol misuse to 46% for anxiety and depression in current athletes. Similarly, Foskett and Longstaff (2018) examined the occurrence of symptoms of anxiety, depression, and psychological distress in a cohort of elite athletes from the United Kingdom. Using cross-sectional survey data, Foskett and Longstaff (2018) found that almost 50% of the sample reported symptoms of anxiety/depression, while more than a quarter met the cut-off score for psychological distress. In a sample of 333 elite Swedish athletes, Åkesdotter et al. (2020) conducted a cross-sectional survey study and found a point prevalence of mental illness and symptoms of 11.7%, with a lifetime prevalence of over 50%. Depression, eating disorders, and trauma were the most common mental illness and symptoms reported by these Swedish athletes (Åkesdotter et al., 2020). In another cross-sectional survey study, Poucher et al. (2021) found in a cohort of 186 elite Canadian athletes that almost a third reported symptoms of depression, 18.8% reported symptoms of anxiety, and 8.6% of athletes reported scores indicating high risk for an eating disorder.

Purcell et al. (2020) conducted a cross-sectional survey study with a national representative sample of 749 elite athletes within the Australian high-performance sport system. In this study, Purcell et al. (2020) found that Australian athletes were significantly more likely to report high psychological distress (17.7% v 9.5%) and met the threshold for 'probable caseness,' (i.e., mental health symptoms severe enough to warrant treatment; 35% v 19%), compared to rates in the Australian general population.

Lastly, Oevreboe et al. (2023) recently examined differences in mental distress and mental disorders (i.e., mental illnesses) in Norwegian elite athletes. Using a combination of self-report questionnaire (i.e., mental distress) and diagnostic interviews (i.e., mental illness), Oevreboe et al. (2023) found that 47 out of 106 athletes (44.3%) met diagnostic criteria for a mental illness based on the diagnostic interview. Sleep problems were the most prevalent (24.5%) in this Norwegian athlete cohort, highlighting the relationship between mental health and sleep in elite athletes. Obsessive-compulsive disorder (OCD) and OCD related disorders were also common (18.9%). In this study, anxiety disorders (6.6%), eating disorders (5.7%), and alcohol use disorder (≤4.7%) were less prevalent (Oevreboe et al., 2023), which contrasts with earlier research in this field.

Taken together, these findings across studies indicate that elite athletes experience elevated rates of mental illness symptoms, and this is consistent across different cultures. Symptoms of depression, anxiety, eating disorders, and psychological distress appear to be the most prevalent for elite athletes. This research, however, is limited as it has largely been conducted with cross-sectional survey studies that rely on self-report measures and generally focus on mental health symptoms, with little or no diagnostic information available. How mental health is measured in research with elite athletes is discussed in the next section.

2.4 Measurement of Mental Health in Elite Athletes

As mentioned above, mental illnesses and symptoms in current and former elite athletes was explored by Gouttebarge et al. (2019) in their systematic review and meta-analysis. Consistent with much of the literature that was reviewed in the previous section, the 34 included studies in this meta-analysis relied primarily on self-report cross-sectional data, obtained from standardised measures such as symptom checklists and questionnaires (Gouttebarge et al., 2019). Subjective, self-report measures are quick and easy to administer, cost-effective, and suitable for use with large cohorts, however, they are prone to memory

recall issues and social desirability biases (e.g., underestimating undesirable behaviours such as substance use; (Haberer et al., 2013). Self-report measures tend to assess symptoms of psychological distress and symptoms of mental health (i.e. subthreshold symptoms), and do not provide information regarding diagnosis, degree of impairment, or ruling out other conditions with similar presentations (Hammond et al., 2013). Additionally, self-report measures generally do not assess functional impairment (Thombs et al., 2018), which is a critical clinical feature in the diagnostic criteria for mental illnesses (American Psychological Association, 2022).

The use of self-report measures with elite athletes to assess mental health has created limitations within sport psychology research, with a lack of information available from empirical studies distinguishing mental health *symptoms* from mental health *disorders* (i.e., mental illness; Currie et al., 2021). Self-report measures like questionnaires assess mental health symptoms not mental illness, however, researchers have at times incorrectly inferred this self-report mental health symptom data to be indicative of prevalence (e.g., Gouttebarge et al., 2017), which has created confusion within the literature. Moreover, the reliance on cross-sectional data means that naturally occurring periodic distress states that athletes experience in pursuit of their sporting endeavours could be incorrectly inferred as representing underlying mental health symptoms and psychological distress (Henriksen et al., 2020; Lundqvist & Andersson, 2021). To help overcome these limitations, researchers may wish to consider the use of a continuum model (

Figure 1-1, Chapter 1) to conceptualise elite athlete mental health. Such use of a mental health continuum will hopefully ensure that researchers are better able to distinguish between evaluating prevalence of mental illness from determining subthreshold symptoms and periodic distress states.

Disparity of findings between self-report measures as opposed to a clinical of diagnostic interview was highlighted in Appaneal et al.'s (2009) study that explored the severity of post-injury depression using both a self-report checklist and a diagnostic interview with 164 male and female College athletes. Comparing depression scores on the self-report checklist and diagnostic interview, the authors observed that the self-report checklist consistently overestimated the prevalence of moderate to severe depression in the athlete sample. Specificity of the checklist compared to the clinical interview was comparatively stable from one to three months post-injury. The sensitivity of the checklist was initially high (>90%) at baseline but then dropped to below 50% at one-month and three-month follow-up in this cohort of athletes. Appaneal et al. (2009) attributed the difference in findings between self-report checklist and diagnostic interview to athletes not accurately disclosing their status on the checklist. It may be that these athletes are not disclosing their accurate mental health status because of their perceptions towards the staff who may have access to their data, and concerns athletes may have that their mental health data may lead to possible negative ramifications (e.g., team selection) for the athlete, depending on who saw this data. It is also plausible that athletes found the interview participation as therapeutic and felt comfortable during the interviews, enabling them to be more open about their symptoms (Appaneal et al., 2009).

The results found by Appaneal et al. (2009) suggest that a diagnostic interview may be more accurate in identifying depressive symptoms and major depressive disorder in elite athletes compared with a self-report checklist. Consequently, the reliance on self-report measures across the literature means that the prevalence of mental illness and symptoms in elite athletes may be overestimated (Lundqvist et al., 2021; Oevreboe et al., 2023; Thombs et al., 2018). In their systematic review, Rice et al. (2016) noted that there was a lack of research with diagnostic interviews with elite athletes, with only one study (Hammond et al.,

2013) included in their review. Rice et al. (2016) emphasised that future research should look to use diagnostic interviews to determine prevalence of mental illness in this population, with a recommendation to also assess athletes for low prevalence mental illnesses such as psychosis and mania. To date, prevalence of psychosis and mania in elite athletes is not known. Following these recommendations, Gorczynski et al. (2017) also called for future research to use clinical interviews when evaluating elite athletes' mental health to deepen the knowledge base on this topic. Despite the recommendations from Gorczynski et al. (2017) and Rice et al. (2016), little research has been conducted with elite athletes using diagnostic interviews, with only two studies containing diagnostic interview data published since these recommendations were made (Oevreboe et al., 2023; Rogers et al., 2021). These two studies add to the three that had previously been published some years prior (e.g., Appaneal et al., 2009; Hammond et al., 2013; Schaal et al., 2011). Given this relatively small evidence base, it seems that there is still scope for further research on elite athlete mental health to utilise diagnostic interview to enhance the current knowledge base regarding the epidemiology of mental illness in elite athletes.

As well as recommending diagnostic interviews with elite athletes, there have also been calls from sporting organisations for the development of athlete-specific measures of mental health (e.g., Henriksen et al., 2020; Moesch et al., 2018; Reardon et al., 2019). These recommendations arose from a growing recognition that many of the self-report measures used in mental health research with elite athletes may not be sensitive enough to detect contextual factors (e.g., gender, culture) and environmental factors specific to high-performance sport (e.g., competition stress) that influence elite athletes' mental health (Henriksen et al., 2020). To help overcome these challenges, an athlete-specific screening tool for mental health was developed by Rice, Parker et al. (2020), the Athlete Psychological Strain Questionnaire (APSQ). The APSQ was developed specifically to screen sport-related

psychological distress in elite athletes. Initially validated in with Australian elite male athletes (Rice, Parker et al., 2020), the ASPQ has been validated with elite female athletes (Rice, Olive et al., 2020) and was recently validated with non-elite amateur athletes (Shannon et al., 2024), suggesting that it may have utility as a screening tool for athletes' mental health symptoms, irrespective of their level of competition. The APSQ has been included in the International Olympic Committee's Sport Mental Health Assessment Tool 1 as the first triage screening assessment for athletes' mental health (Gouttebarge et al., 2021). The Sport Mental Health Assessment Tool 1 is seen as an important advancement in the field for identifying mental health symptoms in elite athletes (Currie et al., 2021).

2.5 Determinants for Elite Athletes' Mental Health

A systematic review of the literature on mental health in elite athletes by Rice et al. (2016) found that there are several determinants that make elite athletes a vulnerable population group susceptible to mental illness and symptoms. These determinants include a combination of sport-related (e.g., injury, overtraining) and personal factors (e.g., life stressors, familial histories). The authors also observed that the competition level at which an elite athlete competes could also contribute to an increased susceptibility for poor mental health (Rice et al., 2016). For example, Hammond et al. (2013) found that the top 25% ranked Canadian elite swimmers were almost twice as likely to meet diagnostic criteria for major depressive disorder and reported significantly more depressive symptoms, compared with the remaining 75% of elite swimmers. This finding by Hammond et al. (2013) may be explained by to elite athletes experiencing heightened stress regarding performance and performance outcomes compared to non-elite athletes, which is consistent with other research that has demonstrated that not achieving athletic performance goals can lead to depressive symptoms (e.g., Hassmén & Blomstrand, 1995; Jones & and Sheffield, 2007).

Other determinants that have also been identified that may contribute to poor mental health in elite athletes include lack of job security, increased prevalence of injuries, physical demands, public/media attention and scrutiny, difficult relationships with coaches or teammates, and overtraining and burnout (Gulliver et al., 2015; Poucher et al., 2021; Wolanin et al., 2015).

Within the elite athlete population, there are sub-groups of elite athletes who appear to be more susceptible to mental illness and symptoms. These sub-groups include athletes transitioning out of sport at the end of their athletic careers or who have retired (Gouttebarge et al., 2015), athletes who are under-performing, are not selected or do not have their contracts renewed (Gulliver et al., 2012; Hammond et al., 2013), or athletes who are medically retired due to injury (Furie et al., 2023). Athletes who are injured are also at greater risk of psychological distress, including mental illness and symptoms (Appaneal et al., 2009; Gouttebarge et al., 2016), while evidence is emerging regarding the link between injuries like sport-related concussion and depressive symptoms in elite athletes (Rice et al., 2018).

Age is another factor that appears to contribute to poor mental health and mental illness in elite athletes. The general age range of onset for a first episode of a mental illness for an individual is 25 years and under (Jones, 2013). This age range greatly overlaps with the age range of athletic careers for many elite athletes (Moesch et al., 2018; Purcell et al., 2019; Schinke et al., 2017). The prevalence of mental illness in adolescent athletes (i.e., 15.1%) from Schaal et al. (2011) underscores how vulnerable young athletes are potentially for developing mental illness and symptoms.

Prevalence of mental illness(es) and symptoms have also been linked to sex differences. There is evidence indicating that female athletes have higher prevalence of symptoms of poor mental health and mental illnesses including depression (Gorczynski et al., 2017; Hammond et al., 2013), anxiety (Schaal et al., 2011), and eating disorders (Torstveit &

Sundgot-Borgen, 2015) compared to male athletes. For example, Yang et al. (2007) found that female college athletes had 1.32 greater odds (95%CI, 1.01 to 1.73) of experiencing depressive symptoms compared to male college athletes. This apparent discrepancy may be because female athletes are more likely to report poor mental health than male athletes (Abrahamsen et al., 2008; Hammond et al., 2013; Schaal, et al., 2011), which is consistent with findings from the general population (Culbertson, 1997). Despite their being evidence of sex differences, female athletes remain underrepresented in research studies that have explored mental health in elite athletes (Walton et al., 2022). To address this potential research gap through the underrepresentation of female athletes, it was suggested by Gouttebarge et al. (2019) that future research on elite athlete mental health field should focus on female athletes.

2.6 Mental Health Interventions with Elite Athletes

Intervention for mental health symptoms and disorders that may be of value to use with elite athletes are psychotherapeutic interventions. A narrative review by Stillman et al., (2019) on psychotherapy for mental health symptoms and disorders found that there is limited research regarding psychotherapeutic interventions in elite athletes. Of this research, there was preliminary evidence to support the implementation of Cognitive Behavioural Therapy (CBT) interventions with elite athletes to improve their mental health. As athletes are familiar with structure, self-reliance, direction, practice, and goal setting as part of the performance environments they inhabit, they are suggested to be good candidates for CBT-interventions because these concepts are also fundamental to the therapeutic approach in CBT (Stillman et al., 2013). In line with these suggestions, Podlog et al. (2020) conducted a four-week CBT skills intervention for enhancing psychological wellbeing, rehabilitation adherence, and rehabilitation outcomes with 16 injured National Collegiate Athletics Association Division 1 college athletes. The study included a control and intervention group,

with eight athletes in each. To be eligible for this study, athletes needed to have incurred an injury requiring a minimum four-week absence from training or competition. Outcome measures were taken pre-intervention, at rehabilitation midpoint, and on medical clearance to return to sport. Injured athletes who received a CBT treatment showed greater positive affect and vitality between rehabilitation midpoint and on medical clearance to return to sport, and lower negative affect on medical clearance to return to sport (Podlog et al., 2020). These results of Podlog et al. (2020) demonstrate that short-term CBT-based interventions can be effective at improving the emotional wellbeing of athletes.

2.7 Conclusion

There is growing recognition of the importance of mental health for elite athletes, which is reflected with a growing number of research articles published on this topic in the past decade (Küttel & Larsen, 2020; Purcell et al., 2019). Despite this increased awareness, there is a need for further research that explores the epidemiology of mental health in elite athletes to enhance the current understanding of this critical issue (Rice et al., 2016). Research that focuses on the prevalence of mental illness in elite athletes, not just mental health symptoms and psychological distress, would help improve the quality of research in this field (Gouttebarge et al., 2019). Additionally, further research using diagnostic interviews would be helpful to develop a greater understanding of the differences between the presentation of symptomology in elite athletes who meet diagnostic criteria for a mental illness(es) and those who present with symptoms of mental illness but do not meet diagnostic criteria (Gorczynski et al., 2017; Gouttebarge et al., 2019). As the epidemiology of mental health in elite athletes is better understood, evidence-based best practice guidelines regarding treatment and management, including developing appropriate and effective interventions, for addressing mental illness and symptoms in this unique and wonderful population can be further advanced.

2.8 Sleep and Elite Athletes

As noted in Chapter 1 and at the beginning of this chapter, there has been rapid growth of research on sleep and athletes over the past 15 years. Indeed, since 2011 over 80% of all peer-reviewed papers have been published and more than 90% of citations generated on the topic of sleep and athletes (Lastella et al., 2020). Reflecting this growing area of research, prominent sporting organisations such as the International Olympic Committee (Reardon et al., 2019) and the National Collegiate Athletics Association (Kroshus et al., 2019) have published position papers on the importance of sleep for athletes, in particular emphasising the benefits that sleep provides to athletic performance, recovery, physical health, and mental health (Charest & Grandner, 2022). Further demonstrating the attention on this topic, in 2021 a consensus statement from a panel of international experts on sleep in high-performance sport was published (Walsh et al., 2021). In this consensus statement, Walsh et al. (2021) provided a narrative review on the literature of sleep characteristics of athletes as well as practical strategies for improving athletes' sleep given travel demands (e.g., jet lag, fatigue) that they are often exposed to. This consensus statement also provided useful strategies for practitioners working with elite athletes, emphasising the importance of sleep education, screening athletes for sleep disturbances, encouraging napping where possible, and banking sleep before an important competition (Walsh et al., 2021)

2.9 Prevalence of Sleep Disturbance in Elite Athletes

From an athletic performance perspective, sleep is regarded anecdotally by athletes and coaches as one of the most important strategies for optimising recovery from exercise due to its restorative effects (Halson, 2013; Roberts et al., 2019; Vitale et al., 2019). The exact amount of sleep needed by elite athletes to optimise athletic performance and recovery is currently unknown. Sargent et al. (2021) attempted to understand how much sleep elite athletes need, by comparing self-reported sleep needs of athletes with objective measures of

their habitual sleep duration. One-hundred and seventy-five elite athletes from 12 individual and team sports (n = 30 female, n= 145 male, mean age 22.2 [SD = 3.8 years]) kept a self-report sleep diary for subjective measurement, wore a wrist activity monitor for objective measurement, and answered the subjective question "how many hours of sleep do you need to feel rested?" over 12 nights during a normal phase of their training schedule . Results of this study indicated that athletes self-reported they needed 8.3 ± 0.9 hours of sleep to feel rested, yet on average they obtained only 6.7 ± 0.8 hours of sleep per night measured by the wrist activity monitor. Concerning, only 3% of athletes obtained enough sleep to satisfy their self-reported sleep need, and almost three quarters (71%) of the athletes failed to meet their self-assessed sleep needs by an hour or more (Sargent et al., 2021).

Consistent with the findings from Sargent et al. (2021), there is a strong body of evidence that elite athletes often obtain significantly less sleep than the normative sleep guidelines for non-athletes of 7-9 hours per night for an adult (Biggins et al., 2018; Hirshkowitz et al., 2015; Lastella et al., 2015; Leeder et al., 2012; Mah et al., 2011). For example, Lastella et al. (2015) investigated the habitual sleep/wake behaviour of 124 elite Australian athletes (n = 104 male, n = 20 female, mean age 22.2 [SD = 3.0 years] from a variety of individual and team sports. Using self-report sleep diaries and wrist-worn actigraphy devices, athletes' sleep/wake behaviour was monitored for a minimum of seven nights during a typical training phase. The results indicated that all athletes obtained well below the recommended 8 hours of sleep per night, with individual sport athletes obtaining 6.5 and team sport athletes 7 hours of sleep per night (Lastella et al., 2015)

This trend of elite athletes acquiring less sleep than is recommended for adults is concerning as insufficient sleep may have significant consequences for elite athletes regarding their ability to train and/or compete optimally (Sargent et al., 2021). For example, Fitzgerald et al. (2019) found that reduced sleep quantity was associated with greater

incidence of illness within the next 7 days in a cohort of professional male Australian rules footballers. There is cause for concern that elite athletes often acquire less sleep than non-athletes, especially given the physical and psychological demands experienced by elite athletes means it is likely that their sleep needs may be greater compared to non-athletes to facilitate adequate recovery and optimise performance (Bird, 2013).

As well as struggling to get adequate sleep duration, there is now also substantial evidence demonstrating that the quality of sleep that elite athletes do get is also often poor (Gupta et al., 2017). This poor sleep quality is characterised by sleep dissatisfaction, unrefreshing sleep, difficulties falling asleep (i.e., sleep onset latency), and daytime sleepiness (Walsh et al., 2021). In a recent study, Halson, Johnston, et al. (2022) examined sleep quality in a cohort of 479 elite Australian athletes across 20 Olympic team and individual sports. More than half of these athletes (52%) reported poor sleep quality as measured by the Pittsburgh Sleep Quality Index (PSQI), a widely used tool in sleep research. Long sleep onset latency (i.e. >30 minutes to fall asleep) and perceived sleep quality were identified as the most important contributors to athletes' high PSQI scores (Halson, Johnston, et al., 2022). These findings suggest that elite athletes are highly susceptible to experiencing poor sleep quality, with difficulties falling asleep a key contributor to this poor sleep quality.

2.10 Determinants of Sleep for Elite Athletes

There are many reasons why athletes may have difficulties obtaining the non-athlete recommended quantity of sleep. Gupta et al. (2017) conducted a systematic review of the literature in sleep and elite athletes, exploring the relationships between elite sport and insomnia symptomology and profiled the quantity and quality sleep characteristics of elite athletes. The review revealed that athletes displayed a high prevalence of symptoms of disturbed sleep, including longer time taken to fall asleep, broken sleep, poor quality sleep, and increased daytime fatigue (Gupta et al., 2017). In addition to sleep quantity, Gupta et al.

(2017) also investigated the quality of sleep (i.e., sleep disturbance) experienced by elite athletes. Elite athletes often experience poor quality sleep, as evidenced by a study by Hoshikawa et al. (2018) of 891 Japanese elite athletes revealing that 28% of athletes met the clinical criteria for poor sleep quality. Gupta et al.'s (2017) systematic review found that sleep quality in elite athletes was found to be compromised before major competitions, during periods of increased training volume or intensity, and due to travel.

Increased training load has been shown to lead to a reduction in sleep quantity and sleep quality in elite athletes (Hausswirth et al., 2014). For example, Leduc et al. (2019) documented decreases in sleep quantity and self-reported subjective sleep quality during the highest training load week of their pre-season in international rugby seven's players. Moreover, Lastella et al. (2018) suggested that sleep disturbances are a key indicator of overreaching/overtraining, which may be directly impacted by increased training load. This evidence suggests that sleep can be compromised by the physiological demands of high-level physical exertion (e.g., increased training volume or intensity) or psychological demands (e.g., before a major competition), which may be of concern for elite athletes given the extreme physical stress many are placed under when training and competing.

Factors associated with training and competition that may have a detrimental impact on sleep, such as travel, jet lag, altitude, and training schedules were identified in a meta-analysis conducted by Roberts et al. (2019). Roberts et al. (2019) found that athletes were often unable to achieve the recommended amount of sleep for adults, with athletes often unable to achieve more than seven hours total sleep time or achieve above 85% sleep efficiency (i.e., time in bed divided by total sleep time; Driller et al., 2019) during training and on the night of competition (Roberts et al., 2019).

Sporting competitions are a known contributor to disturbed sleep in elite athletes, with evidence from German (Erlacher et al., 2011) and Australian (Juliff et al., 2015) athletes

suggesting almost two-thirds of athletes have experienced at least one night of sleep that is worse than normal prior to competition. In addition, Andrade et al. (2021) found that elite Brazilian athletes (i.e., competing internationally) were more likely to report poor sleep quality before a competition compared to athletes competing regionally. Not being able to fall asleep or sleep onset latency has been identified as the main sleep issue self-reported by athletes with disturbed sleep, with anxiety regarding the upcoming competition being the greatest contributing factor to sleep disturbance pre-competition (Erlacher et al., 2011; Juliff et al., 2015). Increasing performance anxieties contributing to disturbed sleep may be in part explained by the level of performance that an athlete competes at. Andrade et al. (2019) demonstrated that international level Brazilian athletes are 84% more likely to have poor sleep quality compared with athletes who compete at a regional level.

As well as difficulties falling asleep prior to competition, elite athletes can also experience disturbed sleep post-competition. In a study with 28 elite male rugby union players, Shearer et al. (2015) used actigraphy; small wearable devices that records movement whilst asleep and estimate sleep quantity and quality to record sleep measures of the athletes over a five-day period pre and post competition. These objective sleep results showed the athletes' total sleep time, sleep latency (i.e., time taken to fall asleep), and sleep efficiency were significantly reduced post-competition compared to their sleep behaviours pre-competition. Reduced sleep quality and quantity post-competition (Roberts et al., 2019) may have detrimental effects on athletes' recovery (Halson, 2008; Halson, 2013), which in turn could heighten the risk of injury or compromise athletic performance.

Training schedules are a known cause of sleep disruptions for elite athletes, with early morning training sessions associated with reduced sleep duration and increased pre-training fatigue levels compared to rest days (Sargent, Lastella, et al., 2014). In a study with seven elite Australian swimmers, Sargent, Halson, et al. (2014) found over a two-week high-

intensity training period prior to the 2008 Olympic Games that early morning training sessions (06:00 – 08:00 h) significantly restricted the amount of sleep obtained by elite athletes (5.4 ± 1.3 hours) compared to rest days (7.1 ± 1.2 hours). The authors concluded that significant sleep restriction as evidenced by the swimmers could impair the training performance of elite athletes (Sargent, Halson, et al., 2014).

Training schedules have also been reported to disrupt sleep for adolescent athletes (Steenekamp et al., 2021). In a study with 32 adolescent athletes (n = 7 female) competing in swimming and rowing in New Zealand, Steenekamp et al. (2021) found that athletes' median sleep duration (measured via actigraphy) was shorter by 2 hours on nights prior to early morning training sessions compared to mornings with no training. Moreover, adolescent athletes appear to be susceptible to sleep disturbances caused by many of the other same factors that influence adult athletes' sleep such as competition stress, travel and jet lag, and electronic device (e.g., smartphone) use (Coel et al., 2023). The International Olympic Committee recognised in a consensus statement on youth athletes that sleep plays an integral role in the development of adolescent athletes (Bergeron et al., 2015). Despite this recognition about the importance of sleep for adolescent athletes, knowledge in this area is limited at present due to a lack of evidence on adolescent athlete sleep and more research in this area has been recommended (Coel et al., 2023).

Adult team sport athletes generally report more sleep compared to adult individual sport athletes (Erlacher et al., 2011; Lastella et al., 2015; Richmond et al., 2007). For instance, Lastella et al. (2015) found that on average individual sport athletes slept for 6.5 hours per night compared to 7 hours per night for team sport athletes. Furthermore, Richmond et al. (2007) found that male professional Australian rules footballers athletes slept for an average of almost 9 hours per night. This apparent discrepancy in sleep quantity between individual and team sport athletes has been attributed to the training and competition

schedules of individual sport athletes, with early morning training sessions common in many sports such as swimming, rowing, and gymnastics (Lastella et al., 2015). In contrast to these findings, Driller et al. (2022) found that individual sport athletes reported a small but significantly greater total sleep time compared to team sport athletes. This study by Driller et al. (2022) used subjective self-report measures with sleep questionnaires, whereas the study by Lastella et al. (2015) measured sleep objectively with actigraphy data. The difference in these findings could be attributed to the different measures of sleep used, as objectively measured sleep data is more accurate than self-reported data (Halson, 2019).

2.11 Measurement of Sleep in Elite Athletes

Sleep research with elite athletes has used objective and subjective measures to assess sleep quantity and sleep quality. Actigraphy is the most common and preferred objective sleep measure used with elite athletes as it is inexpensive, has been validated in an athletic population (Fuller et al., 2017), and is a small wearable sensor usually worn on the wrist suitable for monitoring in athletic environments (Halson, 2019).

Sleep research examining elite athletes has also employed subjective tools, such as sleep diaries and questionnaires (Gupta et al., 2017; Roberts et al., 2019). Sleep questionnaires are useful, quick, and cost-effective tools for gathering information on sleep, particularly with large cohorts (Vlahoyiannis et al., 2021). This subjective data that is self-reported by the individual has been used to gather information regarding an individual's sleep hygiene and sleep behaviour, diagnosable sleep disorders, and daytime sleepiness (Halson, 2019). While this subjective data is useful for assessing sleep across large cohorts and for monitoring athlete sleep in their habitual environments, it is often prone to biases (such as social desirability) or inaccuracies due to recall and memory (Halson, 2019).

Some of the sleep questionnaires validated for use in the general population have been used with elite athletes but not yet been validated for use with athletes (e.g., Pittsburgh Sleep

Quality Index [PSQI]; see Buysse, 1989). Caution must be taken when interpreting the results of sleep questionnaires from athletes, however, as they may not be specific enough to accurately reflect the unique differences in sleep quality and sleep behaviours of athletes (Driller et al., 2018). These differences include frequent travel, napping, use of caffeine, training and competition schedules, and pre-competitive anxiety (Gupta et al., 2017; Juliff et al., 2015; Roberts et al., 2019). Athlete-specific sleep questionnaires (i.e., Athlete Sleep Behaviour Questionnaire [ASBQ]; Driller et al., 2018); Athlete Sleep Screening Questionnaire [ASSQ]; Samuels et al., 2016) have now been developed and validated, and should be employed to potentially gain a more appropriate means of subjectively measuring sleep in elite athletes.

2.12 Sleep Interventions with Elite Athletes

With growing recognition that sleep has an important relationship with athletic performance, researchers have begun exploring sleep intervention strategies designed to improve the sleep behaviours of elite athletes. These sleep intervention strategies that have or could be employed in elite athletes include sleep extension (e.g., Mah et al., 2011; Schwartz & Simon, 2015; Swinbourne et al., 2018), sleep hygiene education (e.g., Driller et al., 2019; Fullagar et al., 2016; Van Ryswyk et al., 2017), and napping (e.g., Davies et al., 2010; (Blanchfield et al., 2018; Boukhris et al., 2020; Hsouna et al., 2022; Petit et al., 2014).

Sleep extension is defined as increasing time in bed to increase the opportunity to attain more sleep. This sleep extension intervention was implemented by Mah et al. (2011) to improve athletic performance, reaction time, and mood on college basketball players in the United States. Over a 5-7-week in-season period, 11 male basketball players were encouraged to obtain a minimum of 10 hours per night in bed. Sleep/wake activity was measured with actigraphy and self-reported daily sleep diaries. Basketball related performance outcomes were measured in the form of timed sprints and shooting accuracy. Reaction times were

assessed using psychomotor vigilance task and mood was assessed using Profile of Mood States. The sleep extension intervention increased total sleep time (110.9 ± 79.9 min ($p < 0.001$) and reduced daytime sleepiness, compared to baseline measures. Athletic performance, reaction time, mood, and self-reported physical and mental wellbeing also improved, suggesting that sleep extension may be a useful intervention to support athletes' sleep, performance, and wellbeing.

Napping is defined as any sleep period with a duration of less than 50% of the average major sleep period of an individual, is often called a 'short sleep' (Dinges, 1989, as cited in Lastella et al., 2021) and usually occurs during the day-time as an opportunity to supplement the night-time sleep period (Cunha et al., 2023). Napping has been explored as a sleep intervention to help improve athletic performance (Cunha et al., 2023), although research exploring the physiological and psychological benefits of napping to date is limited (O'Donnell et al., 2018). For example, Davies et al. (2010) explored the effect of morning naps after endurance training on six male participants who had a history of more than two years of athletic training. The study is one of the few sleep intervention studies in athletes to use PSG to monitor sleep and the results suggest that daytime napping may be a useful recovery strategy following endurance exercise.

Compared to sleep extension and napping, sleep hygiene education interventions have received the most attention of the limited, but growing, research on elite athlete sleep interventions. For example, studies by Driller et al. (2019) and Van Ryswyk et al. (2017) demonstrated that sleep hygiene education may be effective at helping to increase sleep efficiency, sleep latency, and boost mood states in elite athletes. A systematic review by Bonnar et al. (2018) examining sleep interventions designed to improve athletic performance and recovery in elite athletes found only three studies (e.g., Fullagar et al., 2016; Harada et al., 2016; Van Ryswyk et al., 2017) that at the time had utilised sleep hygiene strategies with

elite athletes. Potentially given the limited research with sleep hygiene strategies, Bonnar et al. (2018) concluded that sleep extension was likely to be the most helpful strategy for improving performance in elite athletes. This conclusion was supported by a recent systematic review conducted by Cunha et al. (2023) on the impact of sleep interventions on athletic performance. This systematic review included 25 intervention studies in their systematic review, all of which had been published since 2011, emphasising the growing interest in sleep intervention research. Cunha et al. (2023) found that sleep extension (i.e., increasing total sleep time at night) and napping were the most utilised sleep interventions to improve sleep and performance, and were the most effective sleep interventions

Four years after the review by Bonnar et al. (2018), Gwyther et al. (2022) conducted a systematic review and meta-analysis on sleep interventions for performance, mood, and sleep outcomes in athletes. Of the 27 included studies, 10 had used sleep hygiene education, highlighting the growth of sleep intervention research with athletes using sleep hygiene in recent times. Gwyther et al. (2022) reported that sleep hygiene, assisted sleep (i.e., use of low-colour temperature light or auditory brainwave entertainment), and sleep extension interventions may help to improve sleep, mood, and performance outcomes in athletes. The authors concluded that the methodological quality across the reviewed sleep intervention studies was low, and recommended that further research using sleep interventions with athletes be conducted (Gwyther et al., 2022).

The gold standard of sleep intervention in the general population is Cognitive Behavioural Therapy for Insomnia (CBT-I) (Muench et al., 2022), and despite recommendations to trial it in the athlete population (Halson, Johnston, et al., 2022), it has not yet been used with elite athletes. CBT-I is recommended by the American College of Physicians as the initial treatment for all adults with a chronic insomnia disorder (Manber & Carney, 2015). CBT-I is a brief, structured, evidence-based approach to manage insomnia

symptoms that focuses on identifying and challenging thoughts, feelings, and behaviours linked to insomnia symptomology (Newsom, 2024). It involves cognitive interventions such as cognitive restructuring, behavioural interventions such as sleep restriction (limiting amount of time spent in bed to increase sleep quality and efficiency) and relaxation exercises, and sleep education (Manber & Carney, 2015; Walker et al., 2022). Although use of CBT-I with elite athletes and its effectiveness is unknown, it is widely used in non-athlete populations and has good evidence supporting its effectiveness, and is likely to be helpful for athletes.

2.13 Directions for Future Research for Mental Health and Sleep

Future studies in elite athlete mental health are recommended to use clinical interviews to better examine and understand the prevalence of symptoms of depression in this population (Gorczynski et al., 2017). This future research should also focus on mental illness(es), not just symptoms of poor mental health as previously has generally been explored in the research (Gouttebarge et al., 2019; Rice et al., 2016). Diagnostic interviews may help athletes to feel more comfortable in being honest about their mental health compared to self-reported measures (Appaneal et al., 2009) and this may provide more accurate information regarding prevalence of mental illness and symptoms in elite athletes. Furthermore, only one study to date (Rogers et al. 2021) has included data from a clinical interview with Australian elite athletes, and this data was part of a broader focus on female athlete health. Therefore, it would be worthwhile to examine prevalence of mental illness and symptoms using diagnostic interview in elite Australian athletes.

Understanding the contextual factors and nuances of athlete mental health as it relates to performance and non-performance (i.e., everyday life) domains is important to meet and support the mental health needs of individual athletes (Henriksen et al., 2024). Qualitative research is a useful approach for understanding context as it enables experiences and insights

from individuals within a particular population to be captured (Silverman, 2020). Very few studies exploring mental health in elite athletes have adopted a mixed method approach (e.g., (Hammond et al., 2013) or qualitative methods such as interviews or focus groups (e.g., (Biggin et al., 2017; Gulliver et al., 2012). Psychosocial (e.g., social support, personal beliefs) and environmental factors (e.g., physical environments, cultural contexts) can facilitate or debilitate mental health, and unique environmental demands are placed upon elite athletes (Henriksen et al., 2024). To help understand barriers and facilitators to good mental health in elite athletes, future research should utilise either a mixed method approach or a qualitative approach, as this information is difficult to capture with quantitative research.

Focusing almost exclusively on individual athletes, research to date has not considered the social and environmental factors of those around the athletes. Social and environmental factors are important for protecting and supporting elite athletes' mental health (Biggin et al., 2017; Gulliver et al., 2012). For elite athletes, these social and environmental factors may include the sport microsystem (e.g., coaches, support staff, friends, family) and macrosystem (e.g., National Sporting Organisation, media, general public) as outlined by the ecological systems framework developed by Purcell et al. (2019). To date, only Biggin et al. (2017) and Prior et al. (2024) have included perspectives from key stakeholders in high-performance sport such as coaches and sport directors. A focus on the impact of sport environments on elite athletes' mental health is recommended in future research (Poucher et al., 2021). Therefore, future research that explores social and environmental factors, including key stakeholders such as coaches (and potentially support staff and sports medicine professionals) is likely to be informative for helping to advance the current understanding of mental health in elite athletes.

Sleep in elite athletes is not yet well understood, due to a limited number of studies and relatively low quality of sleep research in elite athletes, regarding prevalence studies and

intervention studies (Gupta et al., 2017; Roberts et al., 2019). Existing limited evidence regarding the effect of sleep with elite athletes is confounded by a general lack of agreement on measurement of sleep (Vlahoyiannis et al., 2021), studies with small sample sizes (e.g., (Driller et al., 2019), studies including only male participants (e.g., Mah et al., 2011) or non-elite participants (e.g., Davies et al., 2010). These research limitations have led to a paucity of sleep research on female athletes (Roberts et al., 2019). Scope exists for further sleep research to utilise larger and more diverse samples of elite athletes across multiple sports to help enhance the scientific evidence of understanding sleep requirements for the elite athlete.

Future sleep studies with elite athletes should look to utilise mixed-method or qualitative approves to investigate barriers and facilitators to sleep for elite athletes was proposed by (Nedelec et al., 2018). Using a mixed-method approach has the advantage to understand how well elite athletes sleep (i.e., sleep quantity and sleep quality) and how psychosocial and environmental factors (e.g., caffeine intake, pre-sleep habits, bedroom environment, stress) may impact their sleep (Nedelec et al., 2018). Support for Nedelec et al.'s (2018) proposal was based on their novel sleep research study conducted in 2014 that adopted a mixed-method approach to explore sleep and injury in a case study with an elite European male soccer player (Nédélec et al., 2019). Nédélec et al. (2019) found that sleep onset latency and sleep efficiency were reduced on the night and in the week preceding injury occurrence compared to baseline measures. These results are consistent with previous research that has documented insufficient sleep can increase risk of injury (Milewski et al., 2014). The use of mixed-methods in Nédélec et al.'s (2019) case study was chosen to enable the researchers to investigate the quality and quantity of sleep of the elite athlete as well as how psycho-socio-physiological affected his sleep. Understanding athletes' perspectives on barriers and facilitators to quality sleep would be very informative and this information is

likely to be helpful for informing strategies to improve sleep behaviours of elite athletes. To date, no research has been conducted in this area.

Despite a growing number of sleep intervention studies with elite athletes, there are concerns about the methodological quality of these studies (Gwyther et al., 2022). To date, sleep hygiene education is showing promise as an effective intervention strategy to improve sleep characteristics and help aid recovery and performance in elite athletes (Vitale et al., 2019). Knowing CBT-I is the gold standard psychological intervention (Muench et al., 2022), strong consideration should be given to trialling CBT-I as a sleep intervention with elite athletes. This trialling could involve adapting CBT-I for specific athlete cohorts (e.g., elite Australian athletes) and examine its effectiveness at improving sleep characteristics (e.g., sleep quality and/or duration) in elite athletes.

2.14 Conclusion

Over the past 15 years, researchers have increasingly been interested in understanding mental health and sleep, separately, within athlete populations. The relationship between mental health and sleep is complex and reciprocal, and is generally considered to be well understood in the general population. Despite growing research interest, less is known about the relationship between mental health and sleep in elite athletes. In the general population, sleep disturbances (e.g., poor sleep quality, inadequate sleep duration) are associated with almost every known mental illness (Asplund & Chang, 2020), and sleep disturbance(s) can be a symptom of or exacerbate mental illness and symptoms, such as major depressive disorder and anxiety disorders. Equally, stress and mental illness symptoms can reduce sleep duration and quality (Charest & Grandner, 2020; Neckelmann et al., 2007). With a limited number of studies to date, new research is required to clarify the bi-directional relationship between sleep and mental health in elite athletes (Kim et al., 2024). This clarification is important as elite athletes are a vulnerable population susceptible to mental illness and symptoms (Rice et

al., 2016; Gouttebarge et al., 2019) and often report inadequate sleep duration and/or poor sleep quality (Walsh et al., 2021). Given that both mental health and sleep are associated with overall health and athletic performance, research that explores this relationship in elite athletes is important to help enhance the current knowledge base and identity the significance of this relationship and its impact on elite athletes. Future research should utilise higher quality subjective and objective measures, such as validated questionnaires and clinical diagnostic interviews, to further assess the relationship between sleep quality and mental health in elite athletes. Utilising different methodological approaches (i.e., qualitative, mixed method) to explore mental health and sleep in elite athletes would also help to advance the current knowledge, and may provide significant implications for moving from theory to practice. For instance, capturing information via different methodological approaches could be used to help inform best-practice guidelines for education and interventions to help elite athletes to obtain adequate, good quality sleep. A better-informed understanding of the relationship between mental health and sleep in elite athletes will help enable interventions to be designed and implemented, which may help to lead to improvements in athlete health and athletic performance outcomes (Charest & Grandner, 2022).

Chapter 3 Bridging Statement

The first of two overarching aims of this thesis was to explore the relationship between mental health and sleep in Australian elite athletes. This aim was investigated by two separate studies, and Chapter 3 presents the investigations of the first study (Study 1) in this thesis.

The first part of the literature review in Chapter 2 focused on mental health. It was identified that research on elite athletes' mental health has been limited by a misconception of the definition of prevalence, which is the proportion of a population that has a specific characteristic or disease at a given time (National Institute of Mental Health, n.d.). Studies have incorrectly inferred they were assessing prevalence of mental illness and symptoms, when they were instead assessing occurrence of mood states such as low/depressed mood and subthreshold symptoms not severe enough to meet diagnostic threshold of mental illness.

This previous mental health research, including research involving Australian elite athletes, has generally relied on methodology that reports subjective measures of subthreshold symptoms and mood states, such as an individual's self-reported anxiety and low mood. While this subjective information is useful to indicate the presence of mental health symptoms in elite athletes, it is likely that this subjective information is misleading as high rates of self-reported subthreshold symptoms are mistakenly inferred to indicate high prevalence of mental illness. This is why there have been recommendations for mental health research, including with elite athletes, to utilise diagnostic interviews to record more accurate information on the prevalence of mental illness and symptoms in this population. To date, only four published studies have utilised a diagnostic interview with elite athletes.

Chapter 2 then explored the sleep literature with elite athletes. Sleep is regarding as the best recovery strategy for athletes, and consistent good quality sleep is fundamental for

maintaining good mental and physical health. In the general population, a strong bi-directional relationship exists between mental health and sleep. That is, sleep disturbance is associated with most mental illnesses, and it is a symptom in the diagnostic criteria for multiple mental illnesses, such as major depressive disorder. Equally, mental illness and symptoms such as depression and anxiety can cause sleep disturbances. In the elite athlete population, existing research has examined mood states rather than mental health and sleep, with limited research to date examining mental health and sleep together in the athletic population. This suggests that a relationship between mental health and sleep in elite athletes is currently unknown.

The work presented in Chapter 3 addresses the identified research gaps regarding point prevalence of mental illness and symptoms in elite Australian athletes, and explores whether a relationship between mental health and sleep exists for elite athletes. This manuscript has been submitted to the *International Journal of Sport and Exercise Psychology*, and the manuscript is currently under review. My roles in this manuscript were as first author and included analysis and interpretation of data, writing/editing/reviewing manuscript, and taking responsibility for the integrity of the work as a whole from inception to published work.

Chapter 3

Study 1: Point prevalence and symptomology of mental illness and sleep quality in elite and pre-elite Australian athletes

The work in this chapter has been submitted for publication as:

de Vos, H., Toohey L., Edwards, S., Lewis, K., Halson, S., Drew, M., Rogers, M., & Appaneal. R. (2024). Point prevalence and symptomology of mental illness and sleep quality in elite and pre-elite Australian athletes. *International Journal of Sport & Exercise Psychology* (submitted).

3.1 Abstract

Mental illness and sleep quality have a strong, bi-directional relationship that is well established in the general population, but less established with the athlete population. The present study sought to explore the relationship between sleep quality and mental illness (including subthreshold symptoms) in Australian athletes. This cross-sectional study included 145 elite/pre-elite Australian athletes (mean age = 21.55 ± 5.21 years; 79% female) from 10 Olympic and Commonwealth Games sports. The Mini International Neuropsychiatric Interview was used to assess mental illness, while sleep quality was assessed by the Pittsburgh Sleep Quality Index. Data were collected as part of athlete periodic health evaluations over three consecutive years. At the time of interview, 11.72% of athletes met diagnostic criteria for lifetime prevalence of mental illness, while 20.70% of athletes reported subthreshold symptoms. In addition, generalised ordered logistic regression modelling demonstrated that athletes who reported subthreshold symptoms or a clinical diagnosis for at least one mental illness had twice the odds of reporting poor sleep quality compared to athletes who reported <50% symptoms (OR=1.97, 95%CI=1.24–3.15, p=0.004). The findings indicate that a relationship exists between mental illness and sleep quality in athletes, suggesting that athletes with mental illness or subthreshold symptoms are more likely experience poor sleep quality. As poor sleep quality is common for athletes, support staff (e.g., sport psychology practitioners, physiologists) working with athletes should consider screening for sleep disturbances, and potentially provide sleep education and sleep intervention strategies to support athletes to optimise their mental health and sleep quality.

3.2 Introduction

A pervasive attitude has historically existed throughout the sporting world that only the mentally and emotionally strongest athletes are able to achieve the pinnacle of elite sport (Hammond et al., 2013; Moesch et al., 2018). Due to this attitude, elite athletes were perceived as not being susceptible to mental illness (Markser, 2011), and consequently, research often overlooked elite athlete mental health. In recent years, however, mental health awareness in broader society has increased, which has led to a greater understanding and recognition that mental health and sports performance are not mutually exclusive (Moesch et al., 2018). It is now recognised that elite athletes can experience mental illness and also achieve elite levels of sports performance. This growing recognition of elite athlete mental health is exemplified by consensus statements from leading organisations such as the International Olympic Committee (Reardon et al., 2019) and the International Society of Sport Psychology (Schinke et al., 2024; Schinke et al., 2017).

Mental health is defined as "a state of wellbeing in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (World Health Organisation, 2001, p. 1). Mental health is multifaceted, and there has been ongoing debate for many years regarding how mental health and mental illness should be conceptualised (Clark et al., 2017). Literature on mental health in elite athletes has included terms such as mental health, mental ill-health, mental health symptoms, mental illness, mental health disorders, psychological disorders, and psychiatric disorders, all alluding to different underpinning conceptualisations of mental health. To help improve how mental health may be defined for athletes, Küttel and Larsen (2020) proposed an athlete specific definition of mental health:

"Mental health is a dynamic state of wellbeing in which athletes can realise their potential, see a *purpose and meaning in sport and life, experience trusting personal relationships, cope with common life stressors and the specific stressors in elite sport, and are able to act autonomously according to their values."* (p. 23)

In addition to the development of an athlete-specific definition of mental health, some researchers began conceptualising mental health as a continuum to aid clarity with the different conceptualisations of mental health (e.g., Keyes, 2002; Lardon & Fitzgerald, 2013). As part of their advocacy work, the International Society of Sport Psychology have suggested that the mental health continuum exists with diagnosed mental illness at one end and flourishing (i.e., the optimal state of mental health and performance; Agenor et al., 2017) or psychological wellness (asymptomatic; Hayes et al., 1996) at the other end (Schinke et al., 2024). In between these extreme states, other psychological states exist along the continuum that present some mental illness symptomology (e.g., subthreshold or subclinical symptoms). The continuum also includes psychological states that reflect a normal part of ones' life (e.g., periodic experiences of adversity accompanied by distressing thoughts and emotions throughout the lifespan; (Lardon & Fitzgerald, 2013). For athletes, this distress could present as heavy training loads, competition demands, and other experiences of distress as the result of pursuing athletic endeavour (Henriksen et al., 2019; Schinke et al., 2017). A recent position stand by International Society of Sport Psychology supports the conceptualisation of mental health using a continuum approach for determining "a momentary state of psychological functioning" (Schinke et al., 2024, p. 4). The continuum model recognises that mental health is not discreet or fixed, but rather dynamic and fluid depending on contextual factors (Schinke et al., 2024). Therefore, adopting a continuum approach to contextualise athletes' mental health may be more representative of high-performance demands and therefore, more helpful for sport psychology researchers (Schinke et al., 2017).

A benefit of adopting a continuum approach to conceptualising athletes' mental health is that it enables greater clarification regarding the terminology used within psychological research. For instance, Appaneal et al. (2009) noted that sport science literature has used the term *depression* interchangeably to mean both a mood state (e.g., depressed mood) and a mental illness (e.g., major depressive disorder). This lack of consistency and consensus has led to misinterpretation of results obtained using instruments validated for the assessment of a particular construct of mental health (e.g., DASS-21 assesses depression, anxiety, and stress-like symptoms but does not diagnose mental illness or assess overall mental health). The focus of this paper is on mental illness (i.e., meeting diagnostic criteria listed in DSM-V-TR) and subthreshold symptoms (i.e., symptoms that are not severe enough to meet diagnostic criteria).

For athletes, mental health and athletic performance are interconnected (Kumar, 2023). There are a number of physical and psychological demands placed upon elite athletes that may impact their mental health, and potentially contribute to the development of subthreshold symptoms, eventually leading to mental illness if left untreated. These demands include high physical loads, travel, physical injury and illness, and media and public scrutiny (Allen, 2015; Purcell et al., 2019; Rice et al., 2016). Susceptibility to mental illness and subthreshold symptoms may also be influenced by age, due to an overlap between the age of primary onset for most mental illnesses and the age range of peak athletic careers (i.e., <25 years; Allen, 2015; Purcell et al., 2019; Rice et al., 2016; Schinke et al., 2017). In addition, there is some evidence to support sex differences with female athletes reporting higher prevalence of mental illness and more symptoms of depression (Gorczynski et al., 2017; Hammond, 2013), anxiety (Schaal et al., 2011), and eating disorders (Torstveit & Sundgot-Borgen, 2015) compared to male athletes, despite females athletes being grossly under-represented in mental health and sport research. With female athlete participation increasing

across elite and professional sport, it is necessary to increase the number of female athletes included in athlete mental health research to ensure adequate representation reflective of the athletic population (Walton et al., 2022). Increasing female participants in athlete mental health research is warranted as female athletes may experience sport differently to male athletes (Roper & Polasek, 2019), which could lead to research mis-informing practical applications (e.g., designing mental health interventions not appropriate for female athletes). To help address this research imbalance regarding female athlete participation, this study will seek to recruit an equal or greater number of female athletes.

The majority of the existing research on elite athlete mental health has focused on the incidence of subthreshold symptoms that athletes experience. Gouttebarge et al.'s (2019) meta-analysis showed that the occurrence of mental illness and subthreshold symptoms athletes experience range from 19% for alcohol misuse to 34% for anxiety and depression. Most of this literature has relied on self-report measures (e.g., questionnaires) which assess subthreshold symptoms or periodic distress in athletes (Rice et al., 2016). While this information offers useful insights for researchers and practitioners in the field, it does not provide accurate information about the prevalence of mental illnesses in this population. Instead of using self-report measures, diagnostic interviews should be encouraged, where practical. Diagnostic interviews are based on specific criteria, such as the APA Diagnostic and Statistical Manual-V-TR (APA, 2022), that must be met for diagnosis of a mental illness (e.g., major depressive disorder). Diagnostic interviews are standardised instruments conducted by trained clinicians (e.g., registered psychologists) and have greater diagnostic reliability and validity compared to self-report measures (Kvig & Nilssen, 2023). Diagnostic interviews also allow for greater breadth of mental illnesses to be assessed at once, including Bipolar disorders and post-traumatic stress disorder, for which there is currently little prevalence data for athletes (Reardon & Factor, 2010; Schinke et al., 2024). To enhance the

current knowledge regarding prevalence of mental illnesses and subthreshold symptoms in elite athletes, it has been recommended that research on elite athlete mental health should utilise diagnostic interviews (Gorczynski et al., 2017). Only four published studies to date have included data from a diagnostic interview with athletes (i.e., Appaneal et al., 2009; Hammond et al., 2013; Rogers et al., 2021; Schaal et al., 2011). Two of these studies focused on major depressive disorder and depressive symptoms in injured athletes (Appaneal et al., 2009), and the impact of competition demands on athletes' mood (Hammond et al., 2013), while Rogers et al. (2021) included data from diagnostic interview as part of a female athlete health prevalence study. Schaal et al. (2011) conducted an epidemiological study on psychological health of 2067 French athletes. Using diagnostic interview, they found that prevalence for mental illness consistent with that is observed in the general population, while a sex difference was found with more female athletes reporting mental illness compared to male athletes (Schaal et al., 2011). Using diagnostic interviews to assess prevalence of mental illnesses in athletes will provide researchers and practitioners a greater understanding of the epidemiology of mental illness in this population. By developing a greater awareness of mental illness prevalence, this will allow for better resources and targeted interventions to support athletes' mental health.

3.2.1 Mental Health and Sleep in Elite Athletes

One of the key features of the International Olympic Committee consensus statement on elite athlete mental health is the inclusion of sleep disorders amongst specific mental health symptoms and mental illnesses in elite athletes (Reardon et al., 2019). Elite athletes often achieve sleep duration less than the recommended 7-9 hours per night for adults (Sargent et al., 2021), and the reported quality of sleep they obtain is often poor. Recently, Halson, Johnston, et al. (2022) found that over 50% of Australian elite athletes reported poor sleep quality. Many of the same physical and psychological demands that can impact

athlete's mental health also can impact their sleep duration and quality (Gupta et al., 2017; Walsh et al., 2021). Insufficient sleep duration and/or poor sleep quality can be problematic for athletes because of the vital role sleep plays in athletic performance, cognitive function, physical health, recovery, and mental health (Charest & Grandner, 2022).

Although the relationship between mental health and sleep is well established in the general population, a recent review of the literature by Montero et al. (2022) demonstrated limited research on sleep and mental health together in athletes. Disturbed sleep can be a symptom of, or exacerbate, subthreshold symptoms and mental illnesses, such as major depressive disorder and anxiety disorders. Sleep disturbance (e.g., poor sleep quality and/or duration) is associated with almost every recognised mental illness in the general population (Asplund & Chang, 2020). Equally, mental illness, subthreshold symptoms, or periodic distress can reduce sleep quality and quantity (Charest & Grandner, 2022; Neckelmann et al., 2007). In clinical and non-clinical populations, strong relationships have been established between sleep disturbances and symptoms of depression, anxiety, and stress (Del Rio João et al., 2018). Athletes who do not obtain sufficient sleep consistently report higher rates of anxiety (Erlacher et al., 2011). Higher anxiety may be both a cause of sleep disturbance and be caused by disturbed sleep, which demonstrates the bi-directional nature of the relationship between mental health and sleep. Lastella et al. (2014) conducted a study on precompetitive sleep behaviour of 103 marathon running participants. Twenty-one percent of athletes reported that anxiety was the main reason why they experienced disrupted sleep on the night before competition. These findings are consistent with previous research by Erlacher et al. (2011), who found that almost two-thirds of German athletes reported experiencing at least one night of disturbed sleep prior to competition in their lifetime. Additionally, there is evidence to suggest that sleep quality has a relationship with psychological stress and mood states in athletes (Biggins et al., 2018; Biggins et al., 2019; Brandt et al., 2016; Halson,

Appaneal et al., 2022). For instance, Halson, Appaneal et al. (2022) found that higher psychological stress and higher perceived stress were associated with poor sleep in Australian elite athletes.

Given the current knowledge gap, there is scope for research to assess mental health and sleep together in elite athletes and improve the current understanding of the relationship between mental health and sleep quality in elite athletes. Establishing the prevalence of mental illnesses, subthreshold symptoms, and sleep quality will broaden the current knowledge base, increase awareness, and enable targeted, effective sleep and mental health interventions to be provided to athletes (Montero et al., 2022). To advance current knowledge in this area, this study had two aims: 1) establish the point prevalence of mental illness in elite/pre-elite Australian athletes using a diagnostic interview; and 2) explore the relationship between mental health and sleep quality in Australian elite/pre-elite athletes.

3.3 Methods

3.3.1 Study Design

A cross-sectional study that included Australian athletes across multiple Olympic and Commonwealth Games sports was conducted. Mental illness and sleep quality data was collected at the Australian Institute of Sport (AIS) between 2017-2019 as part of two related projects: athlete periodic health evaluations and a female-only athlete health prevalence study (Rogers et al., 2021). As the data analysed in this study was from an existing dataset, and on the basis of anonymity, only limited descriptives were available. Ethics approval for this study was granted by the AIS Ethics Committee (approval no. 20210503R1; see Appendix D) and externally approved by The University of Newcastle Human Research Ethics Committee (reference no. H-2021-0326; see Appendix E). The STROBE cross-sectional reporting guidelines (von Elm et al., 2008) and the statistical analysis and presentation consistent with the CHAMP statement were followed (Mansournia, 2021).

3.3.2 Participants

Based on the AIS's Foundations Talent Elite Mastery Framework (Sport Australia, n.d.), eligible participants were classified as elite (Elite 1 or 2) or pre-elite (Talent 3 or 4) in the Australian sports system talent pathway at the time of data collection. In line with the most recent athlete classification framework according to McKay et al. (2022), participants in this study would most likely be classified into Tiers 3-5 (i.e., national level (pre-elite), international/elite level, or world-class). National Sporting Organisations provided organisational consent for athletes to be recruited into these two athlete health projects. At the time of data collection, the majority of sports who participated in the periodic health evaluations had no Paralympic program, and due to the limited descriptives and participant anonymity, no information regarding any athletes with a disability was available. Informed consent was provided by all participants, and where a participant was under 18 years, parental/guardian informed consent was also obtained.

3.3.3 Procedure

The data from the female-only athlete health prevalence study was collected according to the methods described by Rogers et al. (2021). For the data collected as part of the periodic health evaluations, sleep questionnaires were administered to athletes to complete prior to their periodic health evaluation clinical assessments, via a centralised electronic Athlete Management System (AMS) (Smartabase, Fusion Sport Pty Ltd, Brisbane) used for routine collection of internal training loads and wellness monitoring in the Australian sports system. periodic health evaluations were typically conducted outside of sport competition phases (e.g., off/pre-season). Individual diagnostic interviews were conducted in-person by one of six registered (i.e., licenced) psychologists as part of the periodic health evaluation. In Australia, the training pathway to becoming a registered psychologist involves developing and demonstrating competence in diagnosis and assessment

of mental illness. In addition, all of the registered psychologists who conducted the diagnostic interviews were trained to administer the interview protocol prior to the periodic health evaluations. If an athlete's symptoms were complex or were not easily categorised into one of the four categories, the interviewing psychologist conferred with the lead psychologist on the project, who was experienced in the use of the interview protocol. Following the interview, the data were entered into AMS and stored securely. De-identified data were extracted independently and provided to the research team. If any athletes completed multiple periodic health evaluations during the study period, only data from their first periodic health evaluation was included in this study as athletes' first periodic health evaluation covered their whole of life history, whereas subsequent periodic health evaluations only covered the time between periodic health evaluations.

3.3.4 Material

Pittsburgh Sleep Quality Index (PSQI). The PSQI is a validated and widely used self-rated 19-item questionnaire that assesses sleep quality over a one-month period (Buysse et al., 1989). The PSQI has been regularly used to assess sleep quality in athletes (Halson, Johnston, et al., 2022). The PSQI has seven subscales assessing sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, medication, and daytime disturbances, on a 4-point Likert scale (i.e., 0 = not during the past month, 1 = less than once a week, 2 = once or twice a week, 3 = three or more times a week). All scores are summed to yield a global score of sleep quality ranging from 0-21, with higher scores indicating poorer sleep quality. A published cut-off global score of ≥5 has been suggested to indicate poor sleep (Buysse et al., 1989), which has been utilised in elite/pre-elite Australian athletes (Drew et al., 2018; Halson, Johnston, et al., 2022).

Mini International Neuropsychiatric Interview (MINI 7.02). The MINI is a widely used psychiatric structured diagnostic interview instrument (Sheehan, 1998), comprising 16

modules for identifying current and past history of the most common mental illnesses according to the DSM-V-TR, and is based on general population normative data (APA, 2022). Three modules were excluded from the athlete interviews – substance dependence/use (due to mandatory reporting requirements of Australian Sports Anti-Doping Authority and Sport Australia) and psychotic and anti-social disorders (due to time constraints during the periodic health evaluations and low prevalence within the general population) (Moran, 1999; Moreno-Küstner et al., 2018). The suicide module was shortened if current and history of suicidal ideation was denied. Each of the 13 modules comprised screening questions followed by diagnostic questions. For each of the 13 MINI modules, results were categorised by the trained clinician according to the breadth of reported symptoms. Athletes were categorised into one of four categories for current and past history (where assessed): 1) met diagnostic criteria; 2) does not meet diagnostic criteria but presented >75% of required symptoms; 3) does not meet diagnostic criteria but presented between 50%-75% of required symptoms; and 4) none or below 50% required symptoms present. In our study, categories two and three were defined as subthreshold symptoms. Table **3-1** summarises the modules and timeframes used in this study.

Table 3-1 MINI modules and timeframes of current and past history of mental illnesses

Module	Current	Past History
Major Depressive Episode Major Depressive Disorder	Past 2 weeks	Lifetime
Suicidality Suicide Behaviour Disorder	Past month In past year	Lifetime attempt Early remission (1-2 years ago)
Manic & Hypomanic Episodes	At least past week	Lifetime
Panic Disorder	Past month	Lifetime
Agoraphobia	Current	N/A*
Social Anxiety Disorder (Social Phobia)	Past month	N/A
Obsessive-Compulsive Disorder	Past month	N/A
Posttraumatic Stress Disorder	Past month	N/A
Alcohol Use Disorder	Past 12 months	N/A
Anorexia Nervosa	Past 3 months	N/A
Bulimia Nervosa	Past 3 months	N/A
Binge-Eating Disorder	Past 3 months	N/A
Generalised Anxiety Disorder	Past 6 months	N/A

* N/A = not assessed

3.3.5 Data Analysis

Descriptive statistics were used to summarise participant characteristics (i.e., age, sex, sport). All data were checked for normality prior to analyses, with reporting of results aligned to parametric (e.g., mean, standard deviations) and non-parametric data (e.g., median, interquartile range) summary statistics. Point prevalence was calculated as the number of participants above/below cut-off thresholds for the mental illness and sleep quality assessments, divided by the total number of participants who completed each assessment.

To measure the relationship between mental illness and sleep quality, generalised ordered logistic regression analyses were performed due to the violation of the parallel regression assumption. Generalised ordered logistic mixed models were compiled to determine the association the explanatory variable of sleep quality (PSQI) had in relation to the four ordinal MINI categories. A goodness-of-fit test was used to indicate if the models were a good fit. All statistical analyses were performed in Stata (Stata/IC 16.1, StataCorp, USA).

3.4 Results

One hundred and forty-five athletes (n = 115 female, n = 30 male) were included in this study. Athletes ranged from 14-43 years of age (mean age = 21.55 ± 5.21 years) and participated in the following sports: basketball (n = 6), beach volleyball (n = 11), boxing (n = 11), diving (n = 32), netball (n = 14), triathlon (n = 26), rowing (n = 9), taekwondo (n = 7), water polo (n = 18), and weightlifting (n = 11) (see Table **3-2**). Female athletes participated in all ten sports, while male athletes only participated in beach volleyball, diving, taekwondo, and triathlon.

Table 3-2. Summary of sample characteristics and outcome measures

Characteristics & Measures	Female	Male
Participants, *n*	115	30
Age (years)		
Mean ± SD	21.37 ± 5.35	22.24 ± 4.60
Range	(14 – 43)	(15 – 33)
Sports, *n**		
Basketball	6	-
Beach Volleyball	5	6
Boxing	11	-
Diving	22	10
Netball	14	-
Triathlon	16	10
Rowing	9	-
Water Polo	18	-
Weightlifting	11	-
Participants who met diagnostic criteria on MINI, *n* (%)	11 (7.59%)	6 (4.14%)
Estimated hours slept per night (past month)		
Mean ± SD	8.08 ± 1.10	8.50 ± 1.27
Range	(5.5 – 10.5)	(6 – 10.5)
Participants who met poor sleep quality criteria on PSQI, *n***	52 (50.00%)	13 (44.83%)

* due to the small sample size, Taekwondo was not included in the sex split of sports to protect participants anonymity

** 133 athletes in total (104 female) completed a MINI and PSQI

3.4.1 Point Prevalence of Mental Illness

Nine athletes (6.21%) met criteria for a current diagnosis of at least one mental illness, and eight athletes (5.52%) met criteria for a past diagnosis of at least one mental illness. Low co-morbidity was reported by the athletes, with most athletes met criteria only for one diagnosis (current or past) of a mental illness, although one athlete met diagnostic criteria for three current mental illnesses (Agoraphobia, Social Phobia Disorder, and Generalised Anxiety Disorder). Three athletes (2.07%) met criteria for both a current and a past diagnosis of at least one mental illness. Similar percentages of female and male athletes met diagnostic criteria for at least one mental illness (current or past) as assessed by the MINI (7.59% and 4.14%, respectively). The most prevalent mental illnesses were past major

depressive episode (4.83%), current alcohol use disorder (4.83%), current generalised anxiety disorder (2.07%), and past major depressive disorder (2.07%).

3.4.2 Prevalence of Subthreshold Symptoms

Twelve athletes (8.28%) reported >75% of symptoms for at least one current mental illness (but did not meet diagnostic criteria) and six athletes reported >75% of symptoms for at least one prior mental illness (but did not meet diagnostic criteria). The most prevalent mental illnesses that athletes reported >75% symptoms included current generalised anxiety disorder (3.45%), current anorexia nervosa (3.45%), past major depressive episode (2.76%), current agoraphobia (2.07%), and past major depressive disorder (2.07%).

One in five athletes (20.70%) reported 50-75% of symptoms for at least one current mental illness, while just over one in ten athletes (11.03%) reported 50-75% of symptoms for at least one past mental illness. Past major depressive episode (8.28%) was the most prevalent mental illness across subthreshold symptomology, followed by current eating disorders comprising binge eating disorder (6.94%), anorexia nervosa (6.21%), and bulimia nervosa (4.14%). Other mental illnesses with a notable prevalence of subthreshold symptoms included current social phobia (4.83%) and both current and past panic disorder (4.14% and 5.52%, respectively) (see Table **3-3**).

Table 3-3. Point prevalence of mental illness and sub-threshold symptoms in elite/pre-elite Australian athletes as assessed by the MINI

Module	MINI Ratings Category n (%)				
	Meets Criteria	75-99% symptoms	50-75% symptoms	<50% symptoms	Did Not Assess
Major Depression					
Major Depressive Episode (current)	-	1 (0.69)	1 (0.69)	143 (98.62)	-
Major Depressive Episode (past)	7 (4.83)	4 (2.76)	12 (8.28)	122 (84.14)	-
Major Depressive Disorder (current)	1 (0.69)	-	-	144 (99.31)	-
Major Depressive Disorder (past)	3 (2.07)	1 (0.69)	-	141 (97.24)	-
Suicidality					
Suicidality (current)	1 (0.69)	-	-	144 (99.31)	-
Suicidality (past)	2 (1.38)	-	2 (1.38)	141 (97.24)	-
Suicidal Behaviour Disorder (current)	-	-	-	145 (100.00)	-
Suicidal Behaviour Disorder (past)	-	-	-	145 (100.00)	-
Manic & Hypomanic Episodes					
Manic Episode (current)	-	-	1 (0.69)	144 (99.31)	-
Manic Episode (past)	-	2 (1.38)	1 (0.69)	142 (97.93)	-
Hypomanic Episode (current)	-	-	-	145 (100.00)	-
Hypomanic Episode (past)	-	-	-	145 (100.00)	-
Panic Disorder					
Panic Disorder (current)	-	2 (1.38)	6 (4.14)	137 (94.48)	-
Panic Disorder (past)	-	1 (0.69)	8 (5.52)	134 (92.41)	2 (1.38)
Agoraphobia					
Agoraphobia (current)	2 (1.38)	3 (2.07)	2 (1.38)	138 (95.71)	-
Social Anxiety Disorder					
Social Anxiety Disorder (current)	2 (1.38)	1 (0.69)	7 (4.83)	135 (93.10)	-
Obsessive-Compulsive Disorder					
Obsessive-Compulsive Disorder (current)	-	1 (0.69)	3 (2.07)	141 (97.24)	-

Posttraumatic Stress Disorder					
Posttraumatic Stress Disorder (current)	-	-	3 (2.07)	141 (97.24)	1 (0.69)
Alcohol Use Disorder					
Alcohol Use Disorder (current)	7 (4.83)	-	1 (0.69)	137 (94.48)	-
Anorexia Nervosa					
Anorexia Nervosa (current)	-	5 (3.45)	9 (6.21)	131 (90.34)	-
Bulimia Nervosa					
Bulimia Nervosa (current)	-	2 (1.38)	6 (4.14)	137 (94.48)	-
Binge-Eating Disorder					
Binge-Eating Disorder (current)	2 (1.39)	1 (0.69)	10 (6.94)	131 (90.97)	-
Generalised Anxiety Disorder					
Generalised Anxiety Disorder (current)	3 (2.07)	5 (3.45)	5 (3.45)	132 (91.03)	-

3.4.3 Mental Illness, Subthreshold Symptomology and Sleep Quality

Of the 145 athletes who completed a MINI, 133 (91.72%) also completed the PSQI. Female and male athletes reported similar estimated hours slept per night (8.08 hours/night and 8.50 hours/night, respectively), while female athletes reported poorer sleep quality (see Table **3-2**). An average of 8.17 hours of sleep per night (SD = 1.15, range 5.5 – 10.5 hours) was reported, and almost half of the athletes (48.87%) reported poor sleep quality as assessed by the cut-off score (≥5) on the PSQI (see Table **3-4**).

Both current subthreshold symptoms (>50% of symptoms reported) or a current mental illness diagnosis was found to be positively associated with poor sleep quality, where athletes with at least one subthreshold or clinical diagnosis were almost twice the odds of reporting poor sleep quality on the PSQI compared with athletes who reported <50% of symptoms (OR = 1.97, 95% CI [1.24 – 3.15], p=0.004). There was no association between past history of subthreshold symptomology or past history mental illness diagnosis and current poor sleep quality (OR 1.10, 95% CI [0.72 – 1.65], p=0.667). Neither age, sex, nor sport were significant factors in either of the generalised ordered logistic regression models for the PSQI.

Table 3-4: Comparison between MINI ratings categories and sleep quality assessed by PSQI

Sleep quality	MINI Ratings Categories* n (%)				
	<50%	50-75%	>75%	Meets Criteria	Total
Good quality sleep	56 (42.11%)	8 (6.01%)	0 (0%)	4 (3.01%)	68 (51.13%)
Poor quality sleep	33 (24.81%)	20 (15.04%)	7 (5.26%)	5 (3.76%)	65 (48.87%)

* MINI ratings categories include both current and prior mental health status

3.5 Discussion

Elite athletes represent a vulnerable population susceptible to developing mental illnesses and subthreshold symptoms, and often experience poor sleep quality. To our knowledge, this is the first study to examine mental illness and symptomology alongside sleep quality, and quantify this relationship in a cohort of elite/pre-elite athletes. More than one in ten athletes in our sample met diagnostic criteria for at least one mental illness, while a third of athletes reported subthreshold (50% or more) symptoms. While the point prevalence of mental illness in this study was lower than previous research has indicated, the prevalence of subthreshold symptoms was consistent with previous research (Gouttebarge et al., 2019). This finding provides further evidence that elite/pre-elite athletes are vulnerable to experiencing subthreshold symptomology of mental illness. We also found that athletes with a diagnosable mental illness or current symptomology were twice as likely to report poor sleep quality, compared to athletes who had little or no symptoms.

The most prevalent current and past mental illnesses in this study are consistent with Gouttebarge et al.'s (2019) meta-analysis that showed anxiety, depression, and alcohol misuse are the most common mental illnesses reported by elite athletes. Consistent with our findings in our sample, anxiety disorders (e.g., generalised anxiety disorder), affective disorders (e.g., major depressive disorder), and substance use disorders (e.g., alcohol use disorder) are the most prevalent mental illnesses in the general Australian population (AIHW, 2025). Therefore, it is not a surprise that these mental illnesses were the most prevalent in our sample. Sports culture (particularly among team sports such as rowing, field hockey, and rugby) and/or Australian cultural attitudes and behaviours may facilitate substantial alcohol use (e.g., binge drinking during off-season; Gouttebarge et al., 2019), as revealed in this study. In line with our findings, existing literature demonstrated that alcohol use/misuse, especially binge drinking, is higher amongst athletes than non-athletes (McDuff et al., 2019).

This heightened alcohol use may be due to elevated athlete-specific stressors, especially those stressors experienced by elite athletes, where alcohol potentially is used as a coping mechanism (O'Brien et al., 2007).

Our study adds to the small body of research that has examined mental illness in elite athletes using diagnostic interview (i.e., Appaneal et al., 2009; Hammond, 2013; Rogers et al., 2021; Schaal et al., 2011), and our study is the first using diagnostic interview that assessed manic and hypomanic episodes and symptoms and post-traumatic stress disorder, as well as the first study to assess sleep quality alongside diagnostic interview. We found that the point prevalence of mental illness was 11.7%, which is lower than what is indicated in the general population, and lower than what has been indicated by previous research with athletes (Gouttebarge et al., 2019; Gulliver et al., 2015). Lower point prevalence in this study can be explained by the use of diagnostic interview and its greater specificity and reliability in diagnosing mental illnesses (Gulliver et al., 2015). This finding further alludes to the need for greater clarity regarding conceptualisation of mental health and the subsequent use of relevant assessment so that a more accurate picture of athletes' mental health can be developed.

The prevalence of mental illness revealed in our study is broadly comparable with the findings from Schaal et al. (2011) who also used a diagnostic interview. In their study with a large cohort of French athletes, Schaal et al. (2011) found a current (<6 months) prevalence of 16.9% for at least one mental illness and a lifetime prevalence of 25.1% for at least one mental illness. Furthermore, the point prevalence of mental illness in this study is consistent with the findings from Åkesdotter et al. (2020). While they did not use a diagnostic interview, in their study with 333 Swedish athletes, Åkesdotter et al. (2020) also found a point prevalence of current mental health problems (equivalent to both mental illness and subthreshold symptoms as defined in this study) of 11.7%.

In addition to mental illness point prevalence, in our study one in five athletes reported subthreshold symptoms, which is consistent with Gouttebarge et al.'s (2019) meta-analysis. Taken together, these findings demonstrate the susceptibility that elite/pre-elite athletes have to developing and experiencing subthreshold symptoms (Rice et al., 2016). This prevalence is concerning because subthreshold symptoms, if not treated appropriately, could manifest into mental illness over time. Subthreshold symptoms can also have a detrimental impact on quality of life, and can impact athletes' sporting and personal lives, increase injury risk, susceptibility to physical illness, and impede recovery (Reardon et al., 2019). Subthreshold symptoms can also potentially compromise athletic development and performance (Schinke et al., 2017). Consequently, mental health including mental illness and subthreshold symptoms, cannot be separated from physical health (Reardon et al., 2019), indicating the need for all high-performance sport programs to continue to make mental health support for athletes a key priority. As advocated by Purcell et al. (2019), this support should include regular mental health screening and early intervention strategies.

In contrast to previous research by Schaal et al. (2011), we found in this study no clear evidence of sex differences in point prevalence of mental illness, despite a female majority cohort. The lower prevalence of mental illness reported in this study, including the lack of a significant sex difference, might reflect athletes not disclosing mental illness during the diagnostic interviews due to stigma, negative past-experiences of help or treatment seeking, or the lack of psychological safety in their environments to disclose, all of which are known to be barriers to athletes' help-seeking in sport (Castaldelli-Maia et al., 2019). Another possible explanation for the lack of a significant sex difference is that the male athletes in this study are over-represented in mental illness prevalence, with 20% of the male athlete cohort in the current study meeting diagnostic criteria for at least one mental illness, compared with 9.57% of the female athletes. The potential for this male athlete cohort over-representation of

mental illness could be due to sport-specific factors, with all male athletes competing in 'leanness' based or aesthetic sports (e.g., triathlon, diving), as well as weight classes (e.g., taekwondo), factors known to increase athletes' susceptibility to mental illness (Byrne & McLean, 2002; Rice et al., 2016). It is possible that the timing of the interviews could also have contributed to the lower point prevalence, with all interviews in this study conducted outside of competition season, with reduced high-performance pressures and increased recovery.

The significant association between current mental illness (including subthreshold symptoms) and poor sleep quality in elite/pre-elite Australian athletes adds to the limited studies to date that have assessed both mental health and sleep quality in athletes (Montero, 2022). In our study, athletes with current subthreshold symptoms or a mental illness were twice the odds of reporting poor sleep quality compared with athletes with little or no symptoms. This finding provides evidence for a relationship between mental illness, subthreshold symptoms, and poor sleep quality in elite athletes, which confirms that such a relationship exists in the athletic population as it does in the general population (Del Rio João et al., 2018; Milojevich & Lukowski, 2016). Further research should examine this relationship in greater depth with athletes, as to the best of our knowledge this is the first study to examine mental illness and subthreshold symptoms alongside sleep quality in a cohort of elite/pre-elite athletes.

Athletes are known to experience disproportionate rates of poor sleep quality compared to the general population. Given the association found in our study between mental illness (including subthreshold symptoms) and poor sleep quality, we recommend sporting organisations and practitioners regularly monitor athletes' sleep quality. Additionally, we recommend that researchers develop and examine intervention strategies to improve sleep quality in athletes. It may be that improving sleep quality in athletes may help to improve

their mental health due to their bi-directional relationship, especially for those athletes experiencing subthreshold symptoms or periodic distress. We also recommend that researchers and practitioners continue to develop and administer appropriate treatment as required to athletes with mental illnesses.

A limitation of this study is the limited demographic information available about the sample. No demographic information beyond sport, sex, and age was available to report, limiting the generalisability of this study. Our sample, however, comprised a high proportion of female athletes contributing to minimising a gender gap in sport and mental health research (Gouttebarge et al., 2019). Sport-specific factors, including performance outcomes, training and competition demands are known stressors for athletes and they can contribute to the onset of anxiety and/or affective disorders (Gorczynski et al., 2017; Reardon et al., 2019; Rice et al., 2016). Our study did not assess these sport-specific factors, limiting the generalisability of the findings. Further, the data used in this study was collected prior to the COVID-19 pandemic, and while the impact of the pandemic on athletes' mental health is still being studied (Reardon et al., 2021; Shukla et al., 2023), it cannot be ruled out as influencing athletes' mental health in this study. While the cross-sectional design enabled determining point prevalence of mental illnesses and demonstrated an association between mental illness (including subthreshold symptoms) and poor sleep quality, it does not provide any causal inferences as to what contributed to athletes' poor mental health and poor sleep, whether COVID-19 or potential sport-specific factors (e.g., injury, travel, competition demands).

Further research examining mental health in elite athletes should capture demographic data reflecting the diversity of athlete populations (e.g., gender, ethnicity, sport-specific factors such as performance outcomes). Additionally, health-related factors that may influence mental health and/or sleep (i.e., pain) should be captured, and future research must continue to include female athletes, to reduce the current gender-gap. To understand the

influence factors such as sex and age have on the prevalence of specific mental illnesses (e.g., mood disorders and eating disorders), future research should consider a prospective cohort design so that temporal associations can be evaluated and used to inform the design of targeted intervention strategies specific to different populations. We encourage future researchers to also use diagnostic interviews in studies with athletes. Further information is needed to accurately determine the epidemiological profile of mental illness in athletes, which will be crucial for developing and administering preventative measures and intervention strategies. We echo the recommendation from Montero et al. (2022) and also encourage future research to utilise qualitative and/or mixed methods approaches, which would offer greater insight beyond what can be captured through quantitative approaches, and reflect the complexity of athletes' experiences related to mental health and sleep. Future research should consider assessing mental health and sleep in elite athletes over time. Prospective longitudinal research would help to better understand the onset of mental illness in elite athletes and further examine whether subthreshold symptoms and/or poor sleep quality is related to the onset of developing mental illness in the future.

3.5.1 Conclusion

This study addresses a current research gap regarding elite athlete mental health, specifically the point prevalence of mental illness and subthreshold symptoms determined through diagnostic interview. In our study, the point prevalence of diagnosable mental illness is lower than indicated by previous research. The prevalence of subthreshold symptoms, however, is consistent with previous research and adds to the growing body of research that has examined subthreshold symptoms in athletes. This study makes a notable contribution to quantifying the relationship between mental health and sleep in elite athletes. We would encourage further research to use diagnostic interviews to improve the knowledge of prevalence of mental illness and subthreshold symptoms in this population. Given the

importance to athletic performance, recovery, and overall wellbeing, we recommend that future research should look to comprehensively assess mental health and sleep in athletes to better understand this relationship and how it may impact athletes.

Chapter 4 Bridging Statement

The first of two overarching aims of this thesis were to explore the relationship between mental health and sleep in Australian elite athletes. This first aim was investigated by two separate studies (Study 1 and Study 2), and the second aim was informed by the findings of these studies (Study 1 and Study 2) in this thesis. Chapter 4 presents the investigations of Study 2, which investigates both aims of this thesis.

The first aim of this thesis is to bridge this research gap by exploring the relationship between mental health and sleep in Australian elite athletes. Chapter 3 determined the point prevalence of mental illness and symptomology in elite/pre-elite Australian athletes using diagnostic interview, and established evidence of an association between mental health and sleep quality does also exist in elite athletes like in the general population. Chapter 4 builds upon the findings presented in Chapter 3 by using qualitative research to further explore perspectives from athletes, coaches and support staff on athletes' mental health, sleep, and the relationship between them using focus groups.

As highlighted in Chapter 2, over the past 15 years there has been increasing research focused on mental health and sleep, separately, in elite athletes. Most of this research to date has examined either mental health or sleep in elite athletes and has focused on specific athlete populations (e.g., elite athletes, college athletes) and generalised these findings for all athletes. This research published to date has largely utilised quantitative approaches to measure the occurrence of mood states, subthreshold symptoms such as anxiety, stress, and low mood, sleep duration and sleep quality, and identify risk factors unique to elite athletes such as competition demands, training schedules, and travel. Although this research has been beneficial, less is known about athletes' perspectives and lived experiences regarding mental health and sleep.

Increasingly, awareness is shifting regarding elite athletes' mental health to consider how athlete's mental health and athlete's sleep is influenced by the high-performance sporting environment or microsystem that elite athletes operate within. (Purcell et al., 2019) proposed an ecological framework for elite sporting environments to help understand the relationship between experiences of an individual athlete and the broader social and cultural microsystem which they exist within. To help aid understanding of the sporting microsystem and how it can nourish or malnourish elite athlete mental health (Schinke et al., 2017), researchers should investigate perspectives from coaches and support staff, who fundamentally form the high-performance sporting microsystem to support athlete performance and wellbeing. To date, there is little evidence regarding the perspectives from coaches and support staff on elite athletes' mental health and sleep.

The second overarching aim of this thesis was to design, implement, and evaluate the effectiveness of a pilot intervention aimed at improving athlete's sleep quality and/or mental health. By exploring subjective experiences from athletes, coaches and support staff, and in what way(s) they consider how mental health, and sleep can impact upon athletes' overall health and athletic performance, it will provide critical evidence to build a pilot intervention. These focus groups will help address the second overarching aim of this thesis, and capturing these subjective experiences means that a user-centred design approach can be adopted to develop a pilot intervention aimed at improving athlete's sleep quality and mental health. This pilot intervention is developed based on what athletes, coaches, and support staff believe athletes' need to support their sleep and mental health.

The work presented in Chapter 4 addresses the identified research gaps regarding a lack of understanding at present about athletes' perspectives and lived experiences regarding mental health and sleep and explores how the sporting ecosystem may support or hinder athletes' mental health and sleep. Additionally, the work presented in Chapter 4 will be used

to inform the development of a pilot intervention aimed at improving athletes' sleep quality and/or mental health. My roles in this manuscript were as first author and included concept/research design, data collection, analysis and interpretation of data, writing/editing/reviewing manuscript, and taking responsibility for the integrity of the work as a whole from inception to published work.

Chapter 4 Study 2: Does mental health and sleep matter for athletic performance and wellbeing? Exploring perspectives of Australian athletes, coaches, and support staff

4.1 Introduction

Elite sporting environments are centred around achieving successful individual and team performance outcomes and therefore, are a highly pressurised environment (Walton et al., 2024). Historically, sporting environments adopted a 'win at all costs' mentality, whereby athletes were largely valued for their athletic prowess, with limited consideration for the person behind the sporting performance (Henriksen et al., 2020). In high-performance sport, awareness and understanding of mental health have increased, just like it has in our society. Supporting athletes' mental health is now regarded as a "core component of a culture of excellence" (Henriksen et al., 2020, p. 554), such as providing adequate support to athletes to manage the psychological demands of high-performance sport. Despite sporting environments actively supporting athlete's mental health and recognising the importance of environmental factors that can influence mental health and performance, much of the research conducted on athlete mental health has been at an individual or athlete level (Purcell et al., 2019; Rice et al., 2016). In this regard, the research on athlete mental health has often been research on or about athletes, not research co-designed *with* or for athletes.

In 2023, the International Olympic Committee (IOC) published a mental health action plan, which highlighted that "the mental health of athletes exists with the context of the wider sports system… recognising that the athlete is inseparable from their teammates/colleagues, coaches and support staff, and family or primary supports, as well as their sporting organisation" (IOC, 2023). This IOC action plan is based on the original work of Bronfenbrenner's (1992) ecological system approach that was later adapted by Purcell et al.

(2019) into a framework for understanding athlete mental health within the broader sporting ecosystem that athletes operate in. Purcell et al. (2019) proposed that athletes exist within an ecological system that includes the individual athlete (e.g., their beliefs, attitudes, or coping skills); the microsystem comprising coaches, teammates, significant others, and high-performance support staff; the exosystem created by the wider sporting environment (e.g., the rules of the athlete's individual sport); and the macrosystem that includes the athlete's National Sporting Organisation or international governing body, media, and general public. Purcell et al.'s (2019) ecological systems model emphasises that elite athlete mental health research needs to move beyond focusing on the individual and start to consider how the broader ecological systems that athletes exist within influence elite athlete mental health.

To understand mental health in within the ecological systems that athletes exist within, it is imperative to understand subjective experiences of athlete mental health, and how athletes consider that these ecological systems may impact their mental health. To date, little is known about the subjective experiences of mental health in athletes within the Australian high-performance sporting ecosystem, and how environmental and psychosocial factors may influence their mental health. We can also increase our knowledge of athlete mental health within sporting ecosystems by considering perspectives on athletes' mental health from key figures within these ecosystems, such as captured in previous research with coaches (Biggin et al., 2017) and high-performance sports directors (e.g., Prior et al., 2024). Athletes and coaches recognised that coaches have a critical role to play in providing mental health support (Biggin et al., 2017; Bissett et al., 2020. Using focus groups to understand the sporting ecological system, Gulliver et al. (2012) examined barriers and facilitators to mental health help-seeking in 15 young athletes aged 16-23. Gulliver et al.'s (2012) findings demonstrated the positive impact that coaches could have on their athletes, as results indicated that encouragement from others and the positive attitude of others, especially

coaches, were facilitators to help-seeking behaviour. Stigma surrounding poor mental health was the biggest barrier to help-seeking within the ecosystem reported by the authors. In previous Australian-based research, Mazzer and Rickwood (2015) proposed that coaches working with young athletes are gatekeepers for referring athletes to mental health professionals, which suggests that coaches play a crucial role in helping to reduce stigma around mental health and promoting help-seeking behaviours. Although previous research has captured perspectives from coaches regarding athlete mental health (e.g., Biggin et al., 2017), currently it remains unknown what perspectives and experiences high-performance sport personnel, such as support staff, have regarding athlete mental health and how its influences the ecosystems. Support staff play crucial roles in the athlete microsystem and sporting environments, therefore, research capturing these perspectives would advance our understanding on athlete mental health.

Athletes often reported greater occurrence of mental health symptoms compared to what has been observed by coaches (Biggin et al., 2017). This discrepancy was attributed to coaches lacking understanding of mental health or minimising symptoms in athletes, and athletes being uncomfortable with discussing their mental health with coaches. This point was reinforced in a 2020 Delphi study on the critical role of sport coaches in promoting and supporting athlete mental health in the ecosystem and advised that coaches should develop sport/team cultures that promote athlete mental health, encourage help-seeking behaviours, and support for athletes who are receiving mental health treatment (Bissett et al., 2020). As integral components of the sporting ecosystem, coaches should continue to be included in research to further understand their perspectives on athlete mental health and what support they require to be able to care for their athletes.

Consistent with the mental health research, the sporting ecosystem has an important influence on athletes' sleep (Sargent, Lastella, et al., 2014). Elite athletes obtain less sleep

than their self-reported sleep need (Sargent et al., 2021), and regularly report obtaining lower sleep duration than the recommended guidelines of 7-9 hours per night for healthy adults (Gupta et al., 2017; Leeder et al., 2012; Sargent et al., 2021; Walsh et al., 2021). Sleep quality is defined as an "individual's self-satisfaction with all aspects of the sleep experience" (Nelson et al., 2022, p. 149) and it is consistently reported by athletes that they experience high rates of poor sleep quality (Halson, Johnston, et al., 2022).

The sporting ecosystem appears to impact athletes' sleep, with established sport-specific risk factors for reduced sleep duration and quality including training and competition schedules. These factors include early morning training sessions and evening or nighttime competition schedules (Roberts et al., 2019; Sargent, Halson, et al., 2014, physical training loads (Leduc et al., 2019), travel requirements (Janse van Rensburg et al., 2021), and psychological stress (Halson, Appaneal, et al., 2022). Anxiety about an upcoming competition (Erlacher et al., 2011; Juliff et al., 2015) and behavioural risk factors such as caffeine consumption (Caia et al., 2021), alcohol usage (O'Brien et al., 2007), and use of mobile phones or electronic devices in and/or before bed (Jones, 2018) can also compromise sleep duration and quality. To date, much of the research on athletes' sleep has been conducted using quantitative approaches, while less is known about how athletes perceive the importance of sleep. Nor do we know how they experience facilitators and barriers to adequate sleep duration and/or quality. Moreover, it is unclear what sleep intervention strategies, such as sleep education, sleep hygiene, sleep extension, and napping, athletes believe are beneficial for their mental health, wellbeing, and sporting performance.

To better understand how psychosocial and environmental factors in the sporting ecosystems can impact sleep, more qualitative sleep research with athletes should be conducted (Montero et al., 2022; Nedelec et al., 2018). Qualitative research is useful for exploratory purposes, to fill in specific gaps in existing knowledge, to gain a deeper

understanding and comprehend socially constructed meaning about a topic from individuals (Merriam, 2002). Currently, there is a lack of qualitative evidence regarding the subjective experiences from athletes about their sleep, including psychosocial and environmental factors that may support or inhibit optimal sleep characteristics (e.g., sleep duration and quality). Therefore, a qualitative approach would help to enhance the current knowledge in the sporting ecosystems regarding sleep in athletes.

Additionally, no qualitative research has yet been conducted in relation to the relationship between mental health and sleep in athletes (Montero et al., 2022), and so currently it remains unknown what athletes think about this relationship. Given the importance of the sporting ecosystem that athletes operate within, it may be worthwhile for this research to include key stakeholders such as coaches and support staff integral to the sporting ecosystem, to identify their perspectives on athlete mental health and sleep. Capturing these insights is likely to be helpful for changing sporting cultures, enabling opportunities for increasing support structures, and developing targeted interventions as required to better help athletes.

Therefore, the aim of this study was to explore how athletes, coaches, and support staff experienced mental health, the relationship between mental health and sleep, and how this relationship might affect athletic performance. This study sought to explore barriers and facilitators to elite athletes' mental health and sleep as perceived by different stakeholders within the high-performance sporting ecosystem in Australia.

4.2 Methodology

4.2.1 Study Design and Research Philosophy

We adopted a qualitative approach using an interpretivist paradigm to explore athletes' and coaches/staff perspectives. Interpretivism is focused on exploring participants' lived experiences, and assumes that reality is subjective, multiple, and socially constructed

(Braun & Clarke, 2022). Within this interpretivist paradigm, we took a relativist ontology and social constructionist epistemology position. Relativism believes that people's psychosocial reality is subjective, and influenced by the context of the situation, such as the interaction between the individual and the researcher (Ponterotto, 2005). Social constructionism focuses on language, and how individuals engage with the world and develop knowledge that is socially constructed (Braun & Clarke, 2022).

Focus groups allow participants to interact and discuss issues with one another, generating richer data than what may be obtained from individual interviews (Krueger & Casey, 2014. We used semi-structured focus groups, where participants were the driver of conversation, and the first author (HdV) acted as a facilitator or moderator of discussion between participants (Oates & Alevizou, 2018). The role of the researcher(s) in semi-structured focus groups is to facilitate the capture of participant views through clarification and exploration collectively as a group (Krueger & Casey, 2014).

When conducting focus groups, homogeneity is an important consideration. Krueger (1994) proposed that participant commitment to engage fully in the group discussion can be enhanced within a homogenous group, where participants share similar characteristics. To aid this process, we conducted focus groups with athletes and coaches/support staff separately. The size of focus groups is also a key consideration. It has been suggested that six to eight participants are desirable for a focus group, as too many participants (i.e., more than 12) can make the group difficult to manage (Nyumba et al., 2018). Although, focus groups studies have been effectively conducted with group sizes smaller than six (e.g., Jones et al., 2022). In our study, the focus groups ranged between 3-7 participants per group.

For this study, we adopted the Big Q Qualitative research approach, which comprises qualitative techniques *and* qualitative research values (Kidder & Fine, 1987, as cited in (Braun & and Clarke, 2025). Qualitative research values, including researcher subjectivity

and underlying assumptions about how knowledge can be constructed (i.e., research philosophy) distinguishes Big Q Qualitative research from small q qualitative research, used to support quantitative paradigm by generating surface-level qualitative insights (Braun & and Clarke, 2025). Braun and Clarke (2025) offer more detail on the difference between Big Q and small q qualitative research, helpful for better understanding on how to interpret this manuscript.

4.2.2 Participants

A total of 26 participants (n = 9 athletes, n= 17 coaches/staff) took part in this study. The athlete participants (n = 3 male, n = 6 female) averaged 25.9 years of age (range 18 – 43 years) and competed in swimming, rowing, field hockey, and lawn bowls. One athlete was a Para athlete, whereas the other eight athletes competed in non-disabled sport. Five athletes (55.55%) had competed at an international level, while the remainder had competed at a national level. All participants in this study identified their gender as being consistent with their sex recorded at birth (cisgender). Seven athletes (77.77%) described themselves as heterosexual, while two described themselves as bisexual. Seven (77.77%) athletes reported their ethnicity as Australian, and three reported their ethnicity as European. Eight (88.88%) athletes had accessed some form of mental health service or resource during their sporting career, however, no athletes had access to any services or resources to support their sleep. Six athletes (66.66%) had experienced an injury or illness (physical and/or mental) in the past 12 months.

Of the 17 coaches and staff, two completed only some of the demographics questions. There were 12 male and five female coaches/staff in the focus groups, with a mean age of 37.5 years (range 24 – 51 years). The support staff included the following professions: dietetics/nutrition, physiology, sport science, physiotherapy, and strength and conditioning. Coaches/staff worked with a variety of athletes across a variety of sports, including non-

disabled and Para athletes, from team (e.g., basketball) and individual (e.g., swimming) sports. Nine coaches/staff (52.94%) reported completing some form of training in mental health, such as mental health first aid, and 10 coaches/staff (58.82%) reported completing some training or education related to sleep. All coaches/staff participants described themselves as heterosexual, and 13 (76.47%) reported their ethnicity as Australian. Most coaches/staff (82.35%) were working with athletes who competed at a national or international level. Nine of the coaches/staff (52.94%) had worked at their current competition level for 1-5 years, and 10 of the coach/staff (58.82%) participants had worked in sport for 10 or more years. The composition of each focus group is summarised in Table **4-1**.

Table 4-1: Focus Group Participant Details

Focus Group	Role of Participants	Male Participants	Female Participants	Total Participants
1	Athletes	2	1	3
2	Coaches	3	1	4
3	Support Staff (non-coaching staff)	1	2	3
4	Coaches	6	1	7
5	Support Staff	2	1	3
6	Athletes	1	5	6
Total		**15**	**11**	**26**

4.2.3 Data Collection

This study was approved by The University of Newcastle Human Research Ethics Committee (Approval No. H-2021-0241; see Appendix F). Participants were recruited by: a) recruitment flyer that were displayed outside sporting organisation gyms; b) the athletic director at a university affiliated with the research team emailed university sporting programs to garner their interest in participating (see Appendix J); c) social media posts on LinkedIn and Twitter (see Appendix I); and d) personal networks of the research team. Interested participants contacted the first author directly to express their interest in participating. All participants were emailed the Participant Information Statement (see Appendix G) and were

provided with an opportunity to ask any questions prior to the scheduling of the focus group. An electronic consent form and demographics survey (see Appendices H & L) were distributed via the platform Qualtrics (Qualtrics, Provo, USA) to participants 48 hours prior to their scheduled focus group.

The six focus groups were conducted between July 2022 and March 2024, ranged between 40-60 minutes in duration and were all moderated by the first author (HdV), who had adequate knowledge of focus group techniques and no prior relationship with the participants. A potential unforeseen power dynamic with the participants was identified in one focus group, which may have influenced the discussion that took place within that focus group. To try and overcome this power imbalance, participants in that focus were contacted by the research team following the focus group and invited to share their perspectives on the research topic that they may not have felt comfortable sharing during the focus group. None of these participants took the research team up on this offer. Five of the focus groups were conducted in-person, although some participants joined these in-person discussions via the video conferencing platform, Zoom (zoom.us). One focus group was conducted entirely via Zoom. Brown et al. (2021) suggested that qualitative researchers should consider online focus groups, such as via Zoom, a potential qualitative research tool. To encourage all participants to remain engaged throughout the focus groups, especially those who participated via Zoom, the primary researcher requested that all participants have their cameras on during the focus group. Additionally, the primary researcher facilitated these focus groups discussions by asking all participants questions throughout the focus group. Only the participants and the primary researcher were present during the focus groups. At the beginning of each focus group, participants were reminded about appropriate focus group behaviour, confidentiality, the voluntary nature of the discussion, and the focus group were being audio recorded to

ensure accurate transcribing of the discussion. The audio recordings were transcribed using Trint (trint.com), an artificial intelligence transcription platform.

4.2.4 Materials

4.2.4.1 Interview Schedule.

A semi-structured interview schedule was developed based on existing literature and adapted to suit each focus group (i.e., athletes only or coaches and staff only) (e.g., Gulliver et al., 2012). There were eight main questions designed to: i) capture subjective experiences about the importance of mental health and sleep to athletic performance, and ii) enable the conversations to flow organically within the study aims, depending on the individual experiences of the participants and dynamic nature of the conversations within the focus groups. The interview schedule had minor changes to two questions following a pilot focus group that the first author (HdV) conducted with two support staff prior to data collection to trial the interview schedule and process and further develop interviewing skills. A copy of the full interview schedule can be found in Appendix K.

4.2.4.2 Demographics Questionnaire.

An online questionnaire was developed to capture participant demographic information (e.g., age, gender identity, ethnicity, sporting experience). This demographic information was sought due to concerns arising in the sport psychology literature that historically research has not been representative of athletes, such as an underrepresentation of females/women (Walton et al., 2022). The demographics questionnaire included short-answer responses to investigate participant's prior experience with and access to support services and/or education sessions and workshops for mental health and/or sleep (e.g., engaging with a psychologist), to facilitate a deeper discussion during the focus groups. A full copy of the demographic questionnaire can be found in Appendix L.

4.2.5 Data Analysis

The data analysis was conducted iteratively and followed the six stages of reflexive thematic analysis recommended by Braun and Clarke (2022): 1) familiarisation; 2) coding; 3) generating initial themes; 4) developing and reviewing themes; 5) refining, defining, and naming themes; and 6) writing up. NVivo software (Version 14, Lumivero, USA) was used to help with the data analysis, specifically stages 2-5 of reflexive thematic analysis. In addition to collecting all data, the first author (HdV) increased his familiarisation with the data by re-listening to the audio recordings of the focus groups, cross-checking the transcriptions against the audio recordings, and reading through each transcript multiple times to develop and synthesise first impressions based on their interpretative perspective. Examples of some early coding and initial theme generation can be found at Appendix M. He also shared the six anonymised transcripts with another researcher (KL), and both read and familiarised themselves with the transcripts prior to generating initial codes independently in NVivo. After this initial coding, HdV and KL met on five occasions to discuss their interpretations of collected data, and generate and refine themes. Through these in-depth discussions with KL acting as a sounding board, HdV began to develop and refine generated themes. This collaborative discussion contributed to HdV's reflexivity as a qualitative researcher and helped him interpret the data he had generated.

Once the key themes had been generated, HdV presented the findings to the rest of the research team, to explain the analysis process and developing understanding. As part of this iterative approach, step 5) involved presentation to the research team and provided the opportunity for the research team to ask questions, seek clarification on the process, and provide their own insights into the analysis. HdV wrote up findings with input from all authors - the final phase of analysis.

4.2.6 Reflexivity

Braun and Clarke (2022) define reflexivity as a process of critical reflection, whereby a researcher reflects on how their professional, personal, and theoretical assumptions and their chosen research design influences the knowledge they produce within the research process. Within this interpretative perspective, the researcher maintains an active role in coding and theme development. Researchers are considered instruments of data analysis, embedded within their research, whose experiences and assumptions influence the interpretation of the data (Gough & Madill, 2012).

Throughout data collection, analysis, interpretation, and writing the manuscript, HdV and KL reflected on how their experiences and perspectives influenced their work. This reflection was especially important as data collection took longer than anticipated, and HdV's thinking about the relationship between mental health and sleep in athletes evolved over time during his PhD candidature. HdV and KL conducted all the data analysis, and their training is in sport and exercise psychology. This professional background may have influenced how they understood athlete mental health, sleep, and the relationship between the two within the sporting ecosystem. Interpretation of the data might have been influenced by their professional experiences in high-performance environments helping athletes experiencing psychological distress.

As the primary researcher, HdV was conscious of how his occupation as both a PhD researcher and a practicing sport and exercise psychologist may have influenced participants as they facilitated the focus groups. For example, HdV had struggled with episodes of insomnia and sleep disturbances throughout his life, and this personal experience might have shaped some of the discussions in the focus groups. Within each focus group, HdV was able to use his insider perspective (Bradshaw et al., 2017) of elite sport and skills as a sport and

exercise psychologist, such as rapport building and communicating with participants with sport-specific language (Johnson et al., 2025), to facilitate the discussions.

4.3 Analysis

Consistent with Braun and Clarke's (2025) recommendations for conducing Big Q Qualitative research, this section is called Analysis, instead of Findings, Results, or Results and Discussion. Six primary themes were generated from this analysis: 1) what is my experience and understanding of mental health?; 2) what is my social identity?; 3) coach(es) create the environment; 4) my environment defines my sleep; 5) what supports do I [athletes] have?; and 6) you monitor my wellbeing… but what happens with my data? Figure 4.-1 presents the primary themes and how these align with the ecological systems framework proposed by Purcell et al. (2019). For additional information regarding the themes, including definitions and example quotes, please see Appendix N. The six themes are presented below, with quotations to illustrate findings. Each theme is defined through a joint analysis section to offer richer analytical interpretations.

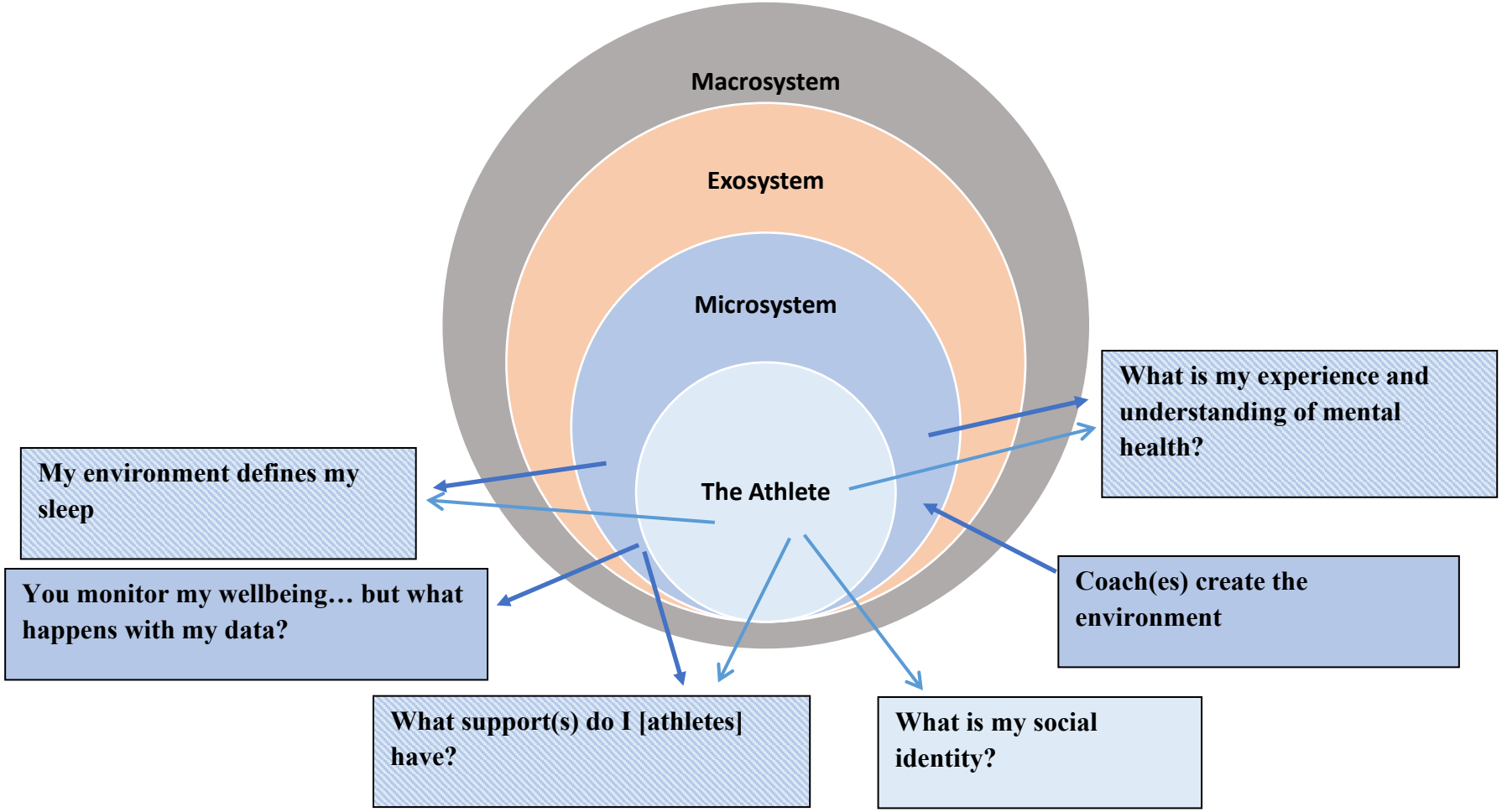

Figure 4.-1 Analytic map of data in relation to Purcell et al. (2019) ecological systems model for elite athlete mental health

4.3.1 Theme 1: What is my experience and understanding of mental health?

The participants in the focus groups conceptualised mental health to be a balanced state, with resilience a key consideration for good mental health. This theme appeared to link across all four levels of Purcell et al.'s (2019) ecological framework. Participants lived experiences of mental health was dependent on their own coping skills, beliefs, and attitudes (i.e., The Athlete). Mental health experiences were, however, understood within the broader systems that athletes exist. The microsystem, especially in relation to coaches and psychological safety, was intertwined with the mental heal experiences discussed. More broadly, athlete mental health was also understood to be influenced by the broader sporting exo- and macrosystems.

There is growing recognition in the sport psychology literature that mental health needs to be considered within the context of the environment. In this study, mental health was considered to be context specific, and participants understood that mental health is multifaceted. For example, one participant noted that "a mentally well person is able to cope well with challenges. Because you're all going to face challenges. But someone who's in a good place will cope with that better. And will be able to bounce back quicker" (Staff V, Focus Group #4).

This balanced state appeared to include mental health, physical health, and sleep, and participants alluded to both a balance *within* their mental health and a balance *between* mental states, that was context dependent. According to Küttel and Larsen (2020), their athlete-specific definition of mental health considers mental health to be a dynamic state of wellbeing whereby athletes can cope with common life and specific sport stressors. This conceptualisation of athlete mental health appears to be consistent with how participants in the focus groups generally understood mental health, and is demonstrated by Staff V's description above. Athletes felt that mental health was a balanced state, and was related to

"the overall healthiness of your mind and having a balance of all the emotions" (Athlete A, Focus Group #1). Other athletes in the athlete focus groups agreed that a balance of emotions was a crucial component of mental health.

The balance and resilience that participants considered important aspects of athlete mental health is consistent with the mental health continuum that researchers have adopted (e.g., Schinke et al., 2024). This continuum acknowledges that athletes can move back and forth along different stages of the mental health continuum depending on different contexts they are experiencing (Stambulova et al., 2021). Participants in the focus groups in this study appeared to appreciate how sport-specific risk factors could impact elite athletes' mental health, reinforcing the understanding of athlete mental health to be dynamic. Athletes spoke in this study about how mental health and athletic performance were inextricably linked, especially due to anxiety around performance and selection, and pressure to perform. For example, one athlete noted that "when I was playing at the highest level, I didn't have the greatest mental health because I was always stressed about selection and worrying and constantly overthinking things" (Athlete E, Focus Group #2). The impact of sport-specific factors on athlete mental health was also noted by coaches and staff, particularly in relation to physical training intensity or volume and how that can impact athletes' mental health. This impact was noted as a positive, with athletes believing that physical health was linked to mental health, and engaging in exercise was important for them to protect and/or boost their mental health. Training load and mental health was also considered from a negative perspective from participants, as noted by one staff member:

> I think another area is probably the overall training phase and load and stress that they're under physically. I think it no doubt has an impact on, at least their mood states, if not their mental health. And you can see pretty clearly across full squads, when you're in a particularly heavy block that the moods of everyone is a little bit,

> maybe potentially depressed, and just probably slightly less motivated. (Staff Y, Focus Group #6)

As part of the discourse regarding participants' experiences and understanding of mental health, alcohol was a topic raised by both athletes and coaches. Athletes noted that alcohol use could be a socialised experience. They shared insights on how sporting cultures can create an environment whereby socialising with teammates is done in situations that involve alcohol, and that in some sporting ecosystems alcohol use is ingrained:

> Yeah, it was always the culture… you go train or compete and then you go into the pub right after. It's just… sort of ingrained? I have vivid memories of before the biggest race, it was like a week out and we all went to go to the pub to go over the race plan. (Athlete C, Focus Group #1)

There is evidence that sport participation has a relationship with alcohol consumption for athletes. In a review of literature, Lisha and Sussman (2010) found that participation in sport for high school and college athletes was positively related to higher alcohol consumption. The authors attributed this relationship to several possibilities: 1) athletes may drink larger quantities of alcohol due to inherit competitiveness (e.g., to prove tolerance of alcohol); 2) drinking as a coping mechanism for sport-related stress; 3) athletic identity and sporting environments, influenced by perceived norms of other athletes (e.g., an athlete might believe others drink more than them); and 4) social culture might encourage an association between drinking alcohol and sport, such as through alcohol advertising (Lisha & Sussman, 2010). In the current study, participants did not share any perspectives on why this positive relationship between sport participation and alcohol consumption may exist. However, their experiences suggest that the social drinking that occurs within sports is likely to be related to

a combination of sporting ecological systems (e.g., sporting culture) and individual athlete factors (e.g., coping mechanism). Additionally, choosing to drink or not drink may also be influenced by social factors outside of sporting circles, such as friends and family members not understanding why athletes were choosing not to consume alcohol at social gatherings, potentially leading to pressure on athletes to consume alcohol.

4.3.2 Theme 2: What is my social identity?

The participants discussed how athletes have multiple social identities, but often a core social identity is strongly linked to their capabilities as an athlete. This theme appeared to be linked to the different levels of Purcell et al.'s (2019) ecological framework. Specifically, athletic identity is linked to the individual level (i.e., athlete), but seemed to be influenced by the microsystem (i.e., how the athlete is perceived by coaches, teammates, and support staff) and the sport itself that the athlete competes in (i.e., exosystem). Social and athletic identity and may also be influenced by the macrosystem, specifically the media, general public, and social media. Athletic identity is defined as "the degree to which an individual identifies with the athlete role" (Brewer et al., 1993, p. 237). This concept of athletic identity was discussed throughout the focus groups, by athletes and support staff, with participants sharing their views about how athletic identity can influence athletes. For example, Athlete B (Focus Group #1) spoke about describing themselves to other people at a family gathering: "Everyone there was asking me, 'So what do you do apart from [individual sport]?' And I was like, 'I [compete in individual sport] … what do you mean? I train and race and I do uni.'" Research has indicated that an athletic identity can be helpful for athletes, especially regarding motivation and can help athlete's achieve optimal performances during their career (Haslam et al., 2024; Ronkainen et al., 2016). For athletes, developing an identity closely tied to their athletic prowess (i.e., an athletic identity) is often a normal (and perhaps necessary) part of pursuing elite athletic endeavours. Athletic identity, however, can also

present some downsides for athletes, as noted during the discussions by one athlete in relation to how other people perceived them:

> The people that I had surrounded myself with had come with such a high worth opinion placed on your position, and how your dedication to the sport regardless of your other commitments and circumstances (was all that mattered). It's as if you weren't there, you weren't training, you weren't a valuable person. (Athlete C, Focus Group #1)

Another downside to athletic identity that was raised in the focus groups related to social isolation. The impact of isolation as a consequence of pursuing elite sporting endeavour, and the potential impact this can have on athletes' mental health was noted by several participants, and highlighted by support staff working with athletes:

> I think, particularly for young athletes, sport in general is very *isolating*. Like it is their life. So, it actually removes them from [life] outside of sport environments. And I think sometimes that can have a really strong link to mental health as well. (Staff X, Focus Group #6)

The athletes in this study's focus groups discussed sacrifices they would make to pursue their sport, and the impact that these sacrifices would have on them. Athlete B told the focus group in this study they would sacrifice social relationships to prioritise their athletic endeavours: "I think social relationships are generally the first thing to fall. Because sport is the priority" (Athlete B, Focus Group #1). This theme of *sacrifices* in relation to social relationships was also identified in a recent study by Haslam et al. (2024) who investigated athletic identity during retirement. Consistent with the perspectives shared by athletes in the current study, Haslam et al. (2024) found that many athletes often lack social connections to

groups outside of their sport. One challenge the athletes in our study reported was that while they identify as an athlete, many people around them may not understand the requirements of being a high-level athlete, creating challenges in maintaining social relationships with non-athletes. A similar failure to understanding the requirements of being a high-level athlete was also identified in the theme 1, specifically in relation to social drinking outside of sporting environments.

In these focus groups, the athletes discussed how they often feel they are valued only because of what they can do as an athlete or based on their physical appearance publicly discussed on social media:

> Unfortunately, when you sort of toy [interfere] with your body and when it happens early on in your life, it still has repercussions later in life. And there's a huge mental side of it, too, because there's that whole aspect of comparison. And now that social media is involved. And you know, what people think athletes should look like as opposed to what an athlete might look like. (Athlete H, Focus Group #2)

Athletes spoke to their multiple social identities that hindered their mental health and sleep. For instance, some athletes in this study were student-athletes, and they openly discussed their challenges in balancing high-level athletic performance and academic performance:

> … All through high school, it had always been that I would fail or 30, 40% grade in first semester just because it was overloaded [with sport]. I was not studying at all… And then I'd have to make it all back in second semester to try and maintain a high grade. It was not sustainable… I'm overloading one semester fully with sport and then trying to overflow the next one to make up for that. (Athlete C, Focus Group #1)

Athlete C discussed an ‘all-or-nothing’ approach that they adopted to school and sport, and how stressful this could be. Like many athletes, they would prioritise sport, reinforcing their athletic identity, until it started to become problematic. Research has demonstrated that student-athletes, particularly college students, are vulnerable to developing mental illness(es) and symptoms, such as depression, anxiety, and stress (Cox et al., 2017; Ryan et al., 2018; Yang et al., 2007). This vulnerability has been attributed to pressure to excel in athletic competition and perform well academically, time commitments for sport, trying to balance sport, academic, and social activities, pressures to perform or win, pressures or expectations from other people (e.g., family, coaches, friends, supporters), and the possibility of an elite or professional sporting career (Yang et al., 2007).

Another subset of athletes in this study with multiple social identities that emerged in these focus groups was the mother-athlete. While male athletes who are fathers has been existing for a long time in sport, in recent times there has been increased research (e.g., (Massey & Whitehead, 2022) and public awareness given to athletes who are mothers (e.g., Serena Williams, Alex Morgan, Dana Vollmer).

> I would just say it was for me managing life and being, you know, a sports person after having children. Well, in the early stages that was a challenging balance to meet. And just now that I'm in Masters (age group sport), I have this whole group that understand and get it, because they've been through it and been in the same situation. But when you were the only one with children in the group, then it's much more challenging to get that understanding and empathy from them. Although, that is not to say they didn't try, but it's just different when you haven't done it yourself.” (Athlete G, Focus Group #2)

Athlete G spoke about the challenge of being a parent-athlete when you are in a team or squad with other athletes who are not parents. Support systems have been identified by research as a key theme regarding mother-athletes (McGregor et al., 2024; Palmer & Leberman, 2009). In the case of Athlete G, that support system included peers who understood what it was like to be an athlete-parent. Just like athletes with high athletic identities may base their entire social connections around their sport, parent-athletes may feel greater belonging and connectedness to peers, teammates, and other personnel in the sporting environment when they have other parent-athletes around them.

4.3.3 Theme 3: Coach(es) create the environment

Participants in the focus groups all discussed the high-performance environment or ecosystem that elite athletes exist within, and the importance that this ecosystem has on making athletes feel safe and supported. This theme was intimately linked to the microsystem within Purcell et al.'s (2019) ecological framework.

> Just to make sure that the athletes feel *important* and valued every session. And that's what I say to all of them, because we all have our moods and our bad days and some more severe than others. They can feel that they can talk to us, and that they also feel welcome and safe in in the gym or in the pool or wherever. (Coach L, Focus Group #3)

As Coach L demonstrated, the coaches in the focus groups expressed a belief that they were responsible for creating a safe, high-performance ecosystem that supported the mental health of the athletes that they worked with. In a recent study, Henriksen et al. (2025) proposed that coaches are 'architects' of high-performance sport ecosystems, responsible for designing, building, and maintaining such an environment. The idea of coach as architect of the sport ecosystem are consistent with the theme generated in this study, that coaches create

the sporting ecosystem. As part of creating the high-performance sporting ecosystem, the coaches interviewed in these focus groups in this study recognised that in order to create a safe environment, they had to understand their athletes as people, not merely as athletes.

> There are times when an athlete uses this [training] as an *escape* from their problems, so it doesn't show here. Which is why you need to know your athletes, know who they are and what they are, what they are doing, what they are thinking. You can't just train them and forget about them. (Coach M, Focus Group #5)

> I always try to make a point with our athletes, just asking them about their family. Brother, sisters. What do they do? What do their parents do? What their home is like? What do they do for fun? It helps build their trust. (Coach O, Focus Group #5)

The coaches in these focus groups discussed how they created safe sporting ecosystems for their athletes. Walton et al. (2024) recently proposed a theoretically informed model of psychological safety and mental health in elite sport. This model recognises that enhanced athlete mental health is the result of attitudes, behaviours, and embedded support within sporting ecosystems, whereby mental health issues are normalised, athletes are able to be authentically themselves, and help-seeking behaviour is promoted (Walton et al., 2024). It was evident in the discussions with the coaches in the focus groups that they had created psychologically safe sporting ecosystems for their athletes.

Through the creation of psychologically safe sporting ecosystems that the coaches demonstrated, it was very apparent how much the coaches *cared* about their athletes. This caring role was evident in the conversations they would have with their athletes, especially in showing interest in the athletes about aspects of the athletes' lives not related to sport. Henriksen et al. (2025) found that the Danish Olympic coaches in their study consistently

emphasised that the athletes they coached are people first, and athletes second. Again, this coaching approach is consistent with what the coaches in the current study demonstrated. Further, there appears to be consistency across the two studies that this person-centred approach to coaching is essential to help athletes thrive and consistently perform at their best.

In our study, the coaches appeared to value trust and respect and intentionally created an ecosystem that would foster these values. Athletes and coaches described their coach-athlete relationships, and how beneficial athletes found this relationship when the athlete understood that their coach cared about them deeply. This care included knowing that coaches can be a source of support that the athlete to confide in when they needed. Additionally, coaches felt that part of creating an effective high-performance ecosystem was to encourage autonomy and promote agency within the athletes that they coached. Developing this athlete agency included preparing young athletes for life as an elite athlete, as well as preparing them for life beyond sport.

> By the time they leave here, they already do more for themselves here than they do at home. They have to set their own alarm, get themselves up on time, have breakfast. They don't do what they would at home. They do way more here… When they leave here they are going to start adulthood. (Coach M, Focus Group #5)

As part of this considerate approach, coaches were invested to create sporting ecosystems that encouraged athletes to socialise with one another outside of their sporting commitments, to build camaraderie and cohesion. There were noted downsides that can occur, however, particularly when this socialising involved alcohol use:

> Grog [alcohol]. Team sport, I'm fairly interested in our teams doing things together. You know, playing the game, women, men, and then go and have a meal together. On the other hand, I think some of those evenings… some… I don't want to sound

> callous when I say this, but some mental health complaints could probably be due to being hungover. (Coach J, Focus Group #3)

As was noted in Theme 1, alcohol was a topic that was organically generated by participants in the focus groups. The point prevalence of alcohol use disorder was 4.8% for Australian elite/pre-elite athletes in Study 1 of this thesis., while alcohol misuse has been reported in 19% of athletes, according to a meta-analysis of the occurrence of mental illness and subthreshold symptoms athletes experience (Gouttebarge et al., 2019). Understanding cultural norms regarding alcohol use in sport is necessary to help generate constructive change where required. Educating athletes and coaches about the benefits and risks of alcohol use, including potential impacts on mental health and sleep, may be worthwhile. Coaches and staff ought to also consider the sporting ecosystem and how they can create cohesive and vibrant sporting cultures where athletes enjoy one another's company but do so in ways that do not facilitate alcohol use. One such example could be hosting team gatherings at venues where alcohol is not present.

A downside of coaches taking agency to create the sporting ecosystem was that an ecosystem that lacked care has a detrimental effect on the athlete. Some athletes expressed their feelings towards challenging ecosystems, and in particular coaches, that they described as *toxic*, that appeared to detrimentally impact them. These sporting ecosystems appeared to be consistent with Walton et al.'s (2024) illustration of a psychologically unsafe environment in elite sport. In our study, for example, Athlete F (Focus Group #2) described how they didn't feel safe in their sporting ecosystem at one stage, saying "the environment was the other issue. The environment was very competitive, not exactly comfortable, and yeah very toxic if I must be honest." This idea of toxicity was also described by another athlete:

> We had quite a toxic coach at one point, that was earlier. Definitely not players at all. Like your players would always be your biggest support network. But it was interesting just the kind of comments that naturally people would end up saying because of, like, a flow on effect of what coaches would kind of say. (Athlete H, Focus Group #2)

Athletes also spoke about their experiences of toxic coaches and consequent sporting ecosystems, and how this had a significant impact on their body image. For example:

> Another thing that kind of didn't support too good a mental health in the national program back in the day, was the element of body composition and things like that. But they've definitely addressed that more recently. I think they've removed the aspect of having skin folds and, yeah, weight [measurement and targets] and things like that. (Athlete F, Focus Group #2)

4.3.4 Theme 4: My environment defines my sleep

Participants in the focus groups identified that sleep is essential for athletes. This theme appeared to be largely related to the individual (i.e., athlete) and microsystem (i.e., coaches and support staff) based on Purcell et al.'s (2019) ecological framework. All participants in the focus groups highlighted how important sleep is for physical recovery and athletic performance:

> Sleep can affect your motivation. Your… excitement levels, your competitive levels, your reaction times, your injury and illness status. I think it plays such a big role, and I actually don't think people realise how much sleep can affect them. (Staff X, Focus Group #6)

As well as recognition that sleep is important for physical recovery and athletic performance, participants in this study understood that there is a relationship between mental health and sleep, and that this relationship is important for athletes. How the participants made sense of this bi-directional relationship, however, varied across the focus groups. Several athletes felt that their mental health had more of an impact on their sleep, rather than their sleep impacting their mental health. In contrast, coaches and staff tended to view sleep as having a bigger impact on mental health. All participants recognised that prolonged nights of poor sleep were impactful for athletes' training and competition performances, reinforcing the link between sleep and physical functioning. Coaches and staff felt that athletes could still perform with one night of inadequate sleep (e.g., the night before a competition). There was a sense from the coaches and staff in the focus groups that this message needed to be better educated to athletes, to help them understand their sleep needs and potentially reduce sleep anxiety related to competition performance. There was also a recognition that there is education on sleep provided to athletes, but perhaps this education does not go far enough, particularly for younger and developing athletes:

> Because sleep, particularly in younger athletes, if we're talking specifically about athletes, it could be the first thing that they are happy to give up. And so that's why that education piece is so important. I think in elite athletes that are older, wiser, quite mature in their training age, realise the importance of it and actually are really good at getting enough sleep. But I think in younger athletes, yeah, it's a massive problem. (Staff X, Focus Group #6)

One of the challenges to achieving regular, adequate, good quality sleep discussed in the focus groups was in relation to athlete's schedules, in particular training times. Some participants recognised that at times the sports that they worked within would have an impact

on athlete's sleep. These perspectives suggested that 'my environment defines my sleep' was also linked to the exosystem (i.e., sport) and macrosystem (i.e., National Sporting Organisation) from Purcell et al.'s (2019) ecological framework. One support staffer observed that "I don't think a lot of coaches or people informing on training scheduling understand that as well. I think that's a piece that's completely missing is that young athletes are tending towards more of that later chronotype" (Staff X, Focus Group #6). Athletes expressed frustration at how training schedules might be arranged, and how hard it would be for them to achieve a consistent sleep schedule:

> Sleep can be improved in athletes by having training times not super early and not super late in the day. I struggled to get good sleep after a late-night session finishing at 9.30pm because I'm so wired from training. Similarly, if I had to get up at 5am for training I'd get alarm anxiety and not be able to sleep for fear of missing the alarm. (Athlete H, Focus Group #5)

Competition schedules and training times are known factors that can disrupt athlete's sleep, impairing sleep quality and/or sleep duration (Gupta et al., 2017; Sargent, 2016; Sargent, Lastella, et al., 2014). As noted above by Staff X, a key consideration for the scheduling of training times is providing education to coaches and staff organising training sessions about the benefits of consistent sleep, and how training schedules (especially if inconsistent) can be disruptive for athletes. This is particularly true for young athletes who naturally have a later chronotype yet are often forced to wake early to attend training sessions, which research has shown significantly impairs adolescent athletes' sleep duration (Steenekamp et al., 2021).

In addition to training schedules, additional barriers to consistent sleep (i.e., adequate duration and high quality) experienced by athletes are related to environmental factors

outside of their sporting ecosystem. The transition into parenthood was identified as one such factor:

> So, whether it's a new parent, mother, father, you know, having children impacts people's sleep. I think that that's a really important point I do want to make is that often we're not in as much of control of our sleep as we as practitioners assume. (Staff W, Focus Group #4)
>
> Our athletes are busy, often they aren't just training, and they have to fit in work and/or school and/or university and all of the other life commitments. What I often see is sleep as being forgotten at the bottom. You know I need to tick everything else off my list and then the sleep is what's left. And often the hours in the day, you know, we're all time poor that the hours in the day just run out and sleep is what gets compromised. (Staff U, Focus Group #4)

The quotes above from Staff W and Staff U demonstrate the dual or multiple identities that athletes can hold. Understanding these different identities is critical for coaches and support staff working in Australian high-performance sporting ecosystems, as it emphasises that tailored and flexible approaches to sleep education, for example, are required to capture the unique experience(s) that each athlete brings to the sporting ecosystem.

Even though participants in the focus groups in this study considered that the sporting ecosystem defines an athletes' sleep, some of the athletes discussed strategies that they had learned or adopted to help them get adequate sleep, even when the sporting ecosystem did not support their sleep needs. Related to Theme 2 and athletes' social identity, athletes considered their sporting ecosystem and how they perceived that they needed to take agency or ownership over many aspects of their athletic life within their ecosystem, including implementing behaviours that would support their sleep and/or mental health. For example,

one athlete described the strategies they had adopted, seemingly without external intervention, to help them with their own sleep:

> I think it's also about being really strict with yourself about when you go to bed. Because I know when I was at school, I found myself wasting hours on my phone before I went to bed, even though I knew I was getting up at 4.30am the next morning… One thing that has helped me is that I have turned off notifications on my phone after 8.30pm. I think our phones are our worst enemy! (Athlete B, Focus Group #1)

4.3.5 Theme 5: What support do I [athletes] have and what support do I need?

Participants in this study's focus groups identified that known barriers to mental health support, including stigma and help-seeking behaviours, persist in sport despite advancements made in this area. This theme appeared to be linked across all four levels of Purcell et al.'s (2019) ecological framework. Support-seeking and support availability is related to the individual athlete (i.e., willingness to seek support); microsystem (i.e., coaches and staff creating a psychologically safe environment and encouraging support seeking); exosystem (i.e., culture of a specific sport related to support-seeking or not); and the macrosystem (i.e., support and resources made available/not available by a National Sporting Organisation). Consistent with this theme conceptualisation related to the ecological framework, one staff member noted that there are different factors that influence support seeking; "I think the culture of accessing support is definitely changing, but that still is a barrier in some ways. People don't want to be seen to be asking for help or accessing help" (Staff X, Focus Group #6). This perspective on stigma associated with mental health in sport was also shared by other participants in the focus group:

> Probably understanding, I guess debunking the myth that it's just from the neck up. That it's directly going to impact performance, and you don't necessarily have to be

> *troubled* or in a situation where you are compromised to reap the benefits of it. (Coach J, Focus Group #3)

Coach J highlighted how although support services exist for athletes, particularly in areas such as sport psychology, athletes may not always understand how or when to utilise such support. This was a recurring theme in the focus groups, with participants agreeing that being *proactive* regarding accessing support services was the best approach but noted that this is often not how services are accessed. For instance, one staff member noted that "I think sometimes the times when athletes probably could most use some extra support are the times they might be less likely to look for that support" (Staff Y, Focus Group #6). This proactive approach to engaging with sport psychology was encouraged by the coaches, who seemed to understand how beneficial it could be for athletes. Coaches were keen for athletes to work with sport psychology practitioners to help them with both sport performance (e.g., performing under pressure) and non-sport performance related matters (e.g., interpersonal difficulties outside of the sporting environment). For example, Coach J stated "I would just like them to use them more, personally. I think sometimes you can … it becomes a reactionary thing. I would much rather that they be proactive and get ahead of things" (Coach J, Focus Group #3).

One barrier that could have contributed to athletes not utilising support services is through the sporting clubs and organisations that they compete with not connecting athletes with specific support services. Athletes felt that sporting clubs and organisations were more receptive to raising awareness and promoting mental health, such as through partnerships with charity/community organisations, and some sporting clubs and organisations offered mental health first aid training. Despite promoting the importance of mental health, athletes felt that often their sporting clubs/organisations did not do a good job of providing referral

pathways for athletes to seek support when required. This meant that some athletes did not know how and where to access available support services.

Consideration was also given that when support services for sleep are available, athletes may be more inclined to use those services compared to seeking mental health support, potentially due to stigma or a lack of mental health awareness.

> Everyone feels like sleep is a quick fix. Whereas, I think maybe mental health is seen like a bigger problem. Like, a lot of people are like 'I'm not getting enough sleep', without realising that that actually takes a really long time to retrain your body. (Staff X, Focus Group #6)

Different levels of support access depending on level of competition athletes are competing at, creating inequity within sporting ecosystems, was a major barrier identified by participants to support structures available to athletes. For instance, athletes understood that they did have access to support structures within their sporting ecosystems to help with their mental health, but that these support structures were only available to athletes competing at the highest levels of competition. This barrier within the sporting ecosystem was considered in relation to the different employment models that psychologists working in sport are engaged in, and how often psychologists are not embedded in the daily training environment, creating an additional layer of barriers to accessing support when required.

> We've got one part-time psych. If for example, we had three people in crisis. I'm not sure how they would deal with it. And where do we go next? I've always had that concern, 'what if the worst-case scenario comes up?' (Coach M, Focus Group #5)

One support issue raised in the focus groups was within the sport science and sports medicine team related to lack of role clarity and scope of practice when monitoring athletes'

sleep and providing necessary interventions. As noted by one participant, "one challenge I do see is whose role is sleep? Because at times there's the doctor, the psychologist, and the recovery physiologist and sleep sits in their wheelhouse. But whose job is it?" (Staff W, Focus Group #4). While sleep is increasingly becoming an important topic in sport, it may not always be clear in sporting ecosystems who is monitoring athletes' sleep and providing intervention or support when required. This evidence does suggest that at times, sleep may fall through the cracks in terms of athlete health and performance, as all practitioners assume that one another is overseeing sleep, when in fact, no one is overseeing sleep.

4.3.6 Theme 6: You monitor my wellbeing… but what happens with my data?

A key discussion points raised by participants in all the focus groups was the monitoring of athletes, in particular training loads, wellness measures including mood states, and sleep. This theme linked across different levels in Purcell et al.'s (2019) ecological framework. Specifically, it related closely to the microsystem (i.e., coaches and support staff monitoring athletes), but was also related to the individual athlete (i.e., if they owned a sleep tracking watch/device) and the macrosystem (i.e., National Sporting Organisations may mandate the monitoring of athletes' sleep and wellbeing). Coaches and support staff in the focus groups highlighted the benefits of monitoring athletes training loads and discussed how routinely monitoring their athletes provides them with data they can use to intervene when required, such as if an athlete is consistently reporting inadequate sleep quality and/or quantity. Staff Y (Focus Group #6) felt that athlete monitoring could be used as "a conversation starter with the athlete if they have any trends that are changing in (measures like) sleep or soreness." The monitoring of athletes, in particular training loads, wellness measures, and sleep, is common practice in modern high-performance sport, as evidenced by the focus group discussions in this study. A survey conducted in 2019 found that almost half of coaches, and two-thirds of support staff working in high-performance sport in Australia

monitored their athletes' sleep, with 75% using sleep diaries and over 20% using wearable devices (Miles et al., 2019). Sport scientists regard athlete monitoring to be essential to manage their training loads, determine if athletes are adapting to their training program, assess fatigue and recovery, and reduce the likelihood of injury and illness (Bourdon et al., 2017).

Although athlete monitoring is common practice in Australian high-performance sport, and the data generated can be beneficial for athletes and support staff, support staff in the focus groups stressed that athlete monitoring can be detrimental to athletes. Staff W (Focus Group #4) noted how monitoring athletes is a "double-edged sword. Because more information is power, but it can be harmful too." Support staff in the focus groups emphasised that for athlete monitoring to be effective, it was important to have honest conversations with athletes about why specific data is being collected, and how that data will be used. For example, a coach acknowledged that another aspect of meaningful athlete monitoring is ensuring the monitoring is conducted in an environment where the athletes feel safe: "We definitely had some who didn't wear it [sleep tracking device] because they were afraid that we were going to find out [that they weren't sleeping enough] " (Coach M, Focus Group #5)". Although not discussed explicitly in the focus groups, there was a sense through the discussions with coaches that they perceived athletes might feel like their data collected via monitoring would be negatively used against them, such as with team selection.

Another consideration discussed in these focus groups relating to meaningful athlete monitoring is the use of wearable and nearable technologies, often referred to as consumer sleep technologies (Trabelsi et al., 2023). There has been a proliferation of sleep tracking devices developed over the past 10-15 years (e.g., Fitbit, Whoop, Garmin, Apple Watch), and reflecting growing use in the general population, increasing numbers of athletes are using them or being asked to use them (Driller et al., 2023; Trabelsi et al., 2023). While consumer

sleep technologies and other forms of sleep tracking devices can be useful (Chinoy et al., 2021), their use can also be problematic.

> I think wearables is a big one. Every second person has a watch/device that syncs their sleep, they sleep in it. There's some good stuff you can get out of it. But I think learning how to use that data is really important, and how that data can influence your day is really important. Because, you know, we've had some horror stories of athletes listening to their device on competition days. It just doesn't go well. So, that heavy reliance on something else telling you how you slept [can be challenging]. (Staff X, Focus Group #6)

One challenge with athletes using consumer sleep technologies is that they can lead to an overestimation of total sleep time and sleep efficiency and an underestimation of wake time (Chinoy et al., 2021). These inaccuracies could be particularly problematic as they minimise subjective experience and quality of sleep, creating over-reliance on the device and creating anxiety and self-doubt, which can further disturb sleep:

> I stopped wearing mine. I would wake up in the middle of the night and check to see how my sleep was going. Whether you would say it's *competitive* or not, but if my sleep score was low, I'd be annoyed with myself (Coach M, Focus Group #5).

Coach M is describing orthosomnia, a term defined by Baron et al. (2017), describing a preoccupation with improving or perfecting one's wearable sleep data. Orthosomnia is a societal phenomenon (Jahrami et al., 2023), unlike insomnia, a diagnosable sleep disorder, and research into orthosomnia is still in its infancy. Behaviours associated with orthosomnia include preoccupation with sleep tracker data, frequent checking of the sleep tracker, and anxiety about disconnection from the technology (Jahrami et al., 2023) In this particular

focus group, Coach M is describing his own personal experience with orthosomnia, while Coach O acknowledges that the tracking of athlete sleep can create competition amongst athletes about who can sleep the best. Although athletes in the focus groups did not explicitly discuss experiencing orthosomnia, it is possible that athlete monitoring without appropriate support could create orthosomnia.

4.4 General Discussion

This study explored the Australian high-performance sporting ecosystem and the lived experiences from athletes, coaches, and support staff. How these individuals understand and view mental health, the relationship between mental health and sleep, and how this relationship may affect athletic performance. Barriers and facilitators within the Australian high-performance sporting ecosystem to mental health and sleep experienced by athletes as perceived by athletes, coaches, and support staff were identified within this study. To the best of our knowledge, this is the first study that qualitatively explored perspectives from athletes, coaches, and support staff on mental health and sleep in elite athletes. Identifying six primary themes: 1) what is my experience and understanding of mental health?; 2) what is my social identity?; 3) coach(es) create the environment; 4) my environment defines my sleep; 5) what supports do I [athletes] have?; and 6) you monitor my wellbeing… but what happens with my data?

In line with the ecological framework adapted by Purcell et al. (2019) for understanding elite athlete mental health, this study sought to understand the sporting ecosystem by exploring the subjective experiences from athletes, coaches, and support staff regarding mental health and sleep. This study focused on the microsystem of high-performance sport that athletes exist within, as well as the unique experiences athletes have at an individual level. Across all focus groups, participants experienced mental health to be a balanced state, with resilience a key consideration for good mental health that was identified

in Theme 1 of understanding mental health. Participants believed that physical health was linked to mental health, and athletes felt that engaging in exercise was important for them to protect and/or boost their mental health. Athletes felt that mental health and athletic performance were inextricably linked, especially due to anxiety around performance and selection, and pressure to perform. Social identity (i.e. Theme 2), including athletic identity, was regarded by athletes as both a barrier and a facilitator to their mental health. Despite advancements in awareness of athlete mental health (e.g., Reardon et al., 2019; Schinke et al., 2024), participants in this study noted that stigma and shame about mental health persist in high-performance sporting environments, and this can be a barrier for athletes to access support. We echo the recommendation from Prior et al. (2024) for high-performance ecosystems to be more open to discussing mental health and illness, and believe that this may help to reduce stigma, encourage athletes to be more open about their mental health, and seek appropriate support when required. A research implication stemming from this study is the need for greater understanding of barriers to athletes accessing mental health support, and build upon the existing knowledge in this space (e.g., Gulliver et al., 2012).

Coaches regarded themselves as the key agents in creating supportive high-performance ecosystems was a notable theme that emerged in this study (i.e., Theme 3). A key consideration for ongoing coach education is on teaching coaches how to create a psychologically safe environment, and providing them with the necessary skills, knowledge, and resources to make safe sporting environments. Further, this study has identified a need for staff working in high-performance sport to understand the importance of adequate sleep duration and quality for athletes (i.e., Theme 4), and how their programming of training schedules and training loads, such as training intensity and volume, can impact athletes' sleep. Sargent et al. (2021) recommended that to help maximise athletes' sleep durations, morning training session starting times should be delayed where possible, and/or reduce the

number of early morning training sessions each week to ensure opportunities for athletes to attain adequate sleep durations and/or quality. These recommendations are supported by the perspectives from participants in this study. By providing access to education about sleep to athletes, coaches, and support staff, sporting environments can become more conducive to supporting optimal sleep for athletes if morning training sessions can be delayed and/or required less frequently than at the present time. Future research should also look to assess the potential benefits to performance of delaying early morning training sessions (e.g., commencing training at 8am instead of 6am), and therefore allowing athletes more time to sleep before they are required to train. Of course, any potential changes to morning training session start times would need to consider other commitments athletes may have outside of their sport such as work, university, or school.

A practical clinical implication arising from Theme's 4 and 5 in this study concerns the support staff working with elite athletes and the need to clearly identify personnel responsible for overseeing sleep monitoring and education in athletes. Such role clarity is necessary so that athlete monitoring becomes more meaningful and actionable. Many support staff are likely to have a broad knowledge of sleep. However, blurred boundaries and lack of clarity about which sport science discipline sleep falls under – physiology, psychology, sport science, sports medicine– are partially to be blamed for overlooking athlete's sleep quality and duration at the detriment of athletic performance and devaluing the purpose of athlete monitoring. Support staff should work collaboratively when it comes to sleep and ensure that one member of staff takes responsibility for educating athletes about sleep. Ideally, these personnel should have training in sleep education so they can provide strategies to athletes when required. Failing this, we would recommend high-performance sport to have referral pathways and support mechanisms available so that athletes' can receive appropriate sleep interventions when their monitoring indicates.

Across all focus groups, there seemed to be a consensus that while good support structures now exist to support athletes' mental health, sleep can sometimes be overlooked (i.e. Theme 5). Participants considered sleep education to be a valuable resource and thus, it should be provided to athletes and coaches, along with strategies and tools to help support athletes' sleep quality and quantity. Consequently, sleep was regarded as a perceived priority for intervention based on these focus groups discussions. Although participants felt that the sporting environment was influential in defining athletes sleep (i.e., Theme 4), participants felt that athletes needed to be equipped with more strategies and support to help with their sleep, rather than intervening at a broader ecosystem level. It was recognised that the sporting ecosystem has natural barriers to athletes' sleep (e.g., infrastructure availability for training session times), and that these barriers may be difficult, and in some instances, not possible to change. But by empowering athletes with sleep education and strategies, they could make changes at an individual level to help support their sleep needs within the broader sporting ecosystem that they experience.

Theme 6 revealed a clinical implication about the use of wearable devices and monitoring processes with athletes, and what do we do with athlete's monitoring and data. While monitoring athletes training loads, physical health status, sleep, recovery, mood states, stress, and other wellness metrics is common practice in high-performance sport (Bourdon et al., 2017), this study highlights the potential downsides of athlete monitoring. It is important that athletes understand why their information is being collected, and what that information will be used for. Additionally, staff must be aware that while monitoring and measuring athlete data has many benefits, it can create distress for athletes if not managed correctly. We would urge caution with athlete monitoring and recommend that monitoring is conducted by an appropriate expert with clear and ongoing communication with athletes.

As this is the first study, to our knowledge, that has qualitatively explored the sporting ecosystem and the perspectives on mental health and sleep, further research is needed to capture perspectives from elite athletes from different sports, competitive levels, and cultures for a more enriched understanding of the sporting ecosystem. Research is needed to better understand athletes' experiences of sleep, especially regarding identified risk factors and sleep behaviours to better support athletes, coaches, and staff within the sporting ecosystems to optimise their health and wellbeing. This sport ecosystem information is fundamentally important to inform sleep education in sport, as well as developing targeted interventions to improve sleep and change behaviours within the sporting ecosystems to better support athletes.

4.4.1 Strengths and Limitations

Strengths of this study include that this is the first study, to our knowledge, that has qualitatively explored the sporting ecosystem and the perspectives on mental health and sleep from athletes, coaches, and support staff. The exploratory approach to the focus groups through semi structured interview questions strengthens this study as it allowed participant discussion to generate themes that were not influenced by previous theory (Nyumba et al., 2018). Participants were able to discuss ideas they believed relevant to the topic, which created richness in the data generated by these focus groups. The adherence to Big Q Qualitative research through our use of reflexive thematic analysis, and embracing researcher subjectivity in this study we feel is another strength (Braun & and Clarke, 2023). Additionally, the participants recruited across multiple focus groups have a diverse range of backgrounds and experiences, including different professions, which we believe is a strength of this study and helps to understand the sporting ecosystem.

A limitation of this study is the sample size of only nine athletes recruited over more than 18 months, along with the PhD research time constraints, means that the athlete

perspectives in this study may be narrower than expected within the Australian high-performance sporting ecosystem. In particular, the lengthy duration of the participant recruitment means that the researcher's and participants' perspectives on mental health and sleep will have evolved over time, and the focus groups may not have been able to capture this evolution. Ideally, future research would capture perspectives in a shorter time frame than we did in this study.

In our study, we were able to recruit one Para athlete. We acknowledge that their perspectives may differ from those in other sports, competitions, cultures and countries, with unique perspectives potentially emerging from the experience of Para athletes. Future research should look at diverse sporting ecosystems and explore by including more diverse athletes such as Para athletes, as well as athletes from different sports, competition levels, and cultures. Qualitative research would be especially valuable with these populations to understand their perspectives on barriers and facilitators to mental health and sleep across our entire sporting ecosystem.

This study captured perspectives from a variety of support staff in the focus groups, such as physiotherapy, physiology, sports dietetics/nutrition, sport science, and strength and conditioning. However, no sports doctors/physicians, for instance, were able to be recruited to participate in the focus groups. As these professionals hold important positions within the performance services team that supports elite athletes (Speed, 2013), it would be valuable for future research to investigate their perspectives on mental health and sleep, and what support structures they would like to see made available for athletes to help protect and promote mental health and sleep to optimise the sporting ecosystem.

A further limitation of this study is that in one focus group, participants all knew each other and appeared to operate in a social hierarchy according to the seniority of their experience within the focus group. This social hierarchy meant that the focus group

discussion was dominated by a couple of participants, with other participants not contributing many ideas. To overcome the potential challenges of this situation, the research team did invite all participants from this focus group to provide individual views on the focus group questions after the focus group was conducted. No participants took the research team up on this offer.

This study's data analysis employed reflexivity, a process of critical reflection, whereby a researcher reflects on how their professional, personal, and theoretical assumptions and their chosen research design influences the knowledge they produce within the research process (Braun & Clarke, 2022). As with all qualitative interpretative research, the findings are limited by the positionality of the research team and consequently, different researchers may uncover alternative meanings from the data (Jones et al., 2021). It is acknowledged that the findings of this study are influenced on the positionality of the research team and that all the authors come from a sport science background, one author conducted all the focus groups and data analysis, and their background in sport and exercise psychology will have influenced the interpretation of the data.

4.4.2 Conclusion

Athletes, coaches, and support staff in high-performance sport understand that mental health and sleep have a strong and bi-directional relationship that has important implications for optimal athletic performance in the sporting ecosystem. Identified barriers to mental health and sleep include social identity, sporting environments, stigma regarding help seeking, limited access to support, and training schedules. Identified facilitators to mental health and sleep include social identity, caring coaches, and accessible and knowledgeable support staff. High-performance sporting ecosystems needs to continue to reduce barries to mental health support and be more supportive and inclusive of athletes experiencing mental illness and symptoms. Greater education for coaches, administrators, support staff, and

athletes is also needed about sleep and strategies that can help promote optimal sleep for athletes.

Chapter 5 Bridging Statement

The second overarching aim of this thesis was to identify, design, implement, and evaluate the effectiveness of a pilot intervention aimed at improving athlete's sleep and/or mental health. The intervention identified that was informed by the findings of Study 1 and 2, was Cognitive Behavioural Therapy for Insomnia (CBT-I) intervention to improve athlete sleep and was piloted in this thesis. This overarching aim was investigated across two separate studies (Study 2 and Study 3), and this chapter presents the findings of the third study (Study 3) in this thesis.

Findings from Study 1 (see Chapter 3) revealed that one in ten Australian elite/pre-elite athletes met diagnostic criteria for at least one mental illness, while one in five athletes reported subthreshold symptoms of mental illness. Athletes who reported mental illness and symptomology were twice as likely to report poor sleep quality. After confirming that a relationship between mental health and sleep exists in elite athletes in Study 1, Study 2 (see Chapter 4) then explored subjective experiences from athletes, coaches, and support staff regarding athletes' mental health and sleep in the sporting ecosystem. In Study 2, six themes were generated based on the focus group discussions with athletes, coaches, and support staff. Participants in Study 2 noted that mental health and sleep can detrimentally impact athletic performance, and that strong but complex relationships exist between physical health, mental health, and sleep within the Australian high-performance sporting ecosystem. Specifically, participants shared their experiences and understandings of mental health within the Australian high-performance sporting ecosystem (Theme 1). Theme 2 was related to athletes' social identities, and how an athletic identity can help and hinder athletes. There was also

discussion about athletes holding multiple social identities, including mother-athletes and student-athletes, and how these athletes would manage these different social identities.

In Study 2, interviewed coaches believed that they were responsible for creating the high-performance sporting microsystem (Theme 3), and demonstrated a high level of psychological safety when discussing how they created these microsystems. Participants in Study 2 shared their perspectives and understanding of mental health as it relates to athletes and felt that athletes' sleep quality and duration was defined by the sporting ecosystem (Theme 4). Despite the apparent influence of the sporting ecosystem on athletes' sleep, interviewed athletes discussed taking agency over their own behaviour, particularly in relation to sleep, and that this agency could help them to thrive in the sporting microsystem. There was also a recognition that there is education on sleep provided to athletes, but perhaps this education does not go far enough, particularly for younger and developing athletes, and practical strategies need to be provided alongside athlete-specific education.

Participants in Study 2 shared their perspectives on the athlete support structures available in Australian high-performance sport, and there seemed to be a consensus that while good support structures now exist to support athletes' mental health, sleep can sometimes be overlooked (Theme 5). Participants considered sleep education to be a valuable resource and thus, it should be provided to athletes and coaches, along with strategies and tools to help support athletes' sleep quality and quantity. Consequently, sleep was regarded as a perceived priority based on the author's reflexive thematic analysis in Study 2 of the focus groups discussions.

Lastly, participants in the focus groups discussed athlete monitoring (Theme 6), and the use of measures both within the sporting ecosystem and externally (i.e., private use) of devices such as consumer sleep technologies to monitor sleep, wellness, and training. It was

recognised that while athlete monitoring is valuable, caution must be exercised with the monitoring, so athletes understand what is being monitored and why it is being monitored.

Based on the findings from the reflexive thematic analysis in Chapter 4, a Cognitive Behavioural Therapy for Insomnia (CBT-I) intervention was adapted specifically for athletes' and designed to improve athlete's sleep characteristics. CBT-I was chosen as an appropriate intervention because it equips athletes with skills and tools that they can use within their sporting environments. Additionally, using CBT-I with athletes addresses an identified research gap as although it is the gold-standard psychological intervention for improving sleep characteristics quality, CBT-I has not yet been investigated as an intervention in athletes. This CBT-I intervention was designed to help improve athletes' sleep quality as the primary outcome.

My roles in this manuscript were as first author and included concept/research design, data collection, analysis and interpretation of data, writing/editing/reviewing manuscript, and taking responsibility for the integrity of the work from inception to published work.

Chapter 5 Using Cognitive Behavioural Therapy for Insomnia (CBT-I) to improve athlete sleep: A pilot sleep intervention study

5.1 Introduction

Increasingly, sleep is being recognised as a critical component for athlete performance, recovery, and mental health (Charest & Grandner, 2022; Walsh et al., 2021). The restorative effects of sleep mean it is regarded by athletes and coaches as one of the best recovery strategies for athletes (Halson, 2013; Roberts et al., 2019; Vitale et al., 2019). Sleep is important for physiological and psychological functions that are of critical importance for elite athletes, including physical performance, cognitive functioning, metabolic functioning, pain perception, memory, learning, immune system functioning, increased production of growth hormone, and regulation of mood states (Halson, 2008; Halson, 2014; Halson & Juliff, 2017; O'Donnell et al., 2018; Samuels, 2009). Developing and establishing the efficacy of sleep interventions to improve and optimise sleep in elite athletes is of considerable interest to researchers and practitioners to optimise athlete performance and wellbeing.

Sleep is characterised by two primary dimensions – quality and quantity. Quantity refers to the amount sleep someone attains, and for the general population, the recommended guidelines are 7-9 hours per night (Hirshkowitz et al., 2015). Sleep quality is defined as an "individual's self-satisfaction with all aspects of the sleep experience" (Nelson et al., 2022), p. 149) and is comprised of four attributes: how much time in bed is spent asleep (sleep efficiency), how long it takes to fall asleep (sleep latency), total sleep time (sleep duration), and how much time is spent awake after initial sleep onset (wake after sleep onset; Nelson et al., 2022). In regards to sleep quantity, elite athletes often report insufficient sleep quantity (i.e., <7 hours per night; Roberts et al., 2019), when compared to the general population and

recommended guidelines include 7-9 hours of sleep per night (Sargent, Lastella, et al., 2014; Sargent et al., 2021). With respect to sleep quality, recent evidence has demonstrated that more than half of athletes report poor sleep quality (Halson, Johnston, et al., 2022). Poor sleep quality is associated with numerous adverse health outcomes, including daytime sleepiness and dysfunction, fatigue, and altered mood (Nelson et al., 2022), all of which may have detrimental effects on an elite athlete.

There is now substantial evidence that elite athletes are susceptible to inadequate sleep quantity and/or quality (Walsh et al., 2021), and this susceptibility is heightened due to a combination of sport-specific (e.g., competition) and non-sport (e.g., mental illness and symptoms – see Study 1). Sport-specific factors that are associated with poor sleep quality in athletes include early morning training sessions (Sargent, Halson, et al., 2014), anxiety about an upcoming competition (Erlacher et al., 2011; Juliff et al., 2015), travel demands (Fowler et al., 2015; Fowler et al., 2017), high training loads (Dumortier et al., 2018; Kölling et al., 2016), and nighttime competition (Fullagar et al., 2016; Nedelec et al., 2019). Non-sport demands can also contribute to poor sleep quality for athletes, such as caffeine use, family commitments, social demands, and work/study commitments (Walsh et al., 2021). In the general population, alcohol use is a known risk factor for sleep disturbances and insomnia (Chakravorty et al., 2016), and alcohol misuse is common for athletes (Gouttebarge et al., 2019), indicating a potential area of education for athletes about sleep and alcohol use. Understanding the sporting ecosystem influence on sleep and mental health, Study 2 highlighted the coach and staff recognition that education on sleep should be provided to athletes, but perhaps this sleep education currently does not go far enough, particularly for younger and developing athletes, suggesting that more targeted sleep education is warranted.

To help improve sleep in athletes, Cognitive Behavioural Therapy for Insomnia (CBT-I) is the gold standard sleep intervention in the general population (Muench et al.,

2022; Newsom, 2024), and was recommended by Halson, Johnston et al. (2022) that it should be trialled in athletes. CBT-I is recommended as the first-line treatment for all adults with a chronic insomnia disorder by the Australasian Sleep Association, Royal Australian College of General Practitioners, and the American College of Physicians (Manber & Carney, 2015; Ree et al., 2017; Sleep Health Foundation, 2025). Moreover, CBT-I is helpful for people who have difficulties with sleep but who do not have insomnia (Sleep Health Foundation, 2025). CBT-I has also been demonstrated to be effective for improving sleep disturbances in school-aged children and adolescents, despite most research being conducted with adults (Dewald-Kaufmann et al., 2019). To date, no published studies have been conducted that have investigated CBT-I in athletes of any ages or sports.

As CBT-I has not been used with athletes, a review of its use with non-sport populations is warranted. More than 30 meta-analyses have been conducted that demonstrate the efficacy of CBT-I in the general population (e.g., Alimoradi et al., 2022; Irwin et al., 2006; Koffel et al., 2015; Sweetman et al., 2023; van Straten et al., 2018). This body of evidence includes a systematic review and meta-analysis by Blake et al. (2017) that found results from four randomised-controlled trials to support the effectiveness of CBT-I as a sleep intervention for adolescents, with improvements reported across subjectively measured (sleep diary/questionnaires) total sleep time and sleep onset latency, as well as objectively measured (actigraphy) sleep onset latency. CBT-I has been shown to be effective at managing insomnia symptoms in the short-term (e.g., Mitchell et al., 2014) and has long-term effectiveness (van der Zweerde et al., 2019). Indeed, CBT-I has been shown to be as effective as medication (Rossman, 2019), but with fewer potential side-effects (Sleep Health Foundation, 2025). CBT-I is also considered to be a viable treatment for people with co-morbid insomnia and mental illness, including depression (Manber et al., 2008), anxiety, and post-traumatic stress disorder (Taylor & Pruiksma, 2014). Therefore, CBT-I is an effective intervention for

treating diagnosable sleep disorders such as insomnia as well as for managing insomnia symptoms (or threshold sleep disorders) that can accompany other mental illnesses and psychological distress.

The structured evidence-based approach of CBT-I is used to manage insomnia symptoms that focuses on identifying and challenging thoughts, feelings, and behaviours linked to insomnia symptomology (Newsom, 2024). As a multicomponent intervention, CBT-I contains several modules, including sleep education (psychoeducation), sleep hygiene (i.e., behaviours that facilitate sleep), behavioural interventions such as sleep restriction (limiting amount of time spent in bed to increase sleep quality and efficiency) and stimulus control (i.e., strengthen the association for bed as a cue for sleep; Jansson-Fröjmark et al., 2024). CBT-I also includes cognitive interventions such as cognitive restructuring (e.g., challenging unhelpful thoughts about sleep and insomnia) and relaxation exercises (e.g., progressive muscle relaxation; Lancee et al., 2016; Manber & Carney, 2015). In addition to forming part of CBT-I treatment protocols, sleep restriction therapy can be used as a standalone sleep intervention (Miller et al., 2014). CBT-I protocols can, however, be modified not to include sleep restriction therapy if it is not necessary (i.e., an individual has good sleep efficiency) or contraindicated (i.e., co-morbid unstable or untreated medical conditions or mental illness, or excessive daytime sleepiness; Royal Australian College of General Practitioners, 2014).

While there is currently no published literature on using CBT-I with athletes, a growing number of studies are exploring different sleep interventions in an elite athlete population. The literature review in Chapter 2 of this thesis provides a summary of this evidence. In a recent study, Vachon et al. (2023) conducted a sleep hygiene intervention with 11 under-21 elite male rugby union players. Their intervention combined athlete-specific sleep education, sleep hygiene strategies, and relaxation techniques over a four-week period.

Results indicated that there were small improvements in aspects of athletes' sleep quality (notably sleep efficiency and sleep latency) compared to baseline, but the sleep hygiene intervention did not improve sleep quantity.

Although sleep hygiene education is the most common sleep intervention used with athletes, sleep medicine researchers have argued that improving sleep hygiene on its own is an ineffective treatment for insomnia (Irish et al., 2015). Consequently, CBT-I is regarded as more effective when compared to sleep hygiene education (Chung et al., 2018). As athletes are known to experience sleep disturbance caused by anxiety and worry about upcoming competitions (Erlacher et al., 2011; Halson, 2022; Juliff et al., 2015), CBT-I may be helpful for athletes to address underlying anxiety that may impair their sleep quality and/or duration by identifying and challenging thoughts that accompany insomnia symptomology. CBT-I can also help improve sleep latency (i.e., time taken to fall asleep) through cognitive and behavioural strategies (van Straten et al., 2018), and athletes are known to experience difficulties falling asleep, potentially due to electronic device use prior to sleep (Jones et al., 2019). Using CBT-I with athletes would represent an advancement on previous sleep intervention research such as sleep hygiene strategies (e.g., Driller et al., 2019), and the combination of sleep hygiene, sport-specific sleep education, and relaxation techniques used by Vachon et al. (2023).

Therefore, the aim of the current study was to implement and evaluate the effectiveness of a pilot CBT-I intervention in improving sleep quality and duration in elite adolescent athletes. We hypothesised that the pilot CBT-I intervention will improve sleep quality (as measured by the Pittsburgh Sleep Quality Index) as our primary outcome measure. Additionally, we hypothesised that athlete sleep behaviours, daytime sleepiness, and athlete-specific psychological distress will improve due to the pilot CBT-I intervention with adolescent athletes.

5.2 Methodology

5.2.1 Study Design

A repeated measures within-subject design was used, where data was collected pre- and post- the 5-week CBT-I intervention. All participants received the CBT-I intervention that consisted of five, 30-minute sessions, delivered in a group setting. Pre-intervention, participants completed all questionnaires, demographic information, and were required to wear an actigraphy device for seven days and complete a sleep diary for each day during this time period. Post-intervention, participants completed all questionnaires, maintained a sleep diary for another period of seven days, and a subsample (n= 11) of participants completed a post-intervention evaluation. This manuscript has been prepared in accordance with the guidelines for reporting a clinical trial developed by Bandholm et al. (2022).

5.2.2 Participants

Participants were recruited from two, national-level indoor team sports academies based in Australia. Participants were eligible for inclusion in this study if they were: a) at least 16 years of age; and b) competing at Tier 3 (highly trained/National level) or higher (McKay et al., 2022). Exclusion criteria for this study were: a) currently pregnant; b) suffering from chronic or complex pain; c) suffering from a cognitive impairment, Autism-Spectrum Disorder, or other neurological disorder; or d) not fluent in English. At the time of the study, participants were out of the main competition phase of their sport(s), although a cohort were playing weekly games in a local competition. Participants had team training sessions and gym sessions in the afternoons, with no compulsory early morning training sessions beginning before 7am.

5.2.3 Procedure

Ethical approval was granted for this study from The University of Sydney Human Ethics Committee (no. 2024/HE000041; see Appendix O – ethics approval & Appendix P – ethics application). Due to the health outcomes (sleep quality, sleep duration, and athlete-specific psychological distress) associated with the study, the study was defined as a clinical trial by The University of Sydney Clinical Trials and Governance (see Appendix Q), sponsored by The University of Sydney, and registered with the Australia and New Zealand Clinical Trials Registry (ANZCTR) (Registration no. ACTRN12624000286549p; see Appendix R). As this study was defined as a clinical trial, we espoused expert recommendations (e.g., Feeley et al., 2009) that an intervention should be piloted first before it is used in a clinical trial to help assess the study's feasibility, identify potential problems within the study protocol, and refine the intervention and methodology. Consequently, we decided that this study would serve as a pilot CBT-I intervention study.

National Sporting Organisations and high-performance sporting academies were contacted directly by the research team to gauge their interest in their athletes participating in the study (see recruitment flyer at Appendix W). Organisational consent (see Appendix U) was obtained by the academies and National Sporting Organisations for their athletes to participate in this study. National Sporting Organisations and sporting academies distributed Participant Information Statements (see Appendix S) to their athletes, and collected written informed consent from each individual participant (see Appendix T) prior to the pilot intervention study commencing. Where a participant was under 18 years, parent/guardian informed consent was also obtained (see Appendix. V). Once organisational and participant consent was obtained, participants completed baseline measures (see Appendix Z), a demographics questionnaire (see Appendix AA), recorded their self-reported sleep information for the consecutive seven - days via a sleep diary and wore an actigraphy

device/wristwatch to objectively measure sleep. Baseline measures and demographics questionnaire took approximately 30 minutes to complete. There was no experimental manipulation of the athletes' training schedules or sleep/wake behaviour, and athletes were free to consume caffeine, training supplements, and/or alcohol during the study. Information regarding medication use, including sleeping medication and hormonal contraception (for female athletes), was collected.

Following the completion of the CBT-I intervention, participants re-completed sleep questionnaires and recorded their self-reported sleep information for the consecutive seven days via a sleep diary. Participants were invited to complete a post-intervention evaluation to share their views on the CBT-I intervention.

5.2.4 CBT-I intervention

The CBT-I intervention was adapted for use with adolescent athletes, with the sleep education module tailored to suit the athletes based on the importance of sleep for optimal athletic performance, physical and mental health, and recovery, from existing CBT-I protocols (e.g., Espie, 2022; Manber & Carney, 2015; Walker et al., 2022) by the first author (HdV), an endorsed sport and exercise psychologist who has completed training in CBT-I from Oxford University (see Appendix X) and the Australian Psychological Society/Australasian Sleep Association. The CBT-I intervention (i.e., sleep education module) was adapted for use with adolescent athletes to ensure that the content was relevant and appropriate for this cohort. The CBT-I intervention was conducted by the first author (HdV) online via Zoom, in a group setting with five 30-min sessions delivered on a weekly basis. To help with participant engagement, a coach from each team was present during each session, while HdV tried to promote engagement by regularly checking-in with the athletes and providing them opportunities to ask questions. This format for CBT-I is consistent with treatment guidelines (e.g., Mitchell et al., 2014; Sleep Health Foundation, 2025) and was

designed to adhere to the availability of the athletes to attend sessions based on their school and training schedules. The CBT-I intervention consisted of five modules that can help promote good sleep characteristics, including athlete-specific sleep education, sleep hygiene, sleep behavioural strategies (including stimulus control therapy/bed equals sleep therapy), cognitive strategies, and relaxation techniques. The final CBT-I pilot intervention protocol was refined after being initially pilot tested in August-September 2023 with a small cohort (n = 12) of male adolescent, team-sport athletes, to ensure the quality and relevancy of the content, and that the intervention sessions could be delivered within the time parameters available. No changes were necessary to the CBT-I intervention following this initial pilot testing. Based on this initial pilot testing of the intervention, and the sleep data collected in this study at baseline, sleep restriction therapy was not clinically indicated and thus was not included in the final CBT-I intervention protocol delivered to the participants. Due to time constraints of the study (training and schooling schedules), the intervention was delivered as 3 x 30-minute sessions plus 1 x 60-minute session over a four-week period.

Due to participants' training schedules, the intervention was delivered to individual teams, where participants trained together. On average, 6-10 participants attended each session and had at least one coach present during the sessions. Due to scheduling changes, for one session male and female athletes were combined. A second member of the research team was present during all online intervention sessions to comply with clinical trial governance and ensure that if any athletes experienced emotional distress during a session, they could be appropriately supported immediately during the session if required. No athletes experienced emotional distress and thus no additional support was required during the intervention. An overview of the intended experimental design is presented below in **Error! Reference source not found.**. A copy of the CBT-I intervention protocol can be found at Appendix Y.

Table 5-1CBT-I intervention study design

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Baseline questionnaire data collection Commencement of sleep monitoring with actigraphy and sleep diary Explanation of CBT-I intervention	**Session 1:** Sleep education What is sleep? Function and purpose of sleep Why sleep is so important for athletes/performance	**Session 2:** Sleep hygiene and environment Light Temperature Noise Bedroom environment	**Session 3:** Behavioural strategies Pre-bed routine Consistent sleep/wake schedule Stimulus control 'Dump pad'	**Session 4:** Cognitive strategies Journalling Worry time Performing after a bad night sleep Cognitive restructuring Acceptance Paradoxical Intention	**Session 5:** Relaxation techniques Progressive muscle relaxation Autogenic training Deep breathing Guided imagery Mindfulness / meditation	Post-intervention questionnaire data collection Commencement of sleep monitoring with actigraphy and sleep diary*

* was intended to be conducted as part of the study, but was not possible to non-compliance and scheduling issues

5.2.5 Material

5.2.5.1 Actigraphy devices

Objective sleep data was captured via GeneActiv wrist-worn actigraphy devices (GeneActiv 1.2, ActivInsights). The devices capture light and movement. Participants were instructed that the actigraphy devices were being used to measure their sleep for the sole purpose of the current research study, and to wear the devices for 24 hours a day over a 7-day period, and to only take them off for training sessions (and record these times). The data collected from the actigraphy devices at baseline was explored in this study to be reported as baseline characteristics and then was excluded from this study due to non-compliance by inconsistent wearing of the actigraphy device during the seven-day period at baseline. Due to non-compliance at baseline, the participants did not wear the actigraphy devices following completion of the intervention due to this non-compliance. In addition, the athletes were returning home from the national sporting academy during the summer school period and it was not feasible to use the actigraphy devices post-intervention with the athletes before they departed the national sporting academy.

5.2.5.2 Sleep Diary

Self-reported sleep information was collected via sleep diaries over consecutive seven days. The sleep diary used in this study has previously been used in athletes (e.g., Sargent et al., 2021). Participants recorded their subjective sleep data via a pen and paper and were instructed to complete their sleep diary each morning after waking and each evening before bed. Bedtime (start) was recorded as the time the participants attempted sleeping, and get-up time (end) was recorded as the time the participants stopped attempted sleeping. Daytime naps were not recorded. The sleep diary also captured daily caffeine consumption and device use (phone/laptop computer) and length of time of device use in bed before sleep. Pre-sleep

and post-sleep fatigue levels were assessed via a 7-point Likert scale (i.e., 1 = fully alert/wide awake, 7 = completely exhausted, unable to function effectively). Daily subjective sleep quality was assessed via a 5-point Likert scale (i.e., 5 = very good, 4 = good, 3 = average, 2 = poor, 1 = very poor).

5.2.5.3 Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a validated and widely used self-rated 19-item questionnaire that assesses sleep quality at a single time point where individuals recall their sleep quality over the preceding one-month period (Buysse et al., 1989). The PSQI has been regularly used to assess sleep quality in athletes (e.g., Halson, Johnston, et al., 2022) and was implemented in this study. The PSQI has seven subscales assessing sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, medication, and daytime disturbances, on a 4-point Likert scale (i.e., 0 = not during the past month, 1 = less than once a week, 2 = once or twice a week, 3 = three or more times a week). All scores are summed to yield a global score of sleep quality ranging from 0-21, with higher scores indicating poorer sleep quality. A published cut-off global score of ≥5 has been suggested to indicate poor sleep (Buysse et al., 1989), which has been utilised in elite/pre-elite Australian athletes (e.g., Drew et al., 2018; Halson, Johnston, et al., 2022). The PSQI has good validity and internal reliability, with a published Cronbach's alpha of 0.83 (Buysse et al., 1989; Smyth, 2012).

5.2.5.4 Athlete Sleep Behaviour Questionnaire (ASBQ)

The ASBQ is an 18-item self-report screening tool that measures maladaptive sleep behaviours in elite athletes (Driller et al., 2018). Each question is self-rated on a 5-point Likert scale of frequency of engaging in specific behaviours (1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, 5 = always), and scores are summed to provide a global score. Driller et al. (2018) suggest that a global score of ≤36 is considered good sleep hygiene and

≥42 is considered poor sleep hygiene. The ASBQ has good internal consistency as measured by Cronbach's alpha (0.73; Driller et al., 2018) and very good test-retest reliability (ICC = 0.88), suggesting that the ASBQ can be used for monitoring and assessing changes in athletes' sleep behaviour over time (Trabelsi et al., 2024).

5.2.5.5 Epworth Sleepiness Scale (ESS)

The ESS is an 8-item self-report questionnaire that assesses daytime sleepiness, an indicator of poor sleep quality (Johns, 1991). The ESS has been previously used in sleep intervention studies with athletes (e.g., Driller et al., 2019). Each question is self-rated on a 3-point Likert scale of frequency of dozing in a particular situation (0 = no chance of dozing, 1 = slight chance of dozing, 2 = moderate chance of dozing, 3 = high chance of dozing). Scores are summed to provide a global score, with higher scores (16-24) indicating excessive daytime sleepiness. The ESS has a high internal consistency as measured by Cronbach's alpha (0.88; Johns, 1991).

5.2.5.6 Athlete Psychological Strain Questionnaire (APSQ)

The APSQ is a brief, 10-item self-report screening tool for elite athlete's mental health (Rice, Parker et al., 2020). Similar to the K10 (Kessler et al., 2002) which is used to assess psychological distress in the general population; the APSQ was developed specifically to screen sport-related psychological distress in elite athletes. The ASPQ was originally validated with Australian elite male athletes (Rice, Parker et al., 2020). It has now been validated with elite female athletes (Rice, Olive et al., 2020) and was recently was validated with non-elite amateur athletes (Shannon et al., 2024). The APSQ has three subscales: self-regulation, performance, and external coping, as well as a total score. Questions are self-rated on a 5-point Likert scale over the past four weeks (1 = none of the time, 2 = a little of the time, 3 = some of the time, 4 = most of the time, 5 = all of the time). The APSQ total sum of

scores ranges from 10-50, with a score ≥17 indicating an elevated risk for psychological distress (Rice, Parker et al., 2020). The APSQ has high internal consistency as measured by Conbach's alpha for male (0.87) and female (0.84) athletes (Rice, Olive et al., 2020).

5.2.5.7 Post-intervention evaluation form

A 10-question study-specific post-intervention evaluation form was designed to capture participant perspectives on the usefulness of the CBT-I intervention. Wolf (1978) contended that social validation is a measure of social importance and is comprised of three components: social significance of the goals, social appropriateness of the procedures, and social importance of the effects. Based on Wolf (1978) and recommendations from Page and Thelwell (2013), the evaluation form developed included three questions that captured how interesting, helpful, and relevant the intervention was, using a 5-point Likert scale (i.e., 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Additional questions asked participants about which specific aspect(s) of the intervention they found most and least helpful, and what would have improved the intervention to make it more helpful. Participants were also asked about their main learning(s) from the intervention, which strategies they had implemented and how frequently. Last, participants were able to add further comments about each of the evaluation items as well as any general comments they wished to provide.

5.2.5.8 Demographics questionnaire

The demographic information captured for this study included participants' age, sex, gender, sporting competition, sporting history, and health status (i.e., injury or illness in preceding 12 months). A copy of the demographic questionnaire can be found in Appendix AA.

5.2.6 Data Analysis

Descriptive statistics were used to report participant demographics (i.e., age, sex, sport). Outcome scores were reported using mean ± standard deviation. Outliers in the dataset were checked using boxplots and quantile-quantile plots, with no outliers found. Shapiro-Wilk's test was used to assess the normality of the data, with all variables found to be normally distributed ($p > 0.05$). Paired t-tests were used to compare total scores of the pre and post measures, differences between sub-scale items not assessed to avoid risk of multiplicity. All statistical analyses were performed in Stata (Stata/BE 18.0, StataCorp, USA).

5.3 Results

5.3.1 Baseline

Twenty-eight athletes (n = 16 female, n = 12 male) participated in this pilot CBT-I intervention. Athletes were aged 16-19 years (mean age = 17.64 ± 0.95 years) and participated in two indoor team sports. Most athletes (79%) identified their ethnicity as Australian, and all athletes (except one who chose not to answer) identified as heterosexual. All athletes in this study identified their gender as being consistent with their sex recorded at birth (cisgender) and described themselves as a man or woman, respectively. Three out of five athletes (64.29%) had been playing their sport for five years or more, with the rest (35.71%) playing their sport for less than five years. Almost two-thirds (64.29%) of athletes reported experiencing an injury or illness (physical or mental) in the past 12 months. Three athletes (10.71%) reported taking a sleeping supplement or prescribed sleep medication at least once a week, and four of the 16 females (25%) reported that they were taking a hormonal contraception.

Athletes self-reported on the PSQI an average sleep duration of 7.59 hours per night (SD = 0.78) and spent an average of 8.19 hours in bed per night (SD = 0.80). Athletes

reported high sleep efficiency (i.e., time in bed that is spent asleep), with an average of 92.89%, and only one athlete reported a sleep efficiency lower than the clinical goal of 85%. Athletes reported relatively good subjective sleep quality (m = 1.14), and low daytime dysfunction (m = 1). Although the cohort overall reported good sleep duration and sleep efficiency, at baseline, 18 out of the 28 athletes (64.3%) reported a global sleep quality score on the PSQI of ≥5, indicative of poor sleep quality. At baseline, athletes self-reported on their sleep diaries an average of 8.48 hours of sleep per night (SD = 1.16).

Seven athletes (25%) reported good sleep behaviour (≤36) as assessed by the ASBQ, while 14 (50%) athletes reported poor sleep behaviour (≥42). At an item-level, athletes reported frequently using light-emitting technology (including phone, laptop, television, video games) in the hour preceding bedtime (m = 4.04), while on average athletes would sometimes lay in bed thinking, planning, and worrying about their sporting performance (m = 3.21) and/or issues not related to their sport (m = 3.00). Athletes also reported on average going to bed with sore muscles some of the time (m = 3.39). No other question on the ABSQ had a mean response above 3. Table **5-2** details the participant characteristics and baseline sleep measures.

Table 5-2 Participant characteristics and baseline data

	Male (n = 12)	Female (n = 16)	Total (n= 28)
Age (years)	17.50 (1.09)	17.75 (0.86)	17.64 (0.95)
Injury/illness in past 12 months (%)	25	39.29	64.29
Bed time	22:42 (1.17)	22:44 (1.19)	22:43 (1.18)
Wake time	07:09 (1.24)	06:43 (1.31)	06:54 (1.27)
Total sleep time (hours)	7.58 (0.67)	7.59 (0.88)	7.59 (0.78)
Time in bed (hours)	8.48 (0.56)	8.03 (0.87)	8.22 (0.77)
Sleep efficiency (%)	89.49 (6.08)	94.54 (4.51)	92.38 (5.73)
PSQI			
PSQI total	4.33 (1.72)	5.75 (2.14)	5.14 (2.07)
Component scores			
Sleep quality	1 (0.43)	1.25 (0.77)	1.14 (0.65)
Sleep latency	1.08 (0.69)	1.44 (0.81)	1.29 (0.65)
Sleep duration	0.25 (0.45)	0.25 (0.58)	0.25 (0.52)
Sleep efficiency	0.17 (0.39)	0 (0)	0.07 (0.26)
Sleep disturbances	0.92 (0.29)	1.13 (0.34)	1.04 (0.33)
Sleep medication	0.17 (0.58)	0.50 (0.89)	0.36 (0.78)
Daytime dysfunction	0.75 (0.45)	1.9 (0.54)	1.00 (0.54)
ASBQ			
ASBQ total	37.92 (6.64)	41.94 (6.98)	40.21 (7.01)

ESS			
ESS total	7.92 (4.52)	7.63 (4.97)	7.75 (4.70)
APSQ			
APSQ total	18.08 (3.87)	21.13 (3.74)	19.78 (3.96)
APSQ subscale scores			
Self-regulation difficulties	7.75 (1.60)	9.8 (2.11)	8.90 (2.10)
Performance concerns	8.17 (2.82)	9.07(2.46)	8.67 (2.57)
Externalised coping	2.17 (0.58)	2.27 (0.59)	2.22 (0.57)

Athletes reported an average daytime sleepiness score of 7.75 as assessed by the ESS, suggesting low/average daytime sleepiness, with one athlete reporting high daytime sleepiness (≥16). Based on the published cut-off scores (Rice, Parker et al., 2020), athletes reported high psychological distress on the APSQ, with a mean score of 19.71 (17-19 = high; 20+ = very high) . Self-regulation difficulties (m = 9.18) and performance concerns (m = 8.64) were the main contributing subscales to overall athlete psychological strain.

5.3.2 Post-intervention analysis

At post-intervention data collection, 24 of the 28 athletes in the sample completed all the post-intervention self-report questionnaires and were included in the final analysis. Athletes reported on their sleep diaries an average of 9.10 hours per night of sleep (SD = 1.19). Due to a significant amount of missing data (~ 30%) on the post-intervention sleep diaries, this information was not analysed for significance. Due to the small sample size in this pilot intervention study, the post-intervention analysis only focused on the main outcome variables of the sleep measures - i.e. global PSQI score, ASBQ score, ESS score, total APSQ score. The primary outcome measures between baseline and post-intervention were comparable, with no significant findings observed (Table 5-3). Figure 5-1 and Figure 5-2 display total PSQI scores for athletes, separated by sex, between baseline and post-intervention. Figure 5-3 and Figure 5-4 display total ASBQ and APSQ scores between baseline and post-intervention.

Table 5-3 Pre- and post-intervention scores on PSQI, ASBQ, ESS, and APSQ

	Pre-Intervention Mean (SD)	Post-intervention Mean (SD)	t-score 95% CI
PSQI (total)	4.79 ± (1.99)	4.63 ± (1.53)	-0.53 (p = 0.60)
ASBQ	39.61 ± (6.69)	39.20 ± (6.03)	-0.32 (p = 0.75)
ESS	7.13 ± (4.50)	8.26 ± (3.92)	1.28 (p = 0.22)
APSQ - total	19.25 ± (3.93)	18.79 ± (4.31)	-0.41 (p = 0.69)

Note. A total of 24 athletes were included in the pre- and post-intervention comparison analysis. ASBQ = Athlete Sleep Behaviour Questionnaire, ESS = Epworth Sleepiness Scale, APSQ = Athlete Psychological Strain Questionnaire

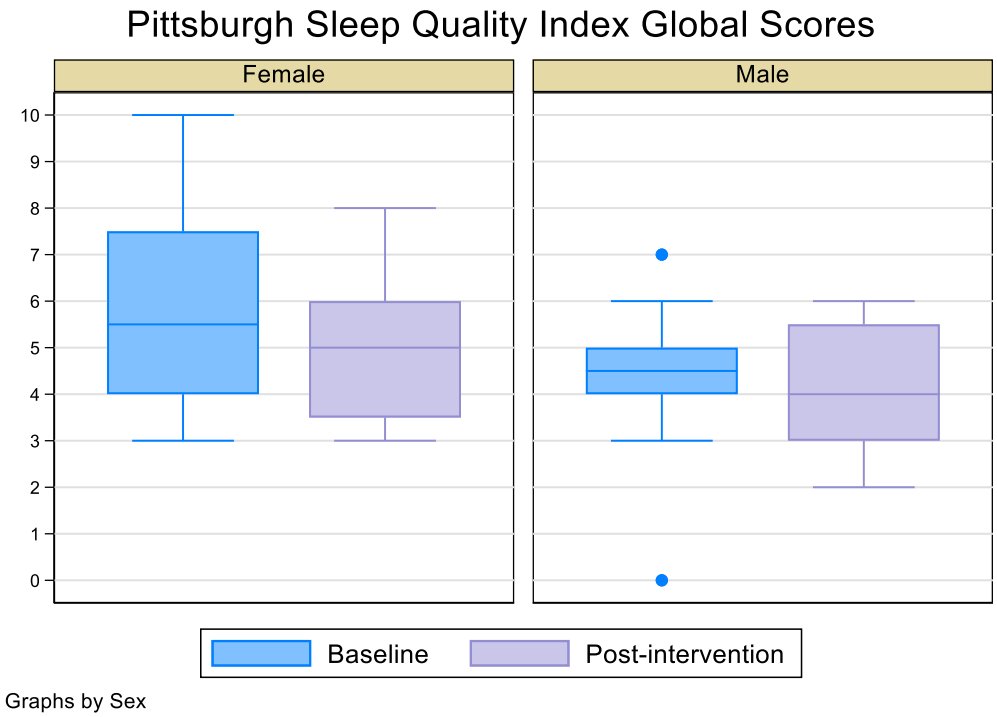

Figure 5-1 Comparison of PSQI scores between male and female athletes

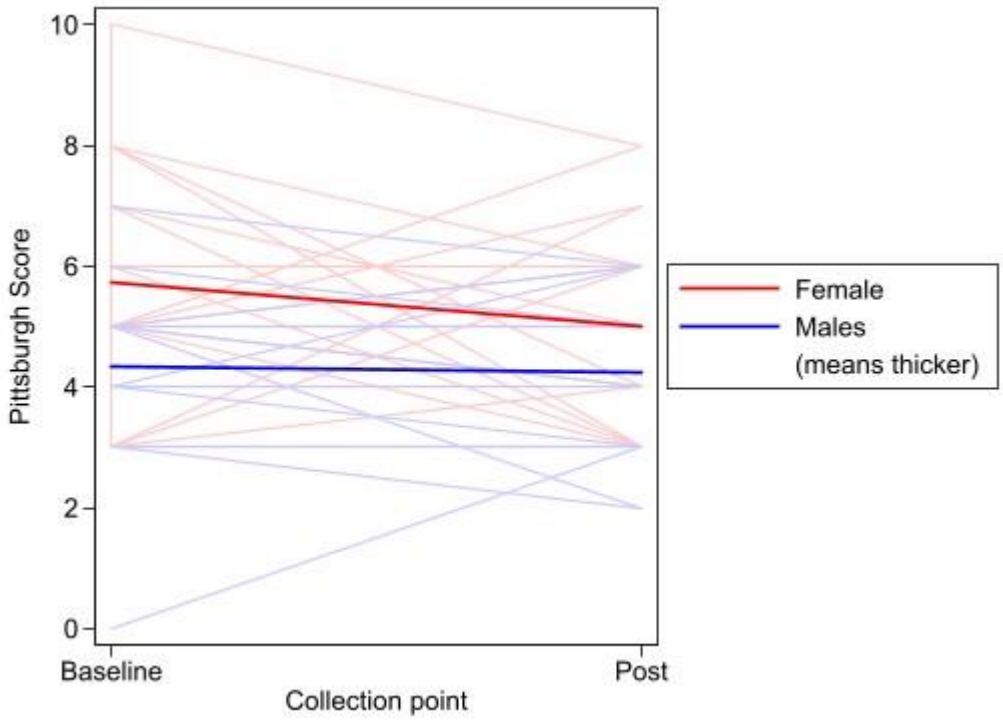

Figure 5-2 Spaghetti plot of male and female PSQI scores from pre- to post-intervention

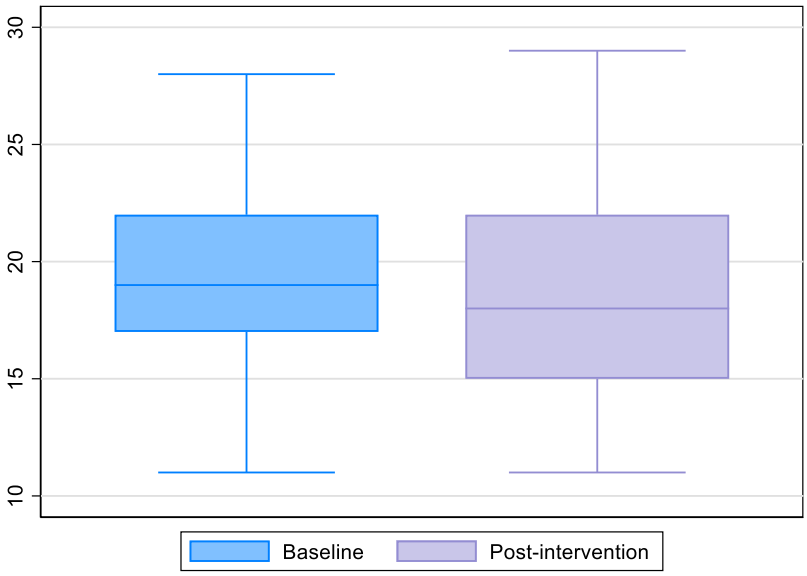

Figure 5-3. Comparison of ASBQ scores pre- and post-intervention.

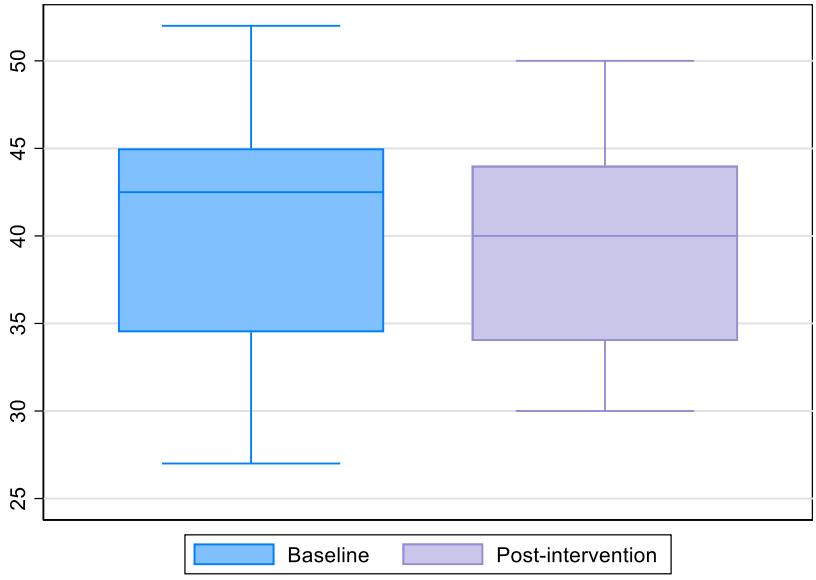

Figure 5-4 Comparison of APSQ scores pre- and post-intervention.

5.3.3 Post-intervention evaluation

At the completion of the CBT-I intervention all adolescent athletes were invited to complete an evaluation form, with a subset of athletes (n = 11) completing the evaluation. Athletes reported an average of 3.1 out of 5 for the intervention content being interesting, 3.4 out of 5 for the content being helpful to them, and 3.73 out of 5 for the content being relevant. Sleep environment information and strategies, and cognitive therapy techniques, were regarded as the most helpful aspects of the intervention, followed by behavioural strategies. Athletes also expressed that the sleep education specifically regarding napping that was provided was helpful. Sleep education was regarded as the least helpful aspect of the intervention. Six athletes reported that they had tried the sleep environment strategies, while five athletes reported trying cognitive techniques and four athletes had tried behavioural strategies. Four athletes reported they had implemented strategies 1-2 times per week, the most frequent implementation, with three athletes implementing strategies 3-5 times per week and two athletes reporting they had implemented strategies daily. Two athletes had rarely, if at all, implemented any sleep strategies.

Athletes had the opportunity to express the main learnings that they had from the intervention. One athlete stated, “for optimal sleep, both your sleep environment and your pre-sleep habits, such as what you consume, play a crucial role in the quality of sleep you have.” Another athlete found the sport-specific aspects of the intervention helpful, noting that their main learning was sleep consistency and that “you can still function and perform [well] after one night of bad sleep.” Athletes appeared to find the cognitive techniques beneficial, with one athlete noting that their main learning was “positive ways to think about sleep/not being able to sleep”. Additionally, athletes found the multifaceted approach of CBT-I to be useful, as demonstrated by one athlete who shared their learnings, stating “don't watch the clock. If you can't fall asleep get

out of bed/out of room and do something relaxing/boring until you feel tired. Trying to only use your bed/room for sleep. Use a dump pad [notepad next to bed].” The benefits of the multifaceted approach were also emphasised by another athlete:

> I have implemented a better routine which includes cooling myself and my room down before sleep and a brain dump to help fall asleep quicker. I found that before, I would be kept awake due to overthinking and stress, but the brain dump [notepad next to bed] is a good strategy to clear my mind.

Athletes reported that the intervention could be improved by being more interactive and increasing engagement, such as with quizzes to test their understanding or participating in activities during the sessions. Athletes felt that delivering the sessions in-person would have helped improve the engagement and increase interactions. Some athletes also felt that the content was repetitive from prior sleep education they had received.

5.4 Discussion

This pilot study was the first known to implement and evaluate the effectiveness of a pilot CBT-I intervention in improving sleep quality and duration in elite adolescent athletes. Overall, the study’s results showed no significant effect between pre- and post-intervention in self-report sleep measures across our primary and secondary outcome variables. We expected that the CBT-I intervention would improve sleep quality as measured by the Pittsburgh Sleep Quality Index, the primary outcome in this study. We also expected that the CBT-I intervention would improve sleep duration, athlete sleep behaviour, daytime sleepiness, and athlete specific psychological strain reported by self-report questionnaires by the adolescent athletes. It is plausible that lack of significant findings in the self-report measures may not have been observed

in the objective sleep variables if this study did not encounter non-compliance to the actigraphy, as it is known that objective rather than self-report sleep data is more accurate (Halson, 2019).

The efficacy of CBT-I in the general population has been shown in more than 30 meta-analyses, including with adolescents (e.g., Blake et al., 2017). Our pilot intervention study, however, failed to support the efficacy of CBT-I in adolescent athletes. There are several potential reasons for this lack of statistically significant findings, including: the adolescent athletes reporting generally good sleep characteristics, highlighted by good sleep durations and sleep quality; environmental factors (e.g., no early morning training sessions); study duration; lack of secondary follow-up; athlete population differences to the general population; previously received sleep education; and, non-compliance to the actigraphy. This study duration of 5-weeks that the study was completed may have not allowed sufficient time for the effectiveness of the CBT-I intervention to become clinically and statistically significant. Mitchell et al. (2012) noted that a downside of CBT-I is that improvements from CBT-I are typically not seen until 3-4 weeks into treatment. As the CBT-I intervention in this study had to be condensed due to scheduling constraints and the post-intervention data was collected 4-5 weeks from commencement of the intervention, and it was not possible to conduct secondary follow-up post-intervention measures (e.g., 12 weeks after completion of intervention), it is likely that this may have contributed to the study's overall lack of impact on sleep outcome variables. Additionally, the PSQI asks individuals about their sleep over the previous 4 weeks, so this may also have been a factor, both from a timing perspective with the post-intervention data collection and also a possible recall bias, such as the adolescent athletes being unable to recall aspects of their sleep accurately.

The adolescent athletes in this study generally self-reported good sleep characteristics, with most attaining adequate sleep duration and quality, which may have also contributed to the lack of statistically significant findings These sleep characteristics may have been further enhanced by a supportive sporting environment that provided sufficient opportunities for athletes to attain adequate sleep, as demonstrated by most team training and gym sessions occurring in the afternoons and no morning training sessions commencing before 7am at the earliest. Despite these sleep characteristics, the adolescent athletes in this study did self-report high rates of poor sleep quality as measured by the global scores on the PSQI. The timing of the CBT-I intervention in this study was not during periods of high stress, such as competition, school term, or exam period for those school-aged athletes. The lack of sporting competition during this study may have meant that athletes experienced less stress and anxiety compared to if it had been during the competition season, which may have helped them attain greater sleep duration and quality. Additionally, no sporting competition may have meant less physical and mental fatigue, and less travel, which are factors that can disrupt athletes' sleep. This high baseline of good sleep data would have made it more challenging for CBT-I to be demonstrated to be effective, as although CBT-I can improve sleep for people who have difficulties with sleep but who do not have insomnia (Sleep Health Foundation, 2025), it is not designed to enhance already good sleep. Typically, CBT-I is used with people who are suffering from insomnia or insomnia symptoms, which the adolescent athletes in this study generally did not appear to suffer from. Therefore, the CBT-I intervention may not have been appropriate for this cohort, and the findings from this pilot study identify further areas of refinement for the intervention. This refinement could include pre-screening prior to the intervention, to identify those athletes with identifiable sleep disturbances and/or insomnia symptoms who are likely to be suitable for the

CBT-I intervention, and those athletes identified as 'good sleepers' (i.e., good sleep characteristics such as sleep quality and adequate sleep duration) who may benefit from athlete-specific sleep education but require no further intervention. This screening process could involve using the Athlete Sleep Screening Questionnaire (Bender et al., 2018), a validated athlete-specific sleep questionnaire designed to screen athletes who have clinically significant sleep problems (such as insomnia). The timing of the CBT-I intervention also warrants further refinement, as it may be more effective during competition when athletes may experience heightened stress and anxiety, and are more vulnerable to sleep disturbances.

Additionally, some of the athletes in this study who completed the post-intervention evaluation reported having previously received education about sleep. This prior knowledge and learning in participant in sleep education may have contributed to the athletes already possessing knowledge and skills about sleep that may have helped them to improve their sleep before participating in this study, supporting this study being good sleepers at the start of this study and reduced the potential effectiveness of the CBT-I intervention. Given the high rates of poor sleep quality as measured by the PSQI in this study, future research and exploration of individual cases may provide refinement for the intervention.

We had hypothesised that the CBT-I intervention would also help to improve athletes' mental health as measured by the Athlete Psychological Strain Questionnaire. Consistent with other findings, however, there was no statistically significant difference observed between the baseline and post-intervention measures. The timing of the intervention is likely to have contributed to the lack of significant findings, with the intervention taking place outside of the competition season. Consequently, the adolescent athletes may have been less stressed,

especially in relation to their performances, compared to if the intervention had been conducted during the competition season.

To understand the lack of statistically significant findings in this study, and explore how future implement of CBT-I in athletes could be improved, evidence was recorded from a subsample of athletes who completed a post-intervention evaluation. Encouraging responses on the value of CBT-I intervention from these athletes were generally reported and they found the multifaceted aspects of the CBT-I intervention to be beneficial. Due to the small subset (n=11 of 28) of athletes who completed the post-intervention evaluation, however, the ratings were more susceptible to volatility from high and low ratings. Specifically, one athlete provided very low ratings for the content of the intervention, which reduced the overall mean ratings for the content being interesting, helpful, and relevant. Despite this low rating, these athletes self-reported that they had noticed some positive improvements in relation to aspects of their sleep, such as developing strategies if they could not get to sleep (e.g., journalling or using a 'dump pad' to write down their thoughts/worries) and they were developing more effective routines for falling asleep. Athletes also reported finding the cognitive techniques helpful, especially for reducing worry and anxiety about not sleeping well and how this could impact their performance. This positive feedback from athletes is encouraging to the value of CBT-I in athletes, and the suggestions from this study enable further refinement of the CBT-I athlete intervention to optimise the CBT-I intervention, such as making it more interactive and engaging, warrant consideration to then be scaled across different athlete cohorts.

There are several limitations in the current study that must be acknowledged. First, the lack of objective sleep data recorded via actigraphy is acknowledged as a major limitation, and the reliance on self-reported sleep data limits the applicability of the findings in this study. The

clinical trial protocol outlined that actigraphy data was to be collected pre- and post-intervention, however, due to participant non-compliance it was not possible to collect or use actigraphy data in this study. The lack of objective sleep data capture via actigraphy meant that it was not possible to accurately quantitatively capture daytime napping, an important indicator of daytime sleepiness and athlete recovery. This non-compliance of the actigraphy is a limitation in this study and may reflect participants' concerns that their sleep data would be used outside of this project (e.g., shared with team coaches), not understanding the actigraphy protocol, not being interested in how the CBT-I intervention might help them, or forgetfulness due to balancing demands of sport and school. Adolescents also experience a sleep phenomenon known as 'shift phase delay', which is a naturally occurring biological shift in the sleep/wake patterns of adolescents that causes them to fall asleep later and wake later. In this adolescent athlete sample, we did not allow for this shift phase delay in this study with either the sleep education provided to athletes nor in the data collection, although the actigraphy devices would have enabled these sleep patterns to have been captured objectively. It is highly plausible that the reliance on subjective data in the current study contributed to the lack of significant findings, especially considering that CBT-I is effective in adolescence general population (Blake et al., 2017), as this subjective self-reported data may not have been sensitive enough to detect potential changes in sleep quality and duration in this cohort of typically good sleepers.

Second, the lack of a control group limits the comparison between athletes exposed to CBT-I compared to athletes not exposed. With no control group, it is not possible to determine how effective CBT-I may be compared to no sleep intervention. The CBT-I intervention had to be delivered online via Zoom to improve feasibility of delivering this program to athletes anywhere in Australia. Although CBT-I can be delivered effectively online, it did make

participant engagement in our study more challenging, and this may have limited its effectiveness, especially in a cohort of adolescent athletes. Additionally, the attendance in each session from coaches may have impacted on athletes' engagement, with athletes potentially reluctant to ask questions and/or share personal stories in front of their coach. The schedule of delivery for sessions necessitated that one session involved combining male and female athletes together, and this may have also impacted on athletes' engagement due to a larger group attending the session. Recent evidence has indicated that CBT-I delivered via telehealth does not meaningfully differ from CBT-I delivered in-person (Arnedt et al., 2020; Muench et al., 2022), although this evidence is based on individual delivery of CBT-I, as opposed to group-based sessions as utilised in the current study. Potentially, group-based CBT-I delivered via telehealth may be less effective than in-person group-based sessions, although research would need to test this speculation.

We chose the PSQI as sleep quality was our primary outcome for this particular study, and we believe that the PSQI is the most appropriate sleep questionnaire to assess for sleep quality. The PSQI is also widely used in athlete sleep research (e.g., Halson, Johnston et al., 2022). Daytime sleepiness is an indicator of poor sleep quality and/or inadequate sleep quantity, and may lead to daytime napping (Sleep Health Foundation, 2024). This study used the Epworth Sleepiness Scale to measure daytime sleepiness. However, neither the PSQI nor ESS have been validated in an elite athlete population, and we echo the view of Driller et al. (2019) and acknowledge that these questionnaires may not be sensitive enough in detecting changes from a sleep intervention in such a unique population compared to the general population. We included the ASBQ and APSQ as athlete-specific measures alongside these questionnaires to help mitigate this potential limitation, however, no changes in sleep were seen in any of these measures. We

would encourage future sleep intervention research with athletes to consider using the Athlete Sleep Screening Questionnaire to determine athletes who may benefit from preventative measures such as sleep education, and those athletes who suffer from clinically significant sleep problems and require clinical intervention. Further research on sleep interventions such as CBT-I with elite athletes may wish to consider measuring daytime napping (ideally via actigraphy devices and/or sleep diaries) to help capture a more detailed oversight of athletes' sleep quality and/or quantity. Capturing data on napping is particularly pertinent to elite athletes as napping is a recommended recovery strategy (Yu et al., 2025).

Future research should look to refine this clinical trial protocol before employing a randomised clinical trial CBT-I with athletes. A randomised clinical trial study would be beneficial to allow comparison between athletes exposed to CBT-I with those not exposed. As this study was conducted with adolescent athletes, future research with CBT-I with adult athletes would be beneficial, and especially with adult athletes from different sports (e.g., individual sports), competitions, and cultures. Exploring the timing of the intervention would also be worthwhile, as CBT-I may be more effective for athletes during periods of heightened stress (e.g., competition season). Trialling CBT-I in face-to-face sessions would be beneficial, and research may also look to explore differences in delivering CBT-I in group versus individual settings. Post-intervention follow-up testing (e.g., three months post-intervention) would also be useful and would enable researchers to determine the effectiveness of CBT-I over time in improving athletes' sleep. Additionally, future research should examine the content in CBT-I to determine what is effective for athletes, and it may be helpful to engage with athletes and other personnel in the sporting ecosystem (e.g., coaches, support staff) to work collaboratively in designing an intervention tailored to the demands that athletes encounter.

5.4.1 Conclusion

The effectiveness of a pilot CBT-I intervention in improving sleep quality as our primary outcome in elite adolescent athletes, to our knowledge the first pilot study that has used a CBT-I intervention with athletes, was not effective in this study based on subjective sleep outcome findings. This study's lack of impact on sleep was in contrast to what is observed when implemented in the general population and did not support our hypothesis that significant improvements in athletes' sleep quality from pre- to post-intervention would be observed. For the secondary outcomes of sleep duration, athlete sleep behaviour, daytime sleepiness, and athlete psychological strain, we also found no significant improvements pre- to post-intervention. The post-evaluation feedback provided encouraging responses about the usefulness of this CBT-I intervention and athletes reported helpful strategies to manage aspects of their sleep. Further, they generally reported themselves as good sleepers as thus this intervention may have had no/minimal impact. We would encourage further research to explore CBT-I in a large athlete cohort as a viable sleep intervention to help manage and improve athletes' sleep quality and/or duration.

Chapter 6 Discussion

6.1 Overview

There were two overarching aims of this PhD thesis. The first aim (Aim 1) was to explore the relationship between mental health and sleep in Australian elite athletes. Informed by the findings of Aim 1 (i.e., Study 1 and 2), an intervention was identified that aimed at improving athlete's sleep and/or mental health (i.e., Aim 2). Thus, the second aim (Aim 2) was to design, implement, and evaluate the effectiveness of a pilot CBT-I intervention aimed at improving athlete's sleep. The rationale for exploring the relationship between mental health and sleep in Australian elite athletes was that: 1) mental health and sleep in elite athletes have increasingly, but separately, been studied in sport psychology research over the past 15 years; 2) mental health and sleep both have implications for athletic performance, physical health, and recovery; 3) mental health and sleep have an established strong and bi-directional relationship in the general population; and 4) limited research has examined mental health and sleep together in elite athletes.

The rationale for Aim 2 of this thesis was informed by: 1) elite athletes report significant rates of poor sleep quality (Halson, Johnston, et al., 2022) and inadequate sleep duration (Sargent et al., 2021); 2) Study 1 (Chapter 3) demonstrated an association between mental illness and symptoms and poor sleep quality in elite/pre-elite Australian athletes; 3) CBT-I is the gold-standard psychological intervention for treating insomnia and sleep disturbances (Muench et al., 2022; Newsom, 2024); 4) to date, CBT-I has not been trialled as an intervention with elite athletes; and 5) the findings in Study 2 (Chapter 4) informed the decision to adopt CBT-I as the intervention. Reflexive thematic analysis of the focus groups with athletes, coaches, and support staff generated a theme on what support exists for athletes in the Australian high-performance

sporting ecosystem. This theme revealed their views and experiences that good support structures exist now to support athletes' mental health, while sleep can be overlooked. Thus, it was concluded that sleep was a perceived priority for intervention within this thesis. Further, CBT-I was chosen as the sleep intervention as it equips athletes with skills and tools that they can use within their sporting environments and is based on principles of Cognitive Behavioural Therapy that athletes are likely familiar with from traditional sport psychology interventions to enhance performance.

6.2 Summary of Findings

Using previously collected data on mental health and sleep in elite/pre-elite Australian athletes, the cross-sectional study in Study 1 (Chapter 3) sought to establish the point prevalence of mental illness in elite/pre-elite Australian athletes using a diagnostic interview (related to Aim 1). This study found a lifetime prevalence of mental illness of 11.7% of athletes who met at least one diagnostic criteria for a mental illness. Study 1 found that one in five athletes reported subthreshold mental illness symptoms (i.e., not enough symptoms present to meet diagnostic criteria). The point prevalence of mental illness found in this athlete cohort was lower than what has been indicated in previous meta-analytic research (Gouttebarge et al., 2019). Diagnostic interviews, however, have greater specificity compared to self-report measures such as questionnaires that have been routinely used in mental health research with elite athletes. Consequently, diagnostic interviews are likely to find lower prevalence of mental illness (Gulliver et al., 2015), and it is unsurprising that Study 1 had a lower point prevalence of mental than previous meta-analytic research by Gouttebarge et al. (2019). The prevalence of mental illness subthreshold symptoms found in Study 1 is consistent with previous research, indicating that elite athletes experience significant incidence of subthreshold symptoms (i.e., 20% or higher

of athletes; Gouttebarge et al., 2019), even if they do not meet diagnostic criteria. It has been argued by Schinke et al. (2017) that subthreshold symptoms of mental health can be problematic for athletes and can detrimentally impact athletic performance, as well as potentially lead to the development of diagnosable mental illness(es) if left untreated. Therefore, regular screening of athletes' mental health should be adopted by all sporting organisations to monitor for subthreshold symptoms and ensure that athletes who are reporting subthreshold symptoms can receive appropriate intervention and treatment. Such an approach of early detection and intervention could potentially help alleviate the number of athletes who develop diagnosable mental illness(es).

A notable finding from Study 1 was that athletes who reported either subthreshold symptoms or a clinical diagnosis for at least one mental illness had twice the odds of reporting poor sleep quality compared to athletes who reported <50% of symptoms (related to Aim 1). Research has demonstrated that a strong, bi-directional relationship between mental health and sleep exists in the general population, with sleep disturbance associated with almost every known mental illness (Asplund & Chang, 2020). Study 1 addressed an identified research gap, by assessing mental health via diagnostic interview and comparing that to sleep quality, captured via self-reported questionnaire. Consequently, this study makes a novel contribution to the existing literature by being one of the first studies to demonstrate an association between mental health and sleep quality in elite athletes. While no casual inferences can be drawn from the findings in Study 1 due to the cross-sectional study design, the evidence of an association between mental health and sleep quality in elite athletes is noteworthy for practitioners (e.g., sport psychologists) working in high-performance sport, as both mental health and sleep quality have implications for athletes related to performance and overall health.

Building on the findings from Study 1 that there is evidence of an association between mental health and sleep quality in elite athletes, Study 2 (Chapter 4) adopted a qualitative approach to explore the sporting ecosystem and how athletes, coaches, and support staff understand mental health, the relationship between mental health and sleep, and how this relationship may affect athletic performance (related to Aim 1). These findings are notable as Study 2 is the first study, to the best of our knowledge, that has explored perspectives and lived experiences from athletes, coaches, and support staff on elite athletes' mental health and sleep. This novel research contribution addresses a research gap identified by Montero et al. (2022) in their literature review, with these authors recommending qualitative research be used to examine the relationship between athlete mental health and sleep.

The key findings for Study 2 were the generation of six primary themes from the shared perspectives and lived experiences of athletes, coaches, and support staff working in Australian high-performance sporting ecosystems on their lived experiences and understanding of mental health and sleep. Theme 1 identified their lived experiences and understanding of mental health. Participants considered mental health to be a balanced state, and resilience was noted as a key feature. The participants believed that mental health and sleep have a strong and complex relationship that has important implications for optimal athletic performance and wellbeing, and that both mental health and sleep are linked to physical health. Theme 2 examined how the social identity of athletes was inextricably linked to their experience of high-performance sporting ecosystems. Based on participants lived experiences and perceptions, athletes felt that having agency with their athletic career was important for them to achieve success and support their wellbeing. Athletes in the focus groups also discussed how they would manage dual social identities, such as mother-athlete and student-athlete. Theme 3, 'coach(es) create the

environment', explored coaches' perspectives that they were responsible for creating the high-performance sporting ecosystem, and all participants perceived that this high-performance sporting ecosystem was instrumental in athletes' mental health and sleep. The coaches in the focus groups discussed creating psychologically safe ecosystem's that valued the athletes they work with as people first, athletes second, demonstrating a deep level of care for athletes. Theme 4, 'my environment defines my sleep', explored how the sporting ecosystem is highly influential on athletes' sleep, particularly regarding training schedules. Athletes expressed frustration about how training schedules could disrupt their sleeping patterns, while coaches and support staff acknowledged that more sleep education for all people involved in Australian high-performance sporting ecosystems (e.g., athletes, administrators) would be beneficial. Theme 5, 'what support do I have/what support do I need, explored the available support in high-performance Australian sporting ecosystems for athletes' for mental health and sleep, and what additional support is perceived that athletes may need. This latter point noted that greater support for athletes' sleep, including opportunities for intervention, was identified as a perceived priority through the reflexive thematic analysis of the focus groups. Finally, Theme 6 'what do we do with athlete's monitoring?' was revealed by coaches and staff shared their perspectives and lived experiences regarding the monitoring of athletes' wellbeing and training loads, how this data is used, and the potential risks associated with athlete monitoring.

The second overarching aim of this thesis was to design, implement, and evaluate the effectiveness of a pilot intervention aimed at improving athlete's sleep quality and mental health. Informed by the findings from Study 1 and Study 2 (related to Aim 1 of this thesis) and Study 2 (related to Aim 2 of this thesis), a pilot CBT-I intervention was designed and implemented in Study 3. Key findings from this study are that no statistically significant differences were found

in self-report measures of sleep quality, sleep duration, daytime sleepiness, athlete-specific sleep behaviours, or athlete-specific psychological distress between pre- and post-intervention. The lack of significant findings is in contrast to the large body of evidence supporting the effectiveness of CBT-I (e.g., Muench et al., 2022), including its use with adolescents (Dewald-Kaufmann et al., 2019). The lack of objective sleep data recorded via actigraphy is acknowledged as a major limitation of this study, and the reliance on self-reported sleep data may have impacted the intervention's effectiveness. Actigraphy is considered to be more accurate than self-report sleep data (Halson, 2019), and it is possible that the inclusion of actigraphy data, had it been collected at both time points, may have produced objective evidence that may have captured significant differences in sleep characteristics of the adolescent athletes that their self-reported sleep data did not, providing greater support for the effectiveness of the CBT-I pilot intervention. In addition to the lack of objective data from actigraphy, there are other reasons that could explain why the pilot CBT-I intervention in Study 3 did not produce significant findings. These include: 1) the adolescent athlete cohort generally obtaining adequate sleep and having good sleep quality, with little to no presenting insomnia symptoms; 2) the study duration, reducing the intervention period; 3) lack of secondary follow-up post-intervention; 4) athlete population differences to the general population; 5) environmental factors (e.g., no early morning training sessions; 6) some of the adolescent athletes in Study 3 may have received sleep education previously as part of their participation in an elite sport pathway program, which is something that most of the general population do not receive; 7) the non-compliance to the actigraphy, meaning the study relied on self-report sleep data compared with objective sleep data captured through actigraphy; and 8) the pilot intervention study was conducted outside of the athletes' competition season.

Despite the non-significant findings within this pilot study, learning from participants experiences in this study is valuable to refine and adapt the CBT-I intervention as this can be insightful to inform a clinical trial of CBT-I in athletes. Encouraging responses on the value of CBT-I intervention from these athletes was reported and they found the multifaceted aspects of the CBT-I intervention to be beneficial. The participants in Study 3 who completed a post-intervention evaluation reported finding the CBT-I intervention to be helpful and relevant for them. This social validation of the CBT-I is encouraging and suggests that CBT-I could be a useful treatment for athletes to support optimal sleep.

6.3 Research Implications of Findings

There are two notable research implications from the findings in this thesis. First, the findings in this thesis support the ecological systems model of elite athlete mental health proposed by Purcell et al. (2019). In this framework, Purcell et al. (2019) suggested that athletes exist within an ecological system that includes the individual athlete (e.g., their beliefs, attitudes, or coping skills); the microsystem comprising coaches, teammates, significant others, and high-performance support staff; the exosystem created by the wider sporting environment (e.g., the rules of the athlete's individual sport); and the macrosystem that includes the athlete's National Sporting Organisation or international governing body, media, and general public. In Study 2, athletes, coaches, and support staff shared their perspectives and lived experiences in relation to athletes' mental health and sleep. This study identified six primary themes: 1) what is my experience and understanding of mental health?; 2) what is my social identity?; 3) coach(es) create the environment; 4) my environment defines my sleep; 5) what supports do I [athletes] have?; and 6) you monitor my wellbeing… but what happens with my data?

Study 2 focused on the microsystem of high-performance sport that athletes exist within, as well as the unique experiences athletes have at an individual level. The findings from Study 2 further enhance current thinking that elite athletes' mental health exists within the broader sporting ecosystem (IOC, 2023), and that this sporting ecosystem can contribute to the development of mental illness and symptoms, while at the same time acting as a facilitator to protect against and help recover from mental illness and symptoms (Purcell et al., 2019). Specifically, Theme 5 in Study 2 described the mental health and sleep support(s) that athletes in the Australian high-performance sporting system are perceived to have access to. Additionally, Theme 5 also considered mental health and sleep support(s) that were perceived athletes needed but they did not currently have access to. This discussion included identified barriers to accessing mental health support such as stigma and promoting help-seeking behaviours, demonstrating how support-seeking and support availability is related to the individual athlete (i.e., willingness to seek support), the microsystem (i.e., coaches and staff creating a psychologically safe environment and encouraging support seeking), the exosystem (i.e., culture of a specific sport related to support-seeking or not), and the macrosystem (i.e., support and resources made available/not available by a National Sporting Organisation). Further research on understanding the broader sporting ecosystem (i.e., the entire sporting ecological system encompassing all four levels of the framework) and how it can promote or discourage athlete help-seeking behaviours and further reduce mental health stigma is warranted.

The coaches in Study 2 regarded themselves as the key agents in creating supportive high-performance microsystems (Theme 3), and believed they play a critical role in supporting the mental health of the elite athletes they work with. Although this also has practical implications for high-performance sport (discussed further in 6.4 Clinical Implications), there are

research implications for further research to understand the skills and support that coaches need to create psychologically safe high-performance sporting ecosystems.

The findings of this thesis suggest that the ecological systems model of elite athlete mental health (Purcell et al., 2019) may also be appropriate as a theoretical framework for understanding elite athletes' sleep. Considering elite athletes' sleep from the ecological systems perspective extends Purcell et al.'s (2019) existing theoretical framework, and potentially provides the foundation for the future development of a theoretical framework appropriate to conceptualise both mental health and sleep together for elite athletes. In Study 2, all participants considered that the sporting ecosystem is critical for supporting or inhibiting athletes' sleep. Specifically, scheduling early morning and/or late-night training sessions (or competitions), and inconsistent training session times were regarded by athletes and support staff as being detrimental to athletes' opportunities to attain adequate sleep. By adopting the ecological systems model for elite athletes' sleep, researchers may be able to explore opportunities for upskilling and educating the Australian high-performance sporting ecosystem on the importance of sleep for athletes and ensuring athletes have appropriate opportunities to attain adequate sleep. This education could be provided to sporting coaches, high-performance sport directors, and other key staff who provide oversight on training programs and scheduling in the high-performance ecosystem. Such research could even consider the potential performance benefits of delaying start times of early morning training sessions to allow athletes to sleep for longer durations.

The second notable research implication from the findings of this thesis is in relation to the biopsychosocial model of adolescent sleep proposed by Becker et al. (2015). In this model, Becker et al. (2015) suggested that adolescent sleep is intertwined with a range of biological

(e.g., genetic factors), psychological (e.g., mental illness and symptoms), social (e.g., family, friends), and contextual factors (e.g., school start times, electronic device use before bed) that can all independently, and interconnected, detrimentally impact upon adolescents' sleep. The findings from Study 1 and Study 2 in this thesis indicate that this biopsychosocial and contextual model of adolescent sleep could have utility as a model for understanding elite athletes' sleep and the relationship between athlete mental health and sleep. In Study 1, Australian athletes who reported either subthreshold symptoms or a clinical diagnosis for at least one mental illness had twice the odds of reporting poor sleep quality compared to athletes who reported <50% of symptoms, demonstrating the connection between psychological factors (i.e., mental illness and symptoms) and sleep.

The findings from Study 2 provide further support for the potential adaptation of Becker et al.'s (2015) biopsychosocial and contextual model of adolescent sleep for elite athletes. Specifically, the themes generated in Study 2 suggested that athletes' mental health and sleep is interconnected with psychological, social, and contextual factors. Participants in Study 2 believed that mental health and sleep had a strong, reciprocal relationship, demonstrating the connection between sleep and psychological factors. Social factors were considered in relation to athletes' sleep, especially in relation to subgroups of athletes such as student-athletes and parent-athletes, who may experience greater challenges for sleep due to these respective social factors. These social factors include sleep disturbances caused by newborn and young children for parent-athletes, and for student-athletes, maintaining friendships with non-athlete friends (such as school or university friends) who may wish to socialise at times when it is difficult for athletes to socialise with them (such as late at night or on weekends when they may be competing). Further research may wish to explore these social factors and the potential impact on athletes'

mental health and/or sleep further, and potentially strengthen the utility of the adaptation of the biopsychosocial model for athletes' sleep.

The findings from Study 2 also emphasised the importance of contextual factors in relation to athletes' mental health and sleep. Participants in Study 2 believed that athlete mental health was contextual, and their descriptions of mental health were consistent with Küttel and Larsen's (2020) athlete-specific definition of mental health that considered mental health to be a dynamic state of wellbeing whereby athletes can cope with common life and specific sport stressors. Further emphasising the role of contextual factors on athlete mental health, the athletes in this study spoke about how mental health and athletic performance were inextricably linked, especially due to anxiety around performance and selection, and pressure to perform. Although not specifically discussed by participants in Study 2, these athlete-specific contextual factors such as anxiety around performance are known causes of sleep disturbances for athletes (Erlacher et al., 2011; Juliff et al., 2015). Participants in Study 2 also felt that contextual factors, such as training session timings, would often have a detrimental impact on athlete sleep. Further evidence for the connection between contextual factors and athlete sleep emerged from participants sharing perspectives that they felt greater education was needed for coaches and sport administrators, to help them understand the sleep needs of athletes and try to make sporting environments more conducive to helping athletes attain adequate sleep.

An exploration of biological factors and their impact on athlete sleep (and mental health) was beyond the scope of this PhD thesis, but future research may wish to examine these and potentially further strengthen the biopsychosocial and contextual model as an appropriate theoretical model for understanding athlete sleep and mental health.

6.4 Clinical Implications of Findings

There are several clinical or practical implications from the findings in this thesis. Alcohol misuse has been reported in 19% of athletes in a meta-analysis of the occurrence of mental illness and subthreshold symptoms athletes experience (Gouttebarge et al., 2019). Both Study 1 and Study 2 identified alcohol use amongst athletes as a potential risk factor associated with mental illness and symptoms. In Study 1, seven of 145 elite athletes (4.83%) reported meeting diagnostic criteria for current alcohol use disorder. In Study 2, athletes shared their lived experiences of how alcohol is culturally ingrained in many team sports in Australia, with one athlete describing how his team sport team would meet at the pub for team meetings and race planning for competition. Athletes discussed challenges they faced in socialising with friends who are not athletes, with many of these social interactions desired by their friends to occur late at night and/or in venues that offered alcohol. Further, athletes also shared their perspectives on challenges they faced when socialising with non-athlete friends and family, and how these people would often encourage athletes to consume alcohol, even if the athlete did not want to. Additionally, coaches interviewed in Study 2 perceived that over-consumption of alcohol by athletes had detrimental impacts on athletes' mood and capacity for training. Coaches perceived that they wanted to create a safe and supportive sporting environment and encouraged athletes to socialise with one another outside of sport commitments to build team cohesion and culture. It was identified, however, that encouraging athletes to socialise outside of sport did come with potential downsides due to alcohol consumption in some social situations.

As this thesis is focused on Australian athletes and the Australian high-performance sporting ecosystem, it is not possible to determine whether the use of alcohol among Australian athletes is reflective of wider social and cultural norms. Consuming alcohol is an intrinsic part of

Australian culture and alcohol consumption, including excessive alcohol consumption, is socially acceptable in most social situations including parties, weddings, and sporting events (VicHealth, 2013). For example, the 2022–2023 National Drug Strategy Household Survey in Australia found that over two-thirds (69%) of the population aged 14 and over had consumed alcohol in the past 12 months, highlighting the high prevalence of alcohol consumption in Australia (AIHW, 2025).

Although not investigated in Study 3 with adolescent athletes due to their age, educating athletes about alcohol and alcohol consumption may be helpful because of the detrimental effect that alcohol can have on mental health and sleep. For instance, consuming alcohol before sleep has been shown to reduce sleep onset latency (Ebrahim et al., 2013) and changes sleep architecture across the night, including disrupting sleep quality in the second half of the night (Colrain et al., 2014). Because of the reduction in sleep onset latency, a common misconception regarding alcohol and sleep is that consuming small quantities of alcohol can improve sleep because people fall asleep faster. Educating athletes about alcohol and its effects on sleep could be beneficial to change this misconception and ensure athletes are equipped with knowledge and strategies to make informed decisions about consuming alcohol and should be included in future clinical trials of CBT-I in athletes. In addition to providing education about alcohol and its effects on sleep in future CBT-I studies with athletes, education should also be provided about sleeping supplements, including medications, and their potential use/misuse.

A clinical implication from this thesis is regarding which support staff member(s) should manage elite athlete mental health. This clinical implication highlights the need for all support staff members in the sporting ecosystem to be cognisant of the management pathways for athlete mental health needs. Participants in the focus groups in Study 2 highlighted that not all high-

performance sporting ecosystems have access to a psychologist, and that even for those that do, the psychologist may not always travel with the team or squad when they are competing. While we would advocate for sporting bodies where possible to invest in a psychologist, we understand that this may not be practical. Consequently, it may be beneficial to upskill other support staff such as physiotherapists (or physical therapists) or strength and conditioning coaches in mental health first aid to be first line of support for athletes when needed. Sebbens et al. (2016) developed a mental health literacy workshop for coaches and support staff in high-performance sport in Australia called Mental Health in Sport. Mental Health in Sport focused on signs and symptoms of depression and anxiety, and a brief suicide intervention protocol. Results indicated that Mental Health in Sport improved coaches' and support staff's knowledge of mental health and confidence to help an athlete who may be experiencing mental illness symptoms. We would encourage all coaches and support staff working in Australian high-performance sport to undertake Mental Health in Sport if possible and recommend that all professional and high-performance sporting bodies in Australia have staff members trained in Mental Health in Sport and/or mental health first aid.

In addition to having staff suitably trained to identify and support athletes experiencing mental illness and symptoms, this thesis identified a clinical implication related to sleep. Specifically, in Study 2 a theme was generated about who in the support team within high-performance sporting environments in Australia is responsible for overseeing sleep with athletes, particularly in relation to sleep education and sleep monitoring. The focus groups identified that within the support team a number of staff have knowledge of sleep, including doctors/sports medicine professionals, physiologists, sport scientists, recovery specialists, and psychologists. While it is a strength to have such diverse knowledge across the support team, it can be

detrimental as support staff may assume that other staff are asking athletes about their sleep quality and duration, and thus no staff are asking athletes about their sleep. We would therefore encourage support staff working in high-performance sporting ecosystem to ensure that they work collaboratively on athlete sleep and have clearly defined and agreed responsibility for which support staff member(s) will be accountable for asking athletes about their sleep and intervening or directing athletes to intervention when warranted.

A final clinical implication from this thesis concerns the practice of athlete monitoring, specifically wellbeing data such as mood and sleep, and the rising use of wearable devices and/or consumer sleep technologies. In Study 2, coaches and support staff expressed concerns about the use of wearable devices without proper supervision and support, and the risks that these devices can create related to obsessive-type behaviour regarding perfecting sleep and recovery. Participants noted in Study 2 that while athlete monitoring is valuable for tracking training loads and wellbeing data, athletes must be informed as to why their data is being monitored and what that data will be used for. And staff must be clear on what purpose the monitoring is serving. For support staff working in high-performance sport, data that is collected from athletes should be used to help inform training, recovery, and support strategies. We would also recommend that only data that will be used to help aid practice should be collected, and athlete monitoring with no specific purpose and clear justification should be avoided.

6.5 Strengths of the Thesis

A strength of this PhD thesis is the mixed methods approach and diversity of research techniques. Using both quantitative and qualitative research methods, this PhD thesis was able to provide a more comprehensive understanding of the relationship between mental health and sleep in elite athletes, compared to using either approach alone. Using mixed methods research in

health outcomes research ensures that the results are reflective of the patient's perspective, or in this case, the athletes' perspective (Regnault et al., 2018). The diversity of research techniques utilised in this PhD thesis demonstrates my proficiency as a researcher in using both quantitative and qualitative methods. The diverse use of research techniques allowed me to develop a deeper understanding of the research topic and use the quantitative data from Study 1 (Chapter 3) and the qualitative data from Study 2 (Chapter 4) to inform the area of intervention (i.e., sleep and/or mental health) and identify the sleep intervention of CBT-I that was piloted in Study 3 in adolescent athletes (Chapter 5).

In addition to the strengths of the mixed methods approach for this PhD thesis, another strength is the multi-disciplinary research team who provided supervision throughout my candidature. The combination of knowledge and expertise from different fields across sport science, including sport psychology, biomechanics, motor control and learning, physiology, recovery, and epidemiology, greatly informed my PhD experience, and allowed me to expand my knowledge beyond my own profession (sport psychology). Thus, I was able to consider my research topic from different perspectives outside of my own field, and I believe that this collaborative sharing of knowledge is reflected in this PhD thesis.

A third strength of this PhD thesis is the pilot intervention we conducted for Study 3 (Chapter 5). Drawing on the findings from Study 1 and Study 2, we designed a sleep intervention for athletes based on the gold-standard psychological treatment for insomnia, CBT-I. Although conducting a clinical trial was beyond the capacity of this PhD thesis, we do believe that the pilot CBT-I study we conducted makes an important contribution as the first study that has utilised CBT-I with athletes.

6.6 Limitations to the Thesis

In considering the unique contribution and findings of this thesis, there are limitations to this thesis that must be acknowledged in addition to the specific study limitations reported in Chapters 3-5. First, this PhD thesis was commenced in 2020 during the onset of the COVID-19 pandemic, and the pandemic impacted this thesis in multiple ways. This PhD thesis was designed to be an embedded project at the Australian Institute of Sport (AIS) in Canberra. Due to government mandated COVID-19 pandemic regulations, however, much of this PhD thesis had to be completed working remotely from home. Consequently, it was not possible to have regular face-to-face meetings with my AIS-affiliated PhD supervisors, and because of a shift to working from home, this PhD was not able to be embedded at the AIS. The reliance on working remotely had a flow on effect regarding participant recruitment, especially for Study 2, which proved to be significantly more challenging and took much longer than was anticipated. The original intention for Study 2 (Chapter 4) was to collect qualitative data from athletes, coaches, and support staff that could then be used to inform the CBT-I intervention in Study 3 (Chapter 5), with the potential to utilise participants and their networks from Study 2 (e.g., sporting programs coached by coach focus group participants) for Study 3. However, the impact of COVID-19 in impeding recruitment for Study 2 meant this plan was not possible. A further impact from the COVID-19 pandemic was that for the first two years of this PhD, I was not able to travel to my universities to meet with my supervisors in-person, nor consider any university affiliated sporting programs (e.g., elite athlete programs) for participant recruitment. Additionally, the use of an existing data set for Study 1 (Chapter 4) was limited with the available demographic information to report on. It was also not possible to analysis any data to enable casual inferences regarding the relationship between mental health and sleep in elite athletes to be reported on.

Another limitation of this PhD thesis is time constraints due to the time-sensitive nature of a PhD project. The time constraints on this PhD thesis were particularly evident for additional recruitment of athlete participants for Study 2 and for the design, implementation, and data collection for Study 3. We had hoped to recruit more than the nine athlete participants we did recruit for focus groups, but due to the longer than anticipated recruitment process, and the time-sensitive nature of an impending PhD thesis submission deadline, we had to limit the number of participants we could recruit for the focus groups to allow sufficient time for the collected data to be analysed, interpreted, and the manuscript written up. Further, time constraints of this PhD thesis meant that for Study 3, we could only recruit enough participants for the intervention group, and were not able to utilise a control group. The non-compliance of the actigraphy to objectively monitor athletes' sleep was observed with inconsistent usage by the participants in the pre-intervention period, while actigraphy was not able to be worn for post-intervention data collection due to the adolescent athletes' leaving the national training centre for the summer school holidays, and the need to complete Study 3 for PhD thesis examination. We acknowledge that the lack of actigraphy data for Study 3 greatly limits the study. When we initially designed the CBT-I intervention for Study 3, we had hoped to conduct follow-up data collection at two separate time points, immediately following the completion of the intervention and again two months later post-intervention, to assess whether the intervention had been effective in improving athletes' sleep quality and/or duration after its completion. Unfortunately, due to PhD thesis time constraints this was not possible.

A final limitation of this PhD thesis is the feasibility of conducting research in high-performance sport with elite athletes. We believe that conducting research in sport science with elite athletes is a worthwhile endeavour to help influence athlete health and performance

(Mitchell et al., 2024). The development of evidence-based practice in elite sport is imperative ensure that athletes receive high-quality service delivery. Despite our beliefs about the value of conducting research with elite athletes, it can be a challenging population to work with, and so it proved during this PhD thesis. One aspect of feasibility that limited this PhD thesis is the difficulty in recruiting participants, especially if you don't have a gatekeeper to the sporting organisation you can work with (Mitchell et al., 2024). For Study 2, we received a lot of initial interest in the research project from multiple sporting organisations, however, when it came to signing organisational consent forms and organising access to potential participants, interest was regularly withdrawn. Multiple approaches to recruitment for Study 2 were utilised, however, generating genuine interest and willingness to participate in a focus group proved challenging. We had hoped to recruit at least 15 elite athletes for the study but could only manage to recruit nine.

A further consideration about the feasibility of conducting research with elite athletes was in relation to Study 3 and timing of conducting research within athlete schedules. For this study, we managed to recruit from two sporting academies potentially 40 athletes for the CBT-I intervention. However, with athletes absent during the baseline data collection, missing multiple intervention sessions throughout the study, or not completing the post-intervention measures, we could only include data from 28 athletes. Further, unbeknown to the research team until the end of the CBT-I intervention sessions, there was non-compliance with the actigraphy data collection during baseline, while the adolescent athletes in the study were not available in the week after the final intervention session to wear actigraphy devices as they were all leaving to return home for the summer from the national sporting academy.

6.7 Future Research Directions

Future research should continue to build on the growing interest in mental health and sleep in elite athletes. In this PhD thesis, Study 1 (Chapter 3) determined point prevalence of mental illness and symptomology in elite/pre-elite Australian athletes using a diagnostic interview. We would encourage further research in elite athlete mental health to also utilise diagnostic interviews with different athlete populations (sports, competitions, ages, cultures). Capturing this data will help to accurately determine the epidemiological profile of mental illness in elite athletes, which is imperative to be able to develop and implement effective mental illness prevention policies and intervention strategies.

Furthermore, a notable finding from Study 1 was we demonstrated an association between mental illness and symptomology and poor sleep quality. Due to the cross-sectional research design, it was not possible to make any casual inferences regarding this bi-directional relationship. Prospective longitudinal research is warranted to assess elite athletes' mental health and sleep over time. This research would help to identify potential aspects of vulnerability that may contribute to the onset of mental illness and subthreshold symptoms, including sport-specific factors such as performance or team success, and non-sport factors such as coping skills and social support (Rice et al., 2016). Identifying these aspects of vulnerability in athletes would enable early detection of at-risk athletes and allow early intervention strategies to be implemented, while longitudinal research may also provide researchers and practitioners with valuable data for developing preventative policies and strategies.

Future research in elite athlete mental health and sleep should also consider utilising qualitative approaches. Qualitative research can help deepen our understanding of this relationship by capturing perspectives and lived experience from athletes and other industry

insiders integral to the high-performance sporting environment (e.g., coaches, support staff, high-performance sporting managers, and administrators). By capturing these lived experiences, we can develop a deeper understanding of how mental health and sleep affects athletes, how the sporting environment impacts athletes' mental health and sleep, and what athletes and industry insiders believe is needed for athletes to support optimal mental health and sleep.

In Study 2, we were able to recruit one para-athlete for the focus groups study. Although this para-athlete did not share perspectives or lived experiences about their mental health or sleep that were different from the non-disabled athlete participants, we did not seek in Study 2 to explore differences in the experiences of mental health and sleep between non-disabled and para-athletes. Future research should also look to capture and understand the mental health experiences of non-disabled and para-athletes, and how they may differ. Understanding these different experiences is worthwhile due to potential complex health needs and/or chronic pain that para-athletes may experience, and how these factors may contribute to the vulnerability for developing mental illness and symptoms in para-athletes. By understanding the lived experiences of para-athletes, and other athlete subgroups such as mother-athletes, tailored interventions can be designed and developed for these subgroups.

Finally, we would encourage future research build upon our pilot intervention study using CBT-I with athletes. Future research should assess the effectiveness of CBT-I with athletes by completing a clinical trial with a control group and an intervention group, to enable comparison between athletes who are exposed to CBT-I and those who are not. Trialling different delivery modalities of CBT-I with athletes (e.g., face-to-face, digital, individual v group settings) would be worthwhile to determine the most effective technique for intervention delivery. Conducting longer duration studies would also be beneficial, as this would enable researchers to conduct

follow-up data collection post-intervention, such as two- and six-months post-intervention, to assess the effectiveness of CBT-I over time at improving athletes' sleep quality and/or duration.

6.8 Concluding Remarks

Over the past 15 years, there has been growing research attention on mental health and sleep in elite athletes. This research has either focused on mental health or sleep, however, little is known about the relationship between mental health and sleep in elite athletes. Although it is well established that mental health and sleep have a strong, bi-directional relationship within the general population, this relationship has not been confirmed in elite athletes. This thesis contains three studies that have examined this relationship in elite/pre-elite Australian athletes – two that explored this relationship using a mixed method approach to broaden the knowledge captured – and then one study that informed by the findings in the thesis, trialled a Cognitive Behavioural Therapy for Insomnia (CBT-I) pilot intervention with adolescent athletes, the first time CBT-I has been used in elite sport research. This thesis has shown that mental health and sleep have an important relationship for elite/pre-elite athletes in Australia, and that this relationship has important implications related to athlete wellbeing, physical health, and performance.

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Appendix A: Conference Abstract

Submitted for Global Alliance in Mental Health in Sport Inaugural Conference November 2022

Point prevalence of mental illness and mental health symptomology in elite Australian athletes

Harley de Vos
PhD Candidate – The University of Newcastle

Background/aims: Prevalence of mental illness among athletes has generally relied on self-report measures not diagnostic interviews (Gouttebarge et al., 2019; Rice et al., 2016). Diagnostic interviews have only been undertaken in three studies to date (i.e., Appaneal et al., 2009; Hammond et al., 2013; Schaal et al., 2011), none of which included Australian athletes. This study used a clinical interview to establish point prevalence of mental illness in elite Australian athletes.

Methods: This cross-sectional study included 145 elite/pre-elite Australian athletes (30 male; M age = 21.55 years, SD = 5.21 years) from 10 sports. The Mini International Neuropsychiatric Interview [MINI 7.02] (Sheehan et al., 1998) was used to assess mental health as part of athlete periodic health evaluations between 2017-2019 (see Drew et al., 2018).

Results: At the time of interview, 6.2% of athletes met diagnostic criteria for at least one mental illness, while 5.5% of athletes met diagnostic criteria for at least one mental illness in their lifetime. Further, 28.97% of athletes reported >50% of symptoms (but did not meet diagnostic criteria) for at least one mental illness currently, and 15.17% of athletes reported >50% of symptoms for at least one mental illness in their lifetime.

Conclusions: This study is the first to establish the point prevalence of mental illness in elite Australian athletes. Although prevalence of mental illness in this cohort reflects non-athlete populations, the high prevalence of athletes with subclinical symptomology is of concern and not optimal for overall health and optimal performance.

Appendix B: Conference Abstract

Submitted for Association for Applied Sport Psychology 38th Annual Conference October 2023

The relationship between poor mental health and sleep quality in elite Australian athletes

Harley de Vos – The University of Sydney

Mental health and sleep have a strong, bi-directional, interdependent relationship (Del Rio João et al., 2018). While this relationship is well understood in the general population, it is not yet as well understood in elite athletes. Mental illnesses such as mood disorders and anxiety disorders are associated with sleep disturbance (Asplund & Chang, 2020) and sleep disturbance is associated with impaired physical function and athletic performance (Charest & Grandner, 2020). Therefore, understanding this relationship in athletes is important to support optimal health and athletic performance outcomes. The present study sought to explore the relationship between mental health and sleep quality in Australian elite athletes. This cross-sectional study included 133 elite/pre-elite Australian athletes (29 male; M age = 21.66 ± 5.25 years) from 10 Olympic and Commonwealth Games sports. The Mini International Neuropsychiatric Interview (Sheehan et al., 1998) was used to assess mental health, while sleep quality was assessed by the Pittsburgh Sleep Quality Index (Buysse et al., 1989). Data were collected as part of athlete periodic health evaluations between 2017-2019. Generalised ordered logistic regression showed a significant association only between poor mental health and poor sleep quality. *Athletes who reported >50% of symptoms or a clinical diagnosis for at least one mental illness had twice the odds of reporting poor sleep quality compared to athletes who reported <50% symptoms (OR=1.97, 95%CI=1.24–3.15, p=0.004).* The findings indicate that a clear relationship exists between poor mental health and sleep quality in athletes, suggesting that athletes with mental health symptomology are more likely experience poor sleep quality. Support staff (e.g., sport psychology practitioners) working with athletes and supporting their mental health should consider screening for sleep disturbances such as poor sleep quality, and potentially provide sleep education and intervention strategies to support athletes' to optimise their sleep quality and support good mental health.

Appendix C: Conference Abstract

Do mental health and sleep matter for athletic performance and wellbeing? Exploring perspectives of Australian athletes, coaches, and support staff

Harley de Vos, Kotryna Lewis, Suzi Edwards, Renee Appaneal, Shona Halson, Liam Toohey

How high-performance sporting environments can influence elite athletes' mental health and sleep is increasingly an area of interest for sport psychology researchers and practitioners (Schinke et al., 2024; Walsh et al., 2021). This study aimed to develop a better understanding of how athletes, coaches, and support staff perceive athletes' mental health, sleep, the relationship between mental health and sleep, and how this relationship may affect athletic performance. We conducted six focus groups with nine athletes (six women) and 17 coaches/staff (five women). Focus groups were audio recorded, transcribed verbatim and analysed using reflexive thematic analysis. Six primary themes were generated: 1) my experience and understanding of mental health; 2) what is my social identity?; 3) coach(es) create the high-performance environment; 4) my environment defines my sleep; 5) what support do I have/what support do I need?; and 6) you monitor my wellbeing… but what happens with my data? The results underlined that mental health and sleep have a strong and complex relationship that has important implications for optimal athletic performance and wellbeing. Based on participants lived experiences and perceptions, athletes felt that having agency with their athletic career was important for them to achieve success and support their wellbeing, while coaches believed that they were responsible for creating the high-performance sporting environment. This study highlights that high-performance sport needs to continue to reduce barries to mental health support and be more inclusive and supportive of athletes experiencing mental ill-health. A notable applied practice implication from this study concerns the routine monitoring of athletes, including how this data is used, and which support staff should be responsible for overseeing athletes' sleep. Based on these results, greater visibility of athlete monitoring would be helpful, while sleep education specific to the demands of high-performance sport is needed for all athletes and staff.

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Appendix D: Study 1 AIS EC Approval

MINUTE: 10 SEPTEMBER 2021

TO: Harley de Vos

FROM: Michael Gillard, AIS Ethics Committee Secretary

SUBMISSION TITLE: Exploring the relationship between mental health and sleep in elite Australian athletes

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The AIS Ethics Committee (EC) have considered your research submission, titled above. Following your responses to the initial queries raised by the EC, the EC does not see any ethical reason why the project should not proceed as specified in your submission.

Ethics approval number: 20210503
Ethics approval expiry: November 2022

As the Principal Researcher, please advise all researchers involved in the study of the EC approval and any conditions of approval stated above. Please also advise the EC immediately (via the Secretary) of:

- Any proposed changes to the research design
- Any adverse events that occur whilst carrying out your research study
- Premature termination of the project
- Project completion.

Researchers are responsible for submitting the required annual status reports and project completion reports to the EC Secretary. Details of report requirements can be found online at:

https://www.ais.gov.au/research-submissions

After approval expires, you will need to submit an extension request to continue the study if required. If you have any questions regarding this matter, please contact me.

Sincerely,

[Redaction]

Michael Gillard
AIS Ethics Committee Secretary
ethics@ausport.gov.au

Appendix E: Study 1 Ethics Approval

RESEARCH INTEGRITY UNIT

Registration of External HREC Approval

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

To Chief Investigator or Project Supervisor: **Dr Suzi Edwards**

Cc Co-investigators / Research Students: **Mr Harley De Vos**

Dr Renee Appaneal

A/Prof Shona Halson

Dr Kotryna Fraser

Dr Michael Drew

Dr Liam Toohey

Margot Rogers

Re Protocol: Exploring the relationship between mental health and sleep in elite Australian athletes

Date: 06-Oct-2021

Reference No: **H-2021-0326**

External HREC Reference No: **20210503**

Thank you for your **Initial Application** submission to the Research Integrity Unit (RIU) seeking to register an External HREC Approval in relation to the above protocol.

Your submission was considered under an **Administrative Review** by the Ethics Administrator.

I am pleased to advise that the decision on your submission is **External HREC Approval Noted** effective

06-Oct-2021.

As the approval of an External HREC has been noted, this registration is valid for the approval period determined by that HREC.

Your reference number is **H-2021-0326**.

PLEASE NOTE:

As the RIU has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's RIU, via RIMS.

Linkage of ethics approval to a new Grant

Registered External HREC approvals cannot be assigned to a new grant or award (ie those that were not identified in the initial registration submission) without confirmation from the RIU.

Best wishes for a successful project.

Mr Alan Hales

Manager, Research Compliance, Integrity and Policy

For communications and enquiries:

Human Research Ethics Administration

Research & Innovation Services Research Integrity Unit

The University of Newcastle Callaghan NSW 2308

T +61 2 492 17894

Human-Ethics@newcastle.edu.au

RIMS website - https://RIMS.newcastle.edu.au/login.asp

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
		,	

Appendix F: Study 2 Ethics Approval

HUMAN RESEARCH ETHICS COMMITTEE

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	**Doctor Suzi Edwards**
Cc Co-investigators / Research Students:	**Doctor Renee Appaneal** **Associate Professor Shona Halson Mr Harley De Vos** **Doctor Kotryna Fraser**
Re Protocol:	**Understanding elite athlete and key stakeholder perspectives on the importance of sleep and mental health to athletic performance**
Date:	**26-Aug-2021**
Reference No:	**H-2021-0241**

Thank you for your **Response to Pre-Review Feedback** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under **Expedited** review by the Chair/Deputy Chair.

We are pleased to advise that the decision on your submission is **Approved** effective **24-Aug-2021**.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. *If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.*

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal *Certificate of Approval* will be available upon request. Your approval number is **H-2021-0241**.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants You may then proceed with the research.

Conditions of Approval

This approval has been granted subject to you complying with the requirements for *Monitoring of Progress*, *Reporting of Adverse Events*, and *Variations to the Approved Protocol* as detailed below.

PLEASE NOTE:

In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

• Monitoring of Progress

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

• Reporting of Adverse Events

1. It is the responsibility of the person **first named on this Approval Advice** to report adverse events.
2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form (via RIMS at https://rims.newcastle.edu.au/login.asp) within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as:
   - Causing death, life threatening or serious disability. Causing or prolonging hospitalisation.
   - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
   - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
   - Any other event which might affect the continued ethical acceptability of the project.
5. Reports of adverse events must include:
   - Participant's study identification number; date of birth;
   - date of entry into the study; treatment arm (if applicable); date of event;
   - details of event;
   - the investigator's opinion as to whether the event is related to the research procedures; and action taken in response to the event.
6. Adverse events which do not fall within the definition of serious or unexpected, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

- **Variations to approved protocol**

If you wish to change, or deviate from, the approved protocol, you will need to submit an *Application for Variation to Approved Human Research* (via RIMS at https://rims.newcastle.edu.au/login.asp). Variations may

include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. **Variations must be approved by the (HREC) before they are implemented** except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Human Research Ethics Committee

For communications and enquiries:

Human Research Ethics Administration

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Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
		,	

Appendix G: Study 2 Participant Information Statement

Information Statement for the Research Project:

Understanding elite athlete and key stakeholder perspectives on the importance of sleep and mental health to athletic performance

Document Version 4.0; dated 11/10/2022

Dear Athlete / Staff member,

You are invited to participate in the above research project conducted by Mr Harley de Vos (Faculty of Medicine & Health, Sydney School of Health Sciences at the University of Sydney; Australian Institute of Sport) as part of his PhD project and is supervised by Dr Suzi Edwards and Dr Kotryna Fraser (Sydney School of Health Sciences, Discipline of Exercise & Sport Science, The University of Sydney), A/Prof Renee Appaneal (Institute of Social Neuroscience), Professor Shona Halson (School of Behavioural and Health Sciences, Australian Catholic University), and Dr Liam Toohey (The University of Canberra).

You are receiving this invitation to participate in this research project as your National Sporting Organisation has identified you as someone who may be interested in participating and they agreed to send you this invitation on behalf of the research team.

Why is the research being done?

Elite and pre-elite athletes can often experience poor mental health and sleep, which can decrease their performance. The rates of mental health issues experienced by elite athletes are comparable to the general population. Almost 50% of Australian elite athletes experienced symptoms of at least one mental health problem during their athletic career. Sleep is another issue affecting an athlete's performance. Athletes and coaches believe sleep is one of the most important strategies for optimising recovery due to its restorative effects, yet elite athletes often acquire significantly less sleep than the recommended amount of 7-9hrs per night.

The purpose of this research is to understand the perspectives from elite athletes' as well as coaches and high-performance staff (e.g., sports medicine staff) on the importance of mental health and sleep to performance and overall health and wellbeing in elite athletes.

Who can participate in the research?

To participate in this research, you must be either:

- An athlete over the age of 18 identified by their National Sporting Organisation who are in the pre-elite or elite stages of the talent pathway, or
- A current coach, sports medicine professional, or other high-performance staff member affiliated with National Sporting Organisations are also eligible to participate in this research study.

What would you be asked to do?

If you agree to participate, you will be asked to take part in a focus group consisting of approximately 5 people for approximately 60 minutes. Approximately 48 hours prior to attending the focus group, you will be asked to complete electronically a written consent form and a demographics survey. This demographic survey will be administered electronically via email through the platform Qualtrics prior to the focus groups. For information regarding the privacy of Qualtrics, please see the privacy statement on their website (https://www.qualtrics.com/privacy-statement/). Focus groups will be conducted in person where possible, and web-based meeting software platforms (such as Zoom) will be used if travel or face-to-face meetings are prohibited (in line with current recommendations by local health departments). Face-to-face focus groups will be conducted on-campus at The Australian Institute of Sport or The University of Sydney. The focus groups will be audio recorded, and the audio recordings will be transcribed verbatim to ensure that you are deidentified. Each focus group will comprise of either elite athletes only or key stakeholders only (i.e., coaches etc.).

What are the risks and benefits of participating?

There are no anticipated risks regarding your reputation, future work opportunities, or community standing by participating in this study. There is, however, a slight possibility that you might experience some emotional distress during the focus group. If talking about the topic of mental health while you are completing or after completing your focus group, you experience any emotional distress, embarrassment, or anxiety, you may benefit from speaking to a professional counsellor by contacting Beyond Blue on 1300 224 636 or visiting

www.beyondblue.org.au or contacting Lifeline on 13 11 14. Alternatively, please contact the project principal investigator Mr Harley de Vos on +61 [Redaction] or hade6628@uni.sydney.edu.au.

There will be an endorsed sport psychologist, Dr Renee Appaneal, available on call should you experience any emotional distress during or after the focus groups. If you feel that after participating in the focus group that you need additional support, the research team will work with you to engage you with a service provider. This may be a psychologist or counsellor within your NSO, an external service provider, or an existing service provider. The research team can also link you in with the AIS Mental Health Referral Network as required.

This research is designed to understand your perspectives on sleep and mental health to athletic performance. Your participation may result in the development of guidelines to governing sports bodies and clubs to guide the promotion of sleep and/or mental health. It may also lead to the development of an intervention in elite athletes if the issues of sleep and/or mental health warrant the implementation of a strategy to help enhance sleep and/or mental health in elite athletes. Although this research has the potential to impact future elite athletes and best practice guidelines in sport, there are no potential benefits to you from taking part in this research.

What choice do you have?

Participation in this study is entirely voluntary. Whether or not you decide to participate, your decision will neither advantage nor disadvantage you and there are no consequences for not participating. The discussions during the focus groups will be conducted in a confidential manner. If you would like to withdraw at any time during the focus group, you can do so without giving a reason by logging off from the Zoom meeting. If you do withdraw, you may ask that your data are not quoted in the final research. You may also withdraw after data has been collected by contacting the research team up to four weeks after participating in the focus group. All data associated with you will be destroyed and you will not be included in the final research.

How will your privacy be protected?

Data will be retained securely for a minimum period of 5 years from completion of the research and managed/stored in accordance with the University's Research Data and Materials Management Guideline (see https://policies.newcastle.edu.au/document/view-current.php?id=72) or any successor Guideline, and applicable The University of Newcastle policy provisions (as amended from time to time). All electronic data will be stored on The

University of Newcastle secure cloud, and all paper records will be scanned and stored electronically, and hard copies will be shredded.

Consistent with the ACRCR and The University of Newcastle's Research Data and Materials Management Guideline, other researchers will be provided with access to the non-identifiable

research data upon request and allowed to analyse the data. The de-identified research data and primary materials may be made available in online public data repositories (e.g., Open Science Framework) that can be accessed by other researchers for further research. This further research may include research questions beyond those stated in the Information Statement.

All discussions held as part of the focus groups are not for public consumption and all participants will be reminded prior to the commencement of the focus group that the discussion will take place in a confidential manner (e.g., 'what is said in the focus group, stays in the focus group').

The transcript of the focus group will be deidentified so that only the participants are identified as Participant 1, Participant 2 etc – no names will be included to ensure anonymity. The researchers will attempt to de-identify the athlete where sport data contains only one participant. If there is a risk, however, that they are identifiable, the researchers will de-identify the sport into a category called "other" therefore removing any risk to the athlete.

How will the information collected be used?

The collected data will be reported in Mr Harley de Vos's Doctor of Philosophy thesis and in scientific journals, and presented at conferences. Non-identifiable data may also be shared with other parties to encourage scientific scrutiny and to contribute to further research and public knowledge, or as required by law. Individual participants will not be named or identified in any reports arising from the project, although anonymous individual responses may be quoted. Participants will be given the opportunity to receive a summary of the written research results. If you would like a copy of the summary of the results, please email Mr Harley de Vos on hade6628@uni.sydney.edu.au.

What do you need to do to participate?

Please read this Information Statement and be sure you understand its contents before you consent to participate. If you have any questions or require any further information, please contact the Student Researcher Mr Harley de Vos or Project Supervisor Dr Suzi Edwards.

Student Researcher

Mr Harley de Vos

Tel: [Redaction]

Email: hade6628@uni.sydney.edu.au

Project Supervisor

Dr Suzi Edwards

Tel: 02 8627 7895

Email: suzi.edwards@sydney.edu.au

If you would like to participate, please let the Student Researcher Harley de Vos know by email.

Thank you for considering this invitation.

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2021-0241.

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Services, NIER Precinct, The University of Newcastle. University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

Appendix H: Study 2 Participant Consent Form

DR SUZI EDWARDS

Faculty of Medicine & Health, Sydney

School of Health Sciences,

Discipline of Exercise &
Sport Science

E: Suzi.Edwards@sydney.edu.au

Consent Form for the Research Project:

Understanding elite athlete and key stakeholder perspectives on the importance of sleep and mental health to athletic performance

Mr Harley de Vos from The University of Newcastle, Dr Suzi Edwards and Dr Kotryna Fraser from the University of Sydney, Dr Renee Appaneal (formerly Australian Institute of Sport), Professor Shona Halson from Australian Catholic University, and Dr Liam Toohey (The University of Canberra)

Document Version 1.2; dated 24/08/2021

Thank you for expressing interest in this research. Please read and retain this information sheet. Should you have any questions regarding this study, please contact the Chief Investigator Mr Harley de Vos or Project Supervisor Dr Suzi Edwards.

Chief Investigator

Harley de Vos

Tel: [Redaction]

Email: harley.devos@uon.edu.au

Project Supervisor

Dr Suzi Edwards

Email: suzi.edwards@sydney.edu.au

My consent to participate in this research is based on the following terms:

1. The purpose of the research has been explained to me, including the potential risks and discomforts involved. YES / NO

2. I understand that the project will be conducted as described in the Information Statement, a copy of which I have retained. YES / NO

3. I understand that my participation is voluntary and that I can withdraw by exiting the focus group before it is completed and without giving a reason. YES / NO

4. I understand the focus group will be audio recorded and anonymised quotes may be used in the final research. YES / NO

5. I understand that my de-identified data will be stored as detailed in the information sheet. YES / NO

6. I have been given the opportunity to ask questions about the research and received satisfactory responses to all questions I have asked. YES / NO

7. I would like to receive a copy of the summary of findings from the focus group. YES / NO

8. I agree to participate in the above research project and give my consent freely. YES / NO

Participant's Name: _____

Participant's Signature: _____

Date: _____

Researcher's Signature: _____

Date: _____

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2021-0241.

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Services, NIER Precinct, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 4921 6333, email Human-Ethics@newcastle.edu.au.

Appendix I: Study 2 Social Media Recruitment Flyers

Research Participants Wanted

- Are you an Australian elite/pre-elite athlete competing at a National level or higher?
- Are you at least 18 years old?

Please consider taking part in a 45-minute focus group with other athletes to help us better understand the importance mental health and sleep may have on athletic performance.

Please contact PhD candidate Harley de Vos for more info or scan the QR code.
hade6628@uni.sydney.edu.au

THE UNIVERSITY OF SYDNEY

Research Participants Wanted!

- Are you a coach or support staff member working in Australian high-performance sport?
- Do you believe that mental health and/or sleep are important for athletes?

Please consider taking part in a 45-minute focus group with other coaches and staff to help us better understand the importance mental health and sleep may have on athletic performance.

Please contact PhD candidate Harley de Vos for more info or scan the QR code.
hade6628@uni.sydney.edu.au

THE UNIVERSITY OF SYDNEY

Appendix J: Invitation to Sporting Organisations

Understanding elite athlete and key stakeholder perspectives on the importance of sleep and mental health to athletic performance

March 4, 2022

To Whom It May Concern,

My name is Dr Suzi Edwards. I am writing to invite your organisation to participate in a research study on understanding elite athlete and key stakeholder perspectives on the importance of sleep and mental health to athletic performance. This project has received ethics approval from The University of Newcastle ethics committee (University of Newcastle H-2021-0241).

This research will be conducted by my PhD candidate, Harley de Vos, in collaboration with his PhD supervisors A/Prof Renee Appaneal (Institute of Social Neuroscience), Dr Kotryna Fraser (Sydney School of Health Sciences, Discipline of Exercise & Sport Science, The University of Sydney), Professor Shona Halson (School of Behavioural and Health Sciences, Australian Catholic University), and myself (Sydney School of Health Sciences, Discipline of Exercise & Sport Science, The University of Sydney).

The aim of this research project

The purpose of this research is to understand the perspectives from elite athletes' as well as coaches and high-performance staff (e.g., sports medicine staff) on the importance of mental health and sleep to performance and overall health and wellbeing in elite athletes.

Who can participate in the research?

We are looking for the following people to participate in this research:

- Athletes over the age of 18 identified by you (their National Sporting Organisation) who is in the pre-elite or elite stages of the talent pathway; OR
- A current coach, sports medicine professional, or other high-performance staff member affiliated with your National Sporting Organisation.

Possible benefits

This research is designed to understand athletes' and stakeholders' perspectives on sleep and mental health to athletic performance. Your athletes and staff participation in this study may result in the development of guidelines to governing sports bodies and clubs to guide the promotion of sleep

and/or mental health. It may also lead to the development of a pilot intervention aiming at improving sleep and/or mental health in elite athletes should such investigation be warranted.

What we require from you

If you are interested in having your athletes and staff participate in this study, we ask that you please sign the Organisational Consent Form and return that to the Chief Investigator (Dr Edwards). Once we have received your consent, we kindly ask that you distribute our Participant Information Statement to your athletes and staff, for their consideration.

Time commitment

This research project consists of two parts – an online survey prior to the focus group that will take approximately 10 minutes to complete; and participation in small focus groups that will each last for approximately 60mins and will contain 3-5 people per focus group. Athletes and stakeholders will be in separate focus groups.

Focus groups will be conducted in person where possible, and web-based meeting software platforms (such as Zoom) will be used if travel or face-to-face meetings are prohibited (in line with current recommendations by local health departments). Face-to-face focus groups will occur, if possible, on-campus at The Australian Institute of Sport or The University of Newcastle. The focus groups will be audio recorded, and the audio recordings will be transcribed verbatim.

How will the privacy of your athletes and staff be protected?

Data will be retained securely for a minimum period of 5 years from completion of the research and managed/stored in accordance with the University's Research Data and Materials Management Guideline (see https://policies.newcastle.edu.au/document/view-current.php?id=72) or any successor Guideline, and applicable The University of Newcastle policy provisions (as amended from time to time). All electronic data will be stored on The University of Newcastle secure cloud, and all paper records will be scanned and stored electronically, and hard copies will be shredded.

Consistent with the ACRCR and The University of Newcastle's Research Data and Materials Management Guideline, other researchers will be provided with access to the non-identifiable research data upon request and allowed to analyse the data. The de-identified research data and primary materials may be made available in online public data repositories (e.g., Open Science Framework) that can be accessed by other researchers for further research. This further research may include research questions beyond those stated in the Information Statement.

All discussions held as part of the focus groups are not for public consumption and all participants will be reminded prior to the commencement of the focus group that the discussion will take place in a confidential manner (e.g., ‘what is said in the focus group, stays in the focus group’).

The transcript of the focus group will be deidentified so that only the participants are identified as Participant 1, Participant 2 etc – no names will be included to ensure anonymity. The researchers will attempt to de-identify the athlete and staff where sport data contains only one participant. If there is a risk, however, that they are identifiable, the researchers will de-identify the sport into a category called "other" therefore removing any risk to the participant.

How will the information collected be used?

The collected data will be reported in Mr Harley de Vos's Doctor of Philosophy thesis and in scientific journals, and presented at conferences. Non-identifiable data may also be shared with other parties to encourage scientific scrutiny and to contribute to further research and public knowledge, or as required by law. Individual participants will not be named or identified in any reports arising from the project, although anonymous individual responses may be quoted.

Participating organisations as well as individual participants will be given the opportunity to receive a summary of the written research results. If you would like a copy of the summary of the results, please email the project chief investigator Dr Suzi Edwards at suzi.edwards@sydney.edu.au

Please feel free to contact me to discuss any aspect of the study. We are happy to work together with you to make it as easy as possible for your athletes and staff to have the opportunity to participate. It should be noted that participants will NOT be required to pay for any cost as this responsibility lies solely with The University of Newcastle, and is supported by an RTP stipend. Please feel free to contact myself via email (suzi.edwards@sydney.edu.au) or the student researcher, Harley de Vos (harley.devos@uon.edu.au) to discuss the study and your potential interest.

Thank you for your consideration of this research project.

Kind regards,

Dr Suzi Edwards

Appendix K: Focus Groups Interview Schedule

Understanding the perspectives of elite athlete and key stakeholders on the importance of sleep and mental health to athletic performance

Document Version 2.0; dated 18/03/2022

Discussion for the workshop: *Allocated time – 60 mins*

Instructions for the interviewer: Please ensure that all Main Questions are asked to all focus groups. Follow up questions, probes and prompts should be used to suit the answers provided by individual athletes and stakeholders and to gain full answers to the main question.

Discuss this is an open and confidential discussion forum to gather 'experts' opinion on the importance of sleep and mental health for elite athletes and athletic performance. Ensure consent forms have been collected from all participants prior to the focus group discussion commencing. Acknowledge to the participants that session's audio will be recorded and transcribed ensuring information from participants is de-identified.

Introduction: Introduce the topic of mental health and sleep in sport and state that you are looking to better understand their views on mental health and sleep in sport and their potential effects on athletic performance.

Start by discussing what all participants think mental health is and create a working definition of mental health for each focus group.

Elite Athletes Focus Group Schedule

Main Question	Follow-up Questions/Probes	Prompts	Area of Investigation	Reference(s)
How important do you think **mental health** is to training or competitive performance?	• Is mental health an issue for athletes? If so, to what extent? • In what way(s) do you think mental health impacts training or competitive performance?	• Increasing public awareness through more athletes speaking openly about mental health • Personal experience(s)? • Can you tell me more about that? • Can you give me an example?	Mental health and performance	Drew et al., (2017); Schinke et al. (2017)
Is there anything you do to protect and boost your mental health?	• Does your sport do anything to help you with your mental health?	• Can you tell me more about that? • Can you give me an example?	Mental health	Henriksen et al. (2019); Gulliver et al., (2015) Reardon et al. (2019); Wolanin et al., (2015)

What do you understand good mental health to be?		• Can you tell me more about that? • Can you give me an example?	Mental health	Henriksen et al. (2019)
As an athlete, have you experienced any barriers to good mental health?	• Why do you think that is the case?	• Can you tell me more about that?	Mental health	N/A
To what extent, in your opinion, does sleep impact mental health?	• Do you think that one has a greater effect on the other? Is one more important than the other?	• Can you tell me more about that? • Can you give me an example? •	Mental health and sleep	Charest & Gardner (2020)
To what extent, in your opinion, would improving sleep help to improve mental health?	• Is mental health and sleep an important relationship for athletes?	• Can you tell me more about that?	Mental health and sleep	Charest & Gardner (2020)

How important do you think is **sleep** to training or competitive performance?	• In what way(s) do you think sleep impacts training or competitive performance? • Is sleep an issue for athletes? If so, to what extent?	• Can you tell me more about that? • Can you give me an example?	Sleep and performance	Halson, (2013); Roberts et al. (2019); Simpson et al. (2017)
To what extent, in your opinion, would improving sleep help to improve training or competitive performance?	• What helps you to sleep better? • What, in anything, impacts your sleep? • How do you think sleep in athletes could best be improved in sport?	• Sleep hygiene practices • Sleep quality • Education • Sleep duration	Sleep and performance	Bonnar et al. (2018); Driller et al., (2019); Schwartz & Simon (2015)

Sporting Stakeholders (e.g. coaches, medical professionals, HP staff) Focus Group Schedule

Main Question	Follow-up Questions/Probes	Prompts	Area of Investigation	Reference(s)
How important do you think **mental health** is to training or competitive performance?	• Is mental health an issue for athletes? If so, to what extent? • In what way(s) do you think mental health impacts training or competitive performance?	• Increasing public awareness through more athletes speaking openly about mental health • Personal experience(s)?	Mental health and performance	Drew et al., (2017); Schinke et al. (2017)
Is there anything you do to protect and boost athletes' mental health?	• What support is currently available to your athletes? • What support would you like to be made available to your athletes?	• Can you tell me more about that? • Can you give me an example?	Mental health and performance	Reardon et al. (2019)

What do you understand **good mental health** to be?		• Can you tell me more about that? • Can you give me an example?	Mental health	Henriksen et al. (2019)
As an coach/staff member, have you seen any athletes experience any barriers to good mental health?	• Why do you think that is the case?	• Can you tell me more about that?	Mental health	N/A
To what extent, in your opinion, does sleep impact mental health?	• Do you think that one has a greater effect on the other? Is one more important than the other?	• Can you tell me more about that? • Can you give me an example?	Mental health and sleep	Charest & Gardner (2020)
To what extent, in your opinion, would improving sleep help to improve mental health?	• Is mental health and sleep an important relationship for athletes?	• Can you tell me more about that?	Mental health and sleep	Charest & Gardner (2020)

How important do you think is **sleep** to training or competitive performance?	• In what way(s) do you think sleep impacts training or competitive performance? • Is sleep an issue for athletes? If so, to what extent?	• Can you tell me more about that? • Can you give me an example?	Sleep and performance	Halson, (2013); Roberts et al. (2019); Simpson et al. (2017)
To what extent, in your opinion, would improving sleep help to improve training or competitive performance?	• How do you think sleep in athletes could best be improved in sport?	• Sleep hygiene practices • Sleep quality • Education • Sleep duration	Sleep and performance	Bonnar et al. (2018); Driller et al., (2019); Schwartz & Simon (2015)

Appendix L: Study 2 Demographics Questionnaire

Understanding the perspectives of elite athlete and key stakeholders on the importance of sleep and mental health to athletic performance

Demographics Questionnaire

For Athletes

The following information will be collected for purposes of the research project. All information will remain confidential:

Surname: _____ First name: _____

Age (years only): _____ Sport: _____

1. How do you describe yourself?
   - ☐ As a man
   - ☐ As a woman
   - ☐ In any other way (please specify: _____)
   - ☐ Prefer not to say
2. Is your gender the same as your sex assigned at birth?
   - ☐ Yes
   - ☐ No
   - ☐ Prefer not to say
3. How do you describe your sexuality?
   - ☐ Heterosexual or straight
   - ☐ Gay
   - ☐ Lesbian
   - ☐ Bisexual
   - ☐ In any other way (please specify: _____)
   - ☐ Prefer not to say

   How do you describe your ethnic identity?

   _____

   _____

4. Are you an AIS scholarship holder?
   - ☐ Yes
   - ☐ No

5. What level in the talent pathway are you currently?
   - □ T1
   - □ T2
   - □ T3
   - □ T4
   - □ E1
   - □ E2
   - □ M1
   - □ Other (please specify: _____)
   - □ Prefer not to say
6. How many years have you been competing at your current talent pathway level?
   - □ Less than 12 months
   - □ 1 – 2 years
   - □ 2 – 3 years
   - □ 3 – 4 years
   - □ 4 – 5 years
   - □ More than 5 years

   How many years have you been competing at any level within the talent pathway?
   - □ Less than 12 months
   - □ 1 – 2 years
   - □ 2 – 3 years
   - □ 3 – 4 years
   - □ 4 – 5 years
   - □ More than 5 years
7. Have you had any medical issues within the past 12 months?
   - □ Yes (go to question 9)
   - □ No
   - □ Prefer not to say

9. If you have had any medical issues within the past 12 months, please describe them below.

_____
_____
_____
_____

SECTION 1

The following questions relate to your experiences of mental health resources, such as education and services.

Question 1. Do you currently have access to any mental health resources and/or services?

- ☐ Yes (go to Question 2)
- ☐ No (go to Question 6)
- ☐ Not sure

Question 2. What mental health resources (e.g., services) do you have available to you? (select all that apply)

- ☐ Psychologist or other mental health professional (e.g., psychiatrist, counsellor) outside of your sport
- ☐ Psychologist or other mental health professional (e.g., psychiatrist, counsellor) within your sport
- ☐ Athlete Wellbeing & Engagement Manager
- ☐ High performance medical/health staff (e.g., doctor, physio etc)
- ☐ Other high-performance staff (please specify: _____)
- ☐ Coach(es)
- ☐ GP
- ☐ Mental health education and/or information (within your sport)
- ☐ Mental health education and/or information (outside of your sport)
- ☐ Other (please specify: _____)
- ☐ Not sure
- ☐ Prefer not to say

Question 3. Have you ever accessed these services?

- ☐ Yes (go to Question 4)
- ☐ No (go to Question 8)
- ☐ Prefer not to say

Question 4. Which of the following services have you accessed within the last 12 months?

□ Psychologist or other mental health professional (e.g., psychiatrist, counsellor) outside of your sport

□ Psychologist or other mental health professional (e.g., psychiatrist, counsellor) within your sport

□ Athlete Wellbeing & Engagement Manager

□ High performance medical/health staff (e.g., doctor, physio etc)

□ Other high-performance staff (please specify: _____)

□ Coach(es)

□ GP

□ Mental health education and/or information (within your sport)

□ Mental health education and/or information (outside of your sport)

□ Other (please specify: _____)

□ Prefer not to say

Question 5. Which of the following services have you accessed within the last 5 years?

□ Psychologist or other mental health professional (e.g., psychiatrist, counsellor) outside of your sport

□ Psychologist or other mental health professional (e.g., psychiatrist, counsellor) within your sport

□ Athlete Wellbeing & Engagement Manager

□ High performance medical/health staff (e.g., doctor, physio etc)

□ Other high-performance staff (please specify: _____)

□ Coach(es)

□ GP

□ Telephone support (e.g., Lifeline, Beyond Blue)

□ Internet support (e.g., Lifeline, Beyond Blue)

□ Mental health education and/or information (outside of your sport)

□ Other (please specify: _____)

□ Prefer not to say

Question 6. Did you find the service(s) beneficial? What did you like about it?

_____
_____
_____
_____

Question 7. Is there anything that you feel would help to improve these services?

_____
_____
_____
_____

Question 8. Have you ever attended a workshop/education session on mental health?

□ Yes (go to Question 9)

□ No (go to Section 2)

□ Not sure

□ Prefer not to say

Question 9. If you have attended a workshop/education session on mental health, did you like it? What did you find beneficial about the session?

_____
_____
_____
_____

Question 10. Did you encounter any issues with the workshop/education session? Is there anything that you feel would help to improve it in the future?

_____
_____
_____
_____

Question 11. Is there any other information that you would like to provide about your experiences of mental health services and resources, including access to services, available resources, and education?

SECTION TWO

The following questions relate to your experiences of sleep resources, such as education and services.

Question 1. Do you currently have access to any sleep resources and/or services (for example, a sleep specialist, sleep education, aids to help you sleep)?

- ☐ Yes (go to Question 2)
- ☐ No (go to Question 3)
- ☐ Not sure
- ☐ Prefer not to say

Question 2. What sleep resources (e.g., services) do you have available to you?

- ☐ Sleep specialist or psychologist outside of your sport
- ☐ Sleep specialist or psychologist within your sport
- ☐ Athlete Wellbeing & Engagement Manager
- ☐ High performance medical/health staff (e.g., doctor, physio etc)
- ☐ Other high-performance staff (please specify: _____)
- ☐ Coach(es)
- ☐ GP
- ☐ Internet support/resources
- ☐ Sleep education and/or information (outside of your sport)
- ☐ Other (please specify: _____)
- ☐ Not sure
- ☐ Prefer not to say

Question 3. Have you ever accessed these services?

- ☐ Yes (go to Question 4)
- ☐ No (go to Question 8)
- ☐ Prefer not to say

Question 4. Which of the following services have you accessed within the last 12 months?

- ☐ Sleep specialist or psychologist outside of your sport
- ☐ Sleep specialist or psychologist within your sport
- ☐ Athlete Wellbeing & Engagement Manager
- ☐ High performance medical/health staff (e.g., doctor, physio etc)
- ☐ Other high-performance staff (please specify: _____)
- ☐ Coach(es)
- ☐ GP
- ☐ Internet support/resources
- ☐ Sleep education and/or information (outside of your sport)
- ☐ Other (please specify: _____)
- ☐ Not sure
- ☐ Prefer not to say

Question 5. Which of the following services have you accessed within the last 5 years?

- ☐ Sleep specialist or psychologist outside of your sport
- ☐ Sleep specialist or psychologist within your sport
- ☐ Athlete Wellbeing & Engagement Manager
- ☐ High performance medical/health staff (e.g., doctor, physio etc)
- ☐ Other high-performance staff (please specify: _____)
- ☐ Coach(es)
- ☐ GP
- ☐ Internet support/resources
- ☐ Sleep education and/or information (outside of your sport)
- ☐ Other (please specify: _____)
- ☐ Not sure
- ☐ Prefer not to say

Question 6. Did you find the service(s) beneficial? What did you like about it?

_____
_____
_____
_____

Question 7. Is there anything that you feel would help to improve these services?

_____
_____
_____
_____

Question 8. Have you ever attended a workshop/education session on sleep?

□ Yes (go to Question 9)

□ No

□ Not sure

Question 9. If you have attended a workshop/education session on mental health, did you like it? What did you find beneficial about the session?

_____
_____
_____
_____

Question 10. Did you encounter any issues with the workshop/education session? Is there anything that you feel would help to improve it in the future?

_____
_____
_____
_____

Thank you for your answers.

Understanding the perspectives of elite athlete and key stakeholders on the importance of sleep and mental health to athletic performance

Demographics Questionnaire

For Coaches / Support Staff

The following information will be collected for purposes of the research project. All information will remain confidential:

Surname: _____ First name: _____

Age (years only): _____ Sport: _____

Qualifications: _____

What is your role(s) in your sport: _____

1. How do you describe yourself?
   - ☐ As a man
   - ☐ As a woman
   - ☐ In any other way (please specify: _____)
   - ☐ Prefer not to say
2. Is your gender the same as your sex assigned at birth?
   - ☐ Yes
   - ☐ No
   - ☐ Prefer not to say
3. What do you describe your sexuality?
   - ☐ Heterosexual or straight
   - ☐ Gay
   - ☐ Lesbian
   - ☐ Bisexual
   - ☐ In any other way (please specify: _____)
   - ☐ Prefer not to say
4. How do you describe your ethnic identity?

   _____

   _____
5. What level in the talent pathway are you currently coaching/working at?
   - ☐ T1
   - ☐ T2
   - ☐ T3
   - ☐ T4
   - ☐ E1
   - ☐ E2
   - ☐ M1

- □ Other (please specify: _____)
- □ Prefer not to say

6. How many years have you been working at your current talent pathway level?
   - □ Less than 12 months
   - □ 1 – 5 years
   - □ 5-10 years
   - □ More than 10 years

   How many years have you been working at any level within the talent pathway?
   - □ Less than 12 months
   - □ 1 – 5 years
   - □ 5-10 years
   - □ More than 10 years

7. Who do you coach / work with?
   - □ Single-sex athletes
   - □ Mixed sex athletes
   - □ Able-bodied athletes
   - □ Athletes with an impairment
   - □ Other (please specify: _____)
   - □ Prefer not to say

SECTION 1

The following questions relate to your experiences of mental health resources, such as education and services, to help you in your work with elite athletes.

Question 1. Have you had any training in mental health first aid?

- □ Yes (go to question 2)
- □ No (go to question 4)
- □ Prefer not to say

Question 2. Did you find the training beneficial? What did you like about it?

_____
_____
_____
_____

Question 3. Is there anything that you feel would help to improve the quality of the training?

_____
_____
_____
_____

Question 4. Have you ever attended a workshop/education session on mental health?

- □ Yes (go to Question 5)
- □ No (go to Section 2)
- □ Not sure
- □ Prefer not to say

Question 5. If you have attended a workshop/education session on mental health, did you like it? What did you find beneficial about the session?

_____
_____
_____
_____

Question 6. Did you encounter any issues with the workshop/education session? Is there anything that you feel would help to improve it in the future?

_____
_____
_____
_____

Question 7. Is there any other information that you would like to provide about your experiences of mental health services and resources, including access to services, available resources, and education?

_____
_____
_____
_____

SECTION TWO

The following questions relate to your experiences of sleep resources, such as education and services, to help you in your work with elite athletes.

Question 1. Have you had any training in helping athletes' with their sleep?

- □ Yes (go to question 2)
- □ No (go to question 4)
- □ Prefer not to say

Question 2. Did you find the training beneficial? What did you like about it?

_____
_____
_____
_____

Question 3. Is there anything that you feel would help to improve the quality of the training?

_____
_____
_____
_____

Question 4. Have you ever attended a workshop/education session on sleep?

- □ Yes (go to Question 5)
- □ No
- □ Not sure
- □ Prefer not to say

Question 5. If you have attended a workshop/education session on mental health, did you like it? What did you find beneficial about the session?

_____
_____
_____

Question 6. Did you encounter any issues with the workshop/education session? Is there anything that you feel would help to improve it in the future?

_____
_____
_____

Question 7. Is there any other information that you would like to provide about your experiences of mental health services and resources, including access to services, available resources, and education?

_____

_____

_____

Thank you for your answers.

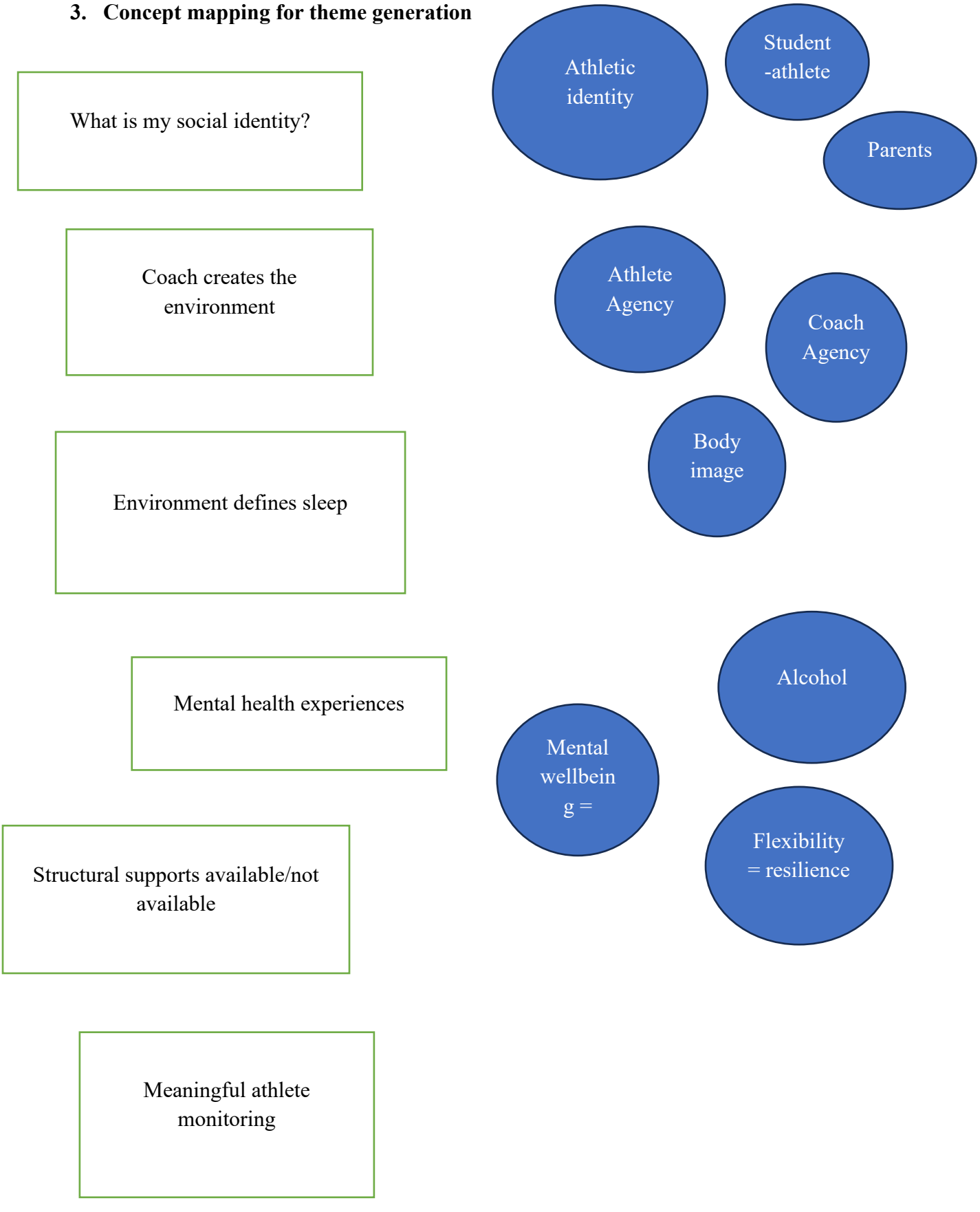
Appendix M: Preliminary Qualitative Data Analysis

1. Example of initial Codebook for data coding

Name	Description	Files	References
Mental Health Definition	Working definition of what mental health is provided by athletes and coaches participating in the focus groups	2	9
Importance of mental health to athletic performance	Perspectives from athletes and coaches on the importance of mental health to athletic performance	2	9
Protective Strategies for Athletes' MH	Strategies used by athletes to protect and/or improve their mental health	2	7
Barriers to Mental Health	Perspectives from athletes and coaches on barriers to athletes' mental health	2	5
MH and sleep relationship for athletes	Perspectives from athletes and caches on the relationship between mental health and sleep	2	12
Impact of sleep on MH	Perspectives from athletes and coaches on the impact of sleep on athletes' mental health	2	9
Importance of sleep on athletic performance	Perspectives from athletes and coaches on the importance of sleep to athletic performance	2	11
Barriers to sleep / Sleep as an issue for athletes	Perspectives from athletes and coaches on whether they perceive sleep as an issue for athletes	2	8
Protective & Proactive Strategies for Sleep	Strategies used by athletes to aid sleep	2	9

2. Initial coding for theme generation

3. Concept mapping for theme generation



Appendix N: Primary themes generated with definitions and quotes contextualising the themes

Theme	Definition	Example quotes
What is my experience and understanding of mental health	This theme explores the lived experiences of participants in the focus groups in relation to mental health. In particular, participants described different definitions and conceptualisations of mental health, and what they understood mental health to mean in the context of Australian high-performance sport.	A mentally well person is able to cope well with challenges. Mental health is the overall healthiness of your mind and having a balance of all the emotions.
What is my social identity	Athletes can have multiple social identities, but often a core social identity is strongly linked to their capabilities as an athlete.	I think, particularly for young athletes, sport in general is very *isolating*. Like it is their life. So, it actually removes them from [life] outside of sport environments.
Coach(es) create the environment	Coaches in the focus groups expressed a belief that they were responsible for creating a safe, high-performance ecosystem that supported the mental health of the athletes that they worked with.	There are times when an athlete uses this [training] as an *escape* from their problems, so it doesn't show here. Which is why you need to know your athletes, know who they are and what they are, what they are doing, what they are thinking. You can't just train them and forget about them.
My environment defines my sleep	Participants felt that athletes' sleep was defined by their sporting environment, including training schedules.	Sleep can be improved in athletes by having training times not super early and not super late in the day. I struggled to get good sleep after a late-night session finishing at 9.30pm because I'm so wired from training
What supports do I [athletes] have?	Barriers and facilitators to accessing support for mental health and/or sleep	I think the culture of accessing support is definitely changing, but that still is a barrier in some ways. People don't want to be seen to be asking for help or accessing help.
You monitor my wellbeing… but what happens with my data?	Benefits and pitfalls of monitoring athletes' health and wellness, including mood and sleep. Use of wearable technologies	Monitoring athletes is a double-edged sword. Because more information is power, but it can be harmful too.

Appendix O: Study 3 Ethics Approval

THE UNIVERSITY OF SYDNEY

RESEARCH INTEGRITY
& ETHICS ADMINISTRATION

HUMAN RESEARCH ETHICS APPROVAL

The University of Sydney confirms that this project meets the requirements of the National Statement on Ethical Conduct in Human Research.

Project identifier:	2024/HE000041
Project title:	Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study
Version:	0.01
Chief Investigator:	Suzi Edwards
Authorised project team:	Shona Halson
	Elizabeth Cayanan
	Harley De Vos
	Kotryna Fraser
	Liam Toohey
	Renee Appaneal
	Shane Ball
Date of approval:	Friday, 7 June, 2024
Project end date:	06 Jun 2028

Project summary

This research project is seeking to be the first study to use Cognitive Behavioural Therapy for Insomnia techniques (specifically sleep education, sleep behaviour strategies, cognitive strategies, and relaxation techniques) to improve sleep quality, sleep duration, and mental wellbeing in Australian elite/pre-elite athletes.

Documents approved

Document type	File name	Document version	Application version
Survey or questionnaire	20240109_Demographics Survey.docx	1	0.01 - Initial Application
Participant Consent Form (PCF)	20240109_Participant Consent Form for Organis.docx	1	0.01 - Initial Application
Participant Consent Form (PCF)	20240109_Participant Consent Form for Parents.docx	1	0.01 - Initial Application
Participant Consent Form (PCF)	20240109_Participant Consent Form.docx	1	0.01 - Initial Application
Survey or questionnaire	20240109_Sleep Diary.pdf		0.01 - Initial Application
Survey or questionnaire	20240109_Sleep Intervention Evaluation Form.docx		0.01 - Initial Application

THE UNIVERSITY OF SYDNEY

Human Ethics Approval certificate

Document type	File name	Document version	Application version
Survey or questionnaire	20240109_Survey Booklet.docx	1	0.01 - Initial Application
Project protocol	20240220_Clinical Trial Protocol.docx	3	0.01 - Initial Application
Participant Information Statement (PIS)	20240221_Organisation PIS version 1.1 cleaned.docx	1.1	0.01 - Initial Application
Participant Information Statement (PIS)	20240221_Participant Information Statement ve.docx	1.1	0.01 - Initial Application
Participant Information Statement (PIS)	20240221_PIS for Parents Guardians version 1..docx	1.1	0.01 - Initial Application
Recruitment or advertising material	20240221_Revised Study Flyer.pdf		0.01 - Initial Application

Conditions of Approval for Clinical Trials

This letter constitutes ethical approval only. This project cannot proceed at any site until the necessary research governance authorisation is obtained.

- If your study is sponsored by the University or is to be conducted on a University of Sydney site, you must comply with additional University governance requirements prior to commencing at each site. Please contact the Clinical Trials Support Office at clinical-trials.research@sydney.edu.au.
- Clinical Trials must be registered on a clinical trials registry that complies with the International Committee of Medical Journal Editors (ICMJE). For trials conducted in Australia or New Zealand registration should be on the Australian New Zealand Clinical Trial Registry before recruitment of the first subject (http://www.anzctr.org.au/).
- If your trial is to be conducted under the Clinical Trials Notification (CTN) or Clinical Trials Approval (CTA) schemes should not commence until it has been notified to the Therapeutic Goods Administration (TGA).

Conditions of Approval

- Research must be conducted according to the approved proposal.
- An annual progress report must be submitted on or before the anniversary of approval and a final report on completion of the project.
- You must report as soon as practicable anything that might warrant review of ethical approval of the project including:
  - Serious or unexpected adverse events (which should be reported within 72 hours).
  - Unforeseen events that might affect continued ethical acceptability of the project.
- Any changes to the proposal must be approved prior to their implementation (except where an amendment is undertaken to eliminate *immediate* risk to participants).

THE UNIVERSITY OF SYDNEY

Human Ethics Approval certificate

- Researchers working on this project must be sufficiently qualified by education, training, and experience for their role, or adequately supervised. Changes to the project team must be reported and approved.
- Researchers must disclose any actual, potential of perceived conflicts of interest, including any financial or other interest or affiliation, as relevant to this project.
- Research data and primary materials must be retained and stored in accordance with relevant legislation and University guidelines.
- Ethics approval is dependent upon ongoing compliance of the research with the *National Statement on Ethical Conduct in Human Research*, the *Australian Code for the Responsible Conduct of Research*, applicable legal requirements, and with University policies, procedures, and governance requirements.
- If your research project is a clinical trial and is being sponsored by the University or is to be conducted on a University of Sydney site, you must comply with additional University governance requirements prior to commencing your Clinical Trial.
- The University may conduct audits on approved projects.
- The Chief Investigator has ultimate responsibility for the conduct of the research and is responsible for ensuring all others involved will conduct the research in accordance with the above.

Ethics Committee Representative

Chair
On behalf of the University of Sydney

The University of Sydney HRECs are constituted and operate in accordance with the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research (NHMRC). All personnel named on the project should be acquainted with these documents.

Research Integrity & Ethics Administration
Research Portfolio
Level 3, Michael Spence Building (F23)
The University of Sydney
NSW 2006 Australia

T +61 2 9036 9161
E human.ethics@sydney.edu.au
W intranet.sydney.edu.au/ethics

ABN 15 211 513 464
CRICOS 00026A

Appendix P: Study 3 HREC Application

HUMAN RESEARCH ETHICS COMMITTEE (HREC) - ONLINE APPLICATION QUESTIONS

The Human Ethics application in IRMA has four tabs, one of which includes a questionnaire. To aid planning, this document provides the questions applicants will encounter when entering their ethics application in IRMA.

The questions are ordered as they will appear in IRMA within their sections. Depending on the response given, not all questions will be presented. The question numbers shown are system-generated and are only visible in this document to indicate the next question that would be presented online.

A range of support materials are provided at the Research Support site under both Ethics and IRMA

topics.

Coversheet

Lay summary of the project:

Provide a clear, plain English summary of the project

Protocol title: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

Chief investigator:

Dr Suzi Edwards.

Internal investigators:

Select 1 of the following for each person you list below:

Chief investigator

Co-investigator

Honours student

Masters student

PhD student

Peer-reviewer

Project manager

Research Assistant

Trial co-ordinator

Undergraduate student

STAFF ID (if known)	Name	FACULTY/SCHOOL (if known)	Role

	Mr Harley de Vos (he/him)	Faculty of Health	PhD Student
	Dr Kotryna Fraser (she/her)	Faculty of Health	Co-Investigator

External investigators:

Must complete an external investigator declaration form

Select 1 of the following for each person you list below:

Chief investigator

Co-investigator

Honours student

Masters student

PhD student

Peer-reviewer

Project manager

Research Assistant

Trial co-ordinator

Undergraduate student

Name	COUNTRY	INSTITUTE	Role
Dr Renee Appaneal	Australia		Co-Investigator
Prof Shona Halson	Australia	Australian Catholic University	Co-Investigator

Dr Liam Toohey	Australia	University of Canberra	Co-Investigator

Contracts and Grants:

Questionnaire

1.0 Welcome to the University of Sydney's Human Ethics Application Questionnaire.

Please be aware that there is a limit of fifteen minutes to complete each individual question. If you exceed this time then your answer may not be saved by the system. We recommend that you prepare long answers outside of IRMA before pasting it back into the report questionnaire and/or save your answers regularly.

If you choose to edit a previous question, your responses to subsequent questions will be deleted. The restore button can be used to refill your subsequent answers if this happens.

For further information on the application procedure, please consult our website or email the Human Ethics team at ro.humanethics@sydney.edu.au

If you experience any technical difficulties, please do not hesitate to contact Research Support using the details below:

T +61 2 8627 8183

E research.support@sydney.edu.au

Section A

Section A is designed to identify student projects that may be eligible to be reviewed by a low-risk sub-committee of the University of Sydney HREC. In addition, this Section also seeks to identify projects that have been approved by other ethics committees.

1.0 You are about to begin the HREC application form.

Continue – directed to 120.0

120.0 Is this project a University of Sydney student project ONLY (i.e. ethics application restricted to the activities of the student research project)?

No - Go to question 130.0

Yes - Go to question 125.0

125.0 Select appropriate student classification:

- Undergraduate
- Honours
- Masters
- **PhD**

Go to question 130.0

130.0 Indicate whether this project has been or will be submitted to any other ethics committees

No - Go to SECTION B

Yes – Go to Q280.0

280.0 Is the responsible ethics committee Australian?

No - Go to question 305.0

Yes - Go to question 300.0

300.0 Is the responsible ethics committee registered with the National Health and Medical Research Council (NHMRC)?

No - Go to SECTION B

Yes - Go to question 325.0

305.0 Will the participants be recruited in Australia?

No - Go to question 315.0

Yes - Go to SECTION B

315.0 Is your research funded by a grant administered by the University of Sydney (this does NOT include scholarships)?

No - Go to question 325.0

Yes - Go to question 320.0

320.0 Is this HREC part of the Federal Wide Assurance?

No - Go to SECTION B

Yes - Go to SECTION B

325.0 Under the University of Sydney Procedures you do not require ethics approval from the University HREC if: - your study has already been approved by an ethics committee registered with the NHMRC and that committee has stated in writing its willingness to be responsible for ALL sites at which the research is to be conducted. Or - your study has already been approved by an overseas ethics committee AND there is no funding, or the funding is being administered by another institution. Please clarify below why you are applying for ethics approval from the University of Sydney HREC. (If you do not wish to continue please contact the Ethics Office on ro.humanethics@sydney.edu.au to unsubmit your application).

Go to SECTION B

Section B

Section B is designed to determine whether your study falls within the National Statement's definition of low or negligible risk. Throughout this section, you may be asked specific additional questions where you indicate that your study involves particular participant and/ or project types. In this document, these additional questions have been included in the Appendices.

Please note that the option "Possible Recruitment" with reference to specific participant populations indicates that these people MAY be recruited into your study, but are not the specific population of interest. If this population is the focus of your study, you should select "Yes".

Please answer the following questions

400.0 Does your research involve women who are pregnant and the human foetus?

Yes - see Appendix 1

No - Go to question 480.0

480.0 Does your study involve children and/or young people (i.e. younger than 18 years)?

Yes - see Appendix 2

No - Go to question 590.0

590.0 Does your study involve people in existing dependent or unequal relationships with the researcher(s)?

Yes - see Appendix 3

No - Go to question 620.0

620.0 Does your research involve people with a cognitive impairment, an intellectual disability or a mental illness?

Yes - see Appendix 4

No - Go to question 680.0

Possible Recruitment - Go to question 680.0

680.0 Does your research involve people highly dependent on medical care who may be unable to give consent?

Yes - see Appendix 5

No - Go to question 710.0

710.0 Does your study have the potential to discover illegal activity by participants or others? This includes research intending to expose illegal activity, as well as research not specifically designed to, but likely to discover, illegal activity.

Yes - see Appendix 6

No - Go to question 760.0

760.0 Does your research involve Aboriginal and/or Torres Strait Islander peoples?

Yes - see Appendix 7

No - Go to question 920.0

Possible Recruitment - Go to question 920.0

920.0 Does your research involve CALD (Culturally and Linguistically Diverse) people?

Yes

No

Possible Recruitment

Go to question 930.0

930.0 Does your research involve travel overseas?

Yes - see Appendix 8

No - Go to question 1020.0

1020.0 Is your study likely to cause or elicit distress in participants due to its subject matter, the procedures involved, information that might be revealed about the participant or related persons, or in some other way?

No

Yes

Go to question 1030.0

1030.0 Does your study involve research that could jeopardise a participant's employment?

Yes - see Appendix 9

No - Go to question 1080.0

1080.0 Is your proposed research a clinical trial? A clinical trial is a form of research designed to find out the effects of an intervention, including a treatment or diagnostic procedure. A clinical trial can involve testing a drug, a surgical procedure, other therapeutic procedures and devices, a preventive procedure, or a diagnostic device or procedure.

Yes - see Appendix 10

No - Go to question 1600.0

1600.0 Does your study involve the use of human tissue?

Yes - see Appendix 11

No - Go to question 2070.0

2070.0 Does your study involve human genetics or human stem cells?

No

Yes

Go to question 2080.0

2080.0 Does your study involve limited disclosure involving active concealment and/or planned deception?

Yes - see Appendix 12

No - Go to question 2130.0

2130.0 Does your study involve research that poses a risk to the physical or emotional safety or welfare of a University of Sydney student researcher (e.g. honours student or postgraduate student)?

Yes - see Appendix 13

No - Go to question 2150.0

2150.0 Does your research involve any of the following:

• Collection of biological samples (e.g. blood, saliva, bodily fluids).

• Physical screening (e.g. blood pressure, cholesterol, physical fitness, MRI scans).

• Physical exertion? (i.e. physical activity, exercise)

No

Yes

Some projects will be directed to the following extra questions

2170.0 Does the research ONLY involve existing collections of data or records about human beings (collected with appropriate ethical approval)?

No - Go to question 2230.0

Yes - Go to question 2180.0

2180.0 Indicate whether the data/records to be used in this research project will be:

- Non-identifiable - Go to question 2190.0
- Re-identifiable - Go to question 2230.0

- Individually Identifiable - Go to SECTION C

For definitions of these terms please refer to the *National Statement on Ethical Conduct in Human Research*, Chapter 3.2

2190.0 According to Sydney University guidelines you do not require HREC approval. Would you like to seek approval for publication or other reasons?

No - end of questions (negligible risk)

Yes - Go to question 2195.0

2195.0 Please outline why you are seeking ethics approval

Go to SECTION C

2230.0 Is there a foreseeable risk of more than 'discomfort'? For a useful description of the differences between harm, discomfort and inconvenience please refer to the *National Statement on Ethical Conduct in Human Research*, Chapter 2.1

No

Yes

Go to SECTION C

Section C

Section C is designed to determine whether there are any conflicts of interests which may compromise the research process.

2340.0 Are any "conflict of interest" issues likely to arise in relation to this research?

No - Go to question 2360.0

Yes - Go to question 2350.0

2350.0 Please provide details of the potential conflicts of interests

Go to question 2360.0

2360.0 Do the researchers have any affiliation with, or financial involvement in, any organisation or entity with direct or indirect interests in the subject matter or materials of this research? (Note that such benefits must be declared in the Participant Information Statement)

No - Go to question 2380.0

Yes - Go to question 2370.0

2370.0 Please provide details of this financial affiliation or involvement

Go to question 2380.0

2380.0 Do the researchers expect to obtain any direct or indirect financial or other benefits from conducting this research? (Note that such benefits must be declared in the Participant Information Statement)

No - Go to question 2400.0

Yes - Go to question 2390.0

2390.0 Please provide details of these financial or other benefits

Go to question 2400.0

2400.0 Have conditions already been imposed OR are likely to be imposed in the future, upon the use (e.g. publication), or ownership of the results (e.g. scientific presentations) or materials (e.g. audio-recordings), by any party other than the listed researchers?

No - Go to SECTION D

Yes - Go to question 2410.0

2410.0 Please provide details of the conditions imposed

Go to SECTION D

Section D

The questions in Section D are specifically directed at the consent process.

2540.0 Describe how you will identify and select potential participants for recruitment into the study. You should include information about how you will obtain contact details for potential participants.

Go to question 2550.0

Potential participants for recruitment into the study will be athletes (including university and high-school athletes) that compete at the pre-elite or elite stages of the talent pathway identified by Sydney University Sport and Fitness (SUSF), their National Sporting Organisation, National Institute Network, or National Basketball Association Global Academy based at the Australian Institute of Sport. National Sporting Organisations and National Institute Networks will be contacted by the research team via email with a study flyer and PIS to seek their interest in allowing their athletes to participate, and to obtain their organisational consent. Potential participants will be contacted directly by their National Sporting Organisation, National Institute Network, or National Basketball Association Global Academy with details of this study. Interested participants will contact the research team directly to express their interest in participating and to avoid perceived or actual coercion from the sporting organisation.

Additionally, the research team may seek permission from appropriate parties so that study flyers may be displayed at the SUSF gym, at the ACT Academy of Sport gym, in training facilities at the Australian Institute of Sport, and/or relevant social media pages (e.g., LinkedIn, Facebook groups, X, etc.). Interested participants will contact the research team directly to express their interest in participating.

Recruitment and/or will not be prompted by a coach or trainer to reduce the likelihood of coercion. Recruitment will occur with a combination of study flyers and on occasion, there may be the opportunity for the researchers to present the research study to athlete groups. Our research team will approach Sydney University Sport and Fitness coaches to request permission to present the project outline at a training session and provide study flyers.

The potential high-school student athletes recruited for this study will only be i) young adults (aged between 16 to 18 years) who ii) reside at the Australian Institute of Sport (Canberra, ACT) as part of the Basketball Australia (National Sporting Organisation) Centre of Excellence or National Basketball Association Global Academy.

Regardless of how potential participants are recruited, participation in this study will be on voluntary basis and require informed consent. Parent/guardian consent will be obtained for the participants under 18 years of age.

2550.0 Describe how and where initial contact will be made with potential participants and how you will avoid real or perceived coercion. Copies of all relevant correspondence (e.g. email, letter of introduction, covering letter, circular/flyer etc.) need to be uploaded with your application. If you are using email addresses please outline how their use will not be in breach of privacy or spam legislation.

Initial contact will be through the athlete seeing the flyer or online post or receiving an email from their SUSF sporting club, National Sporting Organisation, National Institute Network, or National Basketball Associate Global Academy.

Participation in this study will be on a voluntary basis and require informed consent. Parent/guardian consent will be obtained for the participants under 18 years of age. Recruitment will not be prompted by a coach or trainer to reduce the likelihood of coercion. Only participants who willingly approach researchers or register interest by contacting the research team via email or phone will be considered for the study.

The use of email addresses for communication will be on the basis of provision by the interested participant only. Any email addresses from potential participants will not be shared with anyone outside of the research team, and email communications with potential participants will only involve information related to the research study.

Go to question 2570.0

2570.0 If a participant, or person on behalf of a participant, chooses to withdraw from the research, what specific consequences should they be made aware of, prior to giving consent? These details should be included in the Participant Information Statement.

Go to question 2580.0

2580.0 Will participants receive any reimbursement of out-of-pocket expenses, or financial or other "rewards" as a result of participation?

No - Go to question 2600.0

Yes - Go to question 2590.0

2590.0 Specify the nature and value of any proposed incentive/payment (e.g. movie tickets, food vouchers) or reimbursement (e.g. travel expenses) to participants. Explain why this offer will not impair the voluntary nature of the consent, whether by participants or persons deciding for their behalf. Payment that is disproportionate to the time involved, or any other inducement that is likely to encourage participants to take risks, is ethically unacceptable. (See 2.2.10 and 2.2.11 of the National Statement). Note that monetary amounts should not be specified in advertisements, but payments should be disclosed in the Participant Information Statement in accordance with 2.2.6 (j) of the National Statement.

Go to question 2600.0

2600.0 How will consent be obtained (more than one may apply)

- **Written**
- Oral
- Return of a Survey
- Other

Go to question 2605.0

2605.0 Please clarify your response to the question above and justify with reference to the National Statement (e.g. sections 2.2.5, 3.1.16, 5.2.16). For instance, if you indicated that consent will be written and oral, does this refer to all participants undergoing written and

oral consent or does it refer to different consent processes for different participant groups? You should also justify why you have chosen these forms of consent. If you are using oral consent, explain how it will be recorded (e.g. in field notes, using tape recording).

All participants will provide written informed consent prior to participating in the study. In the case of participants under 18 years old, written consent will be required from a parent/guardian as well as the participant. Written consent is considered an appropriate form of consent as the prospective athlete participants will have an adequate level of comprehension. Written consent is considered accessible for the prospective participants of this study.

Go to question 2610.0

2610.0 Will there be participants who are not fluent in English or who have difficulty understanding English?

No - Go to question 2670.0

Yes - Go to question 2620.0

2620.0 In what language(s) will the research be conducted?

Go to question 2630.0

2630.0 Will an interpreter be present during discussions with the participants about the research project?

No - Go to question 2640.0

Yes - Go to question 2650.0

2640.0 Why will an interpreter not be present during discussions with participants about the research project?

Go to question 2650.0

2650.0 Will participants be provided with certified translated documents (Participant Information Statement and Participant Consent Forms, questionnaires etc) in the language in which they speak?

No - Go to question 2660.0

Yes - Go to question 2685.0

2660.0 Explain why participants will not be provided with written information in the language in which they speak

Go to question 2685.0

2670.0 Will a Participant Information Statement be provided? If so, please attach this in the Documents tab.

No - Go to question 2680.0

Yes - Go to question 2685.0

2680.0 Give reasons why a Participant Information Statement will not be provided

Go to question 2685.0

2685.0 Is there an intention to recruit participants who have a physical impairment or disability that may affect the consent process (e.g. blind/vision impaired/deaf/hearing impaired/speech impaired)?

No - Go to SECTION E

Yes - Go to question 2690.0

2690.0 How will you manage your consent process to ensure that these participants are able to provide informed consent? (e.g. provision of your Participant Information Statement in Braille, the presence of an Auslan interpreter, a combination of written and recorded oral consent).

Go to SECTION E

Section E

The questions in Section E relate to how you will protect participants' privacy and the confidentiality of their information in your research project.

2700.0 Will you be collecting information/data directly from a participant?

No - Go to question 2715.0

Yes - Go to question 2705.0

2705.0 Which of the following recordings will be used?

- Audio Recordings
- Film/Video Recordings
- **Online Surveys**
- **Other**

Go to question 2710.0

2710.0 Outline how these recordings will be used and why they are necessary to achieve the aims of the research project. If your project involves online surveys, state where the surveys will be hosted and comment on any security, data ownership and privacy constraints associated with this survey host

This research study will utilise hard copy (paper) surveys and electronic data collected from actigraphy (sleep monitoring devices).

Go to question 2715.0

2715.0 Will you be collecting information/data about a participant from a third party (i.e. another individual)? Please note that this DOES NOT include agencies or organisations

No - Go to question 2735.0

Yes - Go to question 2720.0

2720.0 Describe the information that will be collected from this other person

Go to question 2725.0

2725.0 Will consent be sought from the individuals concerned to obtain information about them from this other person?

No - Go to question 2730.0

Yes - Go to question 2735.0

2730.0 Please explain why consent will not be sought from the individuals concerned to obtain information about them from this other person

Go to question 2735.0

2735.0 The following questions will establish whether the HREC needs to apply federal or state/territory privacy legislation when reviewing your ethics application.

Will you use, collect or disclose information about human participants from an agency, authority or organisation? This includes Commonwealth agencies, private sector organisations, state/territory agencies and international organisations. For instance, you may be using information from a medical practice, a hospital, a university, a state or federal government department. You should say 'yes' even if it is your own organisation (e.g. your medical practice)

No - Go to question 3225.0

Yes - Go to APPENDIX 14

3225.0 Is the research project likely to produce information or results that are of personal significance to individual participants? For instance, a project may reveal that participants are at risk of developing a particular disease, provide insight into their intellectual/other abilities, or indicate that they have physical or mental health problems.

No - Go to question 3265.0

Yes - Go to question 3230.0

3230.0 Is it intended that any such information that is of potential significance to participants will be reported back to the individual concerned?

No - Go to question 3240.0

Yes - Go to question 3235.0

3235.0 Specify who will be responsible for communicating these results back to participants, and how these results will be communicated (e.g. telephone call, letter, copy of publication, consultation with clinician).

PhD Student Mr Harley de Vos will be responsible for communicating the results of the study back to participants. These results will be communicated in the form of a brief lay summary as well as follow-up consultation in the form of a telephone call or in-person consultation as required.

Go to question 3245.0

3240.0 Explain why these results will not be reported back to individual participants.

Go to question 3255.0

3245.0 Will results that are of personal significance to participants be reported to anyone other than the participant?

No - Go to question 3265.0

Yes - Go to question 3250.0

3250.0 To whom will the results be reported, and why?

Go to question 3255.0

3255.0 Will the participant be told that their results will be reported to this third party?

No - Go to question 3260.0

Yes - Go to question 3265.0

3260.0 Explain why the participant will not be told that their results will be reported to this third party.

Go to question 3265.0

3265.0 Is the research project likely to reveal a significant risk to the health or wellbeing of persons other than the participant (e.g. family members, colleagues, community members)?

No - Go to question 3275.0

Yes - Go to question 3270.0

3270.0 Describe what will be done with this information concerning a significant risk to the health or well-being of persons other than the participant, and explain why.

Go to question 3275.0

3275.0 Does this project involve the use of information that you or your organisation had collected previously for another purpose?

No - Go to question 3290.0

Yes - Go to question 3280.0

3280.0 When you collected this information, did the original consent cover the uses of the information that you are now proposing in this project?

No - Go to question 3285.0

Yes - Go to question 3290.0

3285.0 Please justify why the HREC should permit you to operate outside the original terms of consent.

Go to question 3290.0

3290.0 Describe how the overall results of this research project will be disseminated (e.g. journal publications and book chapters, conference presentations, student theses, creative works).

The collected data will be reported in Mr Harley de Vos's Doctor of Philosophy thesis (primary use) and further disseminated via scientific journals, conference presentations, social media, news reports or similar. Participants will not be individually identifiable in these publications.

Go to question 3295.0

3295.0 Will the confidentiality of participants and privacy of their data be protected in the dissemination of overall research results? Please note that if you propose to identify individuals in publications, you should select 'no' here and obtain their consent for this. Please also note that if you have obtained personal information without individual consent under a waiver of consent, you can only publish this information in de-identified form.

No - Go to question 3305.0

Yes - Go to question 3300.0

3300.0 Explain how confidentiality of participants and privacy of their data will be protected in the dissemination of research results.

Data will be deidentified prior to analysis and dissemination of results. Limited sociodemographic characteristics about the sample will be provided to minimise the risk of identification because the sporting community in some sports can be quite small.

Go to question 3310.0

3305.0 Explain why confidentiality of participants and privacy of their data will not be protected in the dissemination of research results (e.g. because it is appropriate to identify/name participants), describing the measures that have been taken to respect and protect the welfare and rights of participants (e.g. they will consent to being named).

Go to question 3310.0

3310.0 Will the information generated in this research project be used for any purpose(s) other than those outlined in this application? For example, will data be retained and used in future research projects, used to establish a database/research register, provided to a third party or to a public data sharing resource? Please note that this question does not refer to the use of the data for the purposes of this project (e.g. publication of results).

No - Go to question 3320.0

Yes - Go to question 3315.0

3315.0 You have indicated that the information generated in this research project will or may be used for another purpose. Please describe this other purpose here and ensure it is outlined on the Participant Information Statement/Consent Form. If this other purpose involves data being made available to other researchers or third parties, outline the standards that will be applied to protect participants' privacy and the confidentiality of data. Please note that ethical approval will also need to be sought in future for any secondary use of the data.

Go to question 3320.0

3320.0 Outline how feedback concerning the overall results of the project will be made available to participants (e.g. via a lay summary or newsletter). If participants are not to receive feedback, please justify why not.

Feedback concerning the overall results of the study will be made available to participants who express interest in receiving feedback about the results via a brief lay summary. A lay summary of the overall findings may be shared with the interested sporting organisation (such as National Sporting Organisations, National Institute Networks, or National Basketball Association Global Academy) upon request.

Go to question 3325.0

3325.0 Describe where study materials will be stored DURING the project (including electronic and hard copy files, consent forms, audio recordings, questionnaires, interview transcripts, video recordings, photographs etc). Please include building and room numbers for hard copy materials.

Electronic files, including actigraphy data, will be stored within The University of Sydney Research Data Store (RDS). Hard copy materials will be scanned and stored within RDS, and will be securely shredded. RDS can only be accessed by study personnel with password. If hard copy materials are required to be kept during or after this study, they will be securely stored in a locked filing cabinet at PhD Student Researcher, Harley de Vos's house.

Go to question 3330.0

3330.0 Describe where study materials will be stored upon COMPLETION of the project (including electronic and hardcopy files, consent forms, audio recordings, questionnaires, interview transcripts, video recordings, photographs etc). Please include building and room numbers for hardcopy materials. Note that on conclusion of the project a copy of all materials must be kept in an accessible and secure location on University premises.

Electronic files, including actigraphy data, will be stored in The University of Sydney Research Data Store (RDS). RDS can only be accessed by study personnel with password. If hard copy materials are required to be kept after the study is completed, they will be stored by Dr Suzi Edwards in a secure location onsite at The University of Sydney.

Go to question 3335.0

3335.0 Outline the security measures that will be used to protect study materials from misuse, loss or unauthorised access during and after the project (e.g. removal of identifiers, secure storage, restriction of access to appropriate personnel etc).

Electronic files, including actigraphy data, will be stored in The University of Sydney Research Data Store (RDS). RDS can only be accessed by study personnel with password.

Go to question 3340.0

3340.0 Specify how long study materials will be retained for after project completion.

Please note that the options provided below are intended to facilitate compliance with relevant legislation from the State Records Authority of NSW. Data from research involving children; and from clinical trials, scanning and radioactivity studies, clinical studies, genetic manipulation, human tissue studies, and psychological research that has potential long term effects must be retained for a minimum of 20 years or until participants are 25 years of age (whichever is longer). Data from other types of studies must be retained for a minimum of 5 years. For some types of research (e.g. oral history, gene therapy) or where it is intended to reuse data in the future, it is appropriate to retain data in perpetuity (i.e. indefinitely).

- **20 yrs/until subjects are 25**
- **5 years**
- In perpetuity
- Other

Go to question 3345.0

3345.0 Explain why this storage period has been chosen.

This study may potentially involve participants who are aged 16 years or older. In the event that participants under the age of 18 are involved, their data will be stored until they are 25 years old.

Go to question 3350.0

3350.0 At the end of the project, will study materials/information be stored in individually identifiable or re-identifiable form? Please note that this does not refer to the consent forms.

Individually identifiable information is that from which the identity of a specific individual can reasonably be ascertained. Re-identifiable information has had identifiers removed and replaced by a code, so it is possible to identify individuals by using the code. Non-identifiable information has had all identifiers irreversibly removed or was never identifiable (see Chapter 3.2 of the National Statement for more information).

No - Go to question 3360.0

Yes - Go to question 3355.0

3355.0 Outline why it is necessary to store information in identifiable or re-identifiable form, given this poses a potential risk to participants' privacy and the confidentiality of data. If the data can be re-identified using a code, specify the security arrangements for the code and which research personnel will have access to the code.

This protocol involves multiple testing timepoints, therefore it is necessary to re-identify participants during subsequent testing dates. Once a participant has completed the informed consent process, they will be allocated a participant ID. This ID will be used on all subsequent documents (i.e., hard copies, e-copies) instead of names. Participants will be asked to create their own participant ID, which will be used across the three testing timepoints. A master sheet will be created (and stored on RDS) with participant names and participant ID as a separate document with no other data. This process ensures that participant sociodemographic data is protected. If required, participants will be re-identified through their participant ID.

Go to question 3360.0

3360.0 If they are not to be kept in perpetuity, how will project materials ultimately be disposed of?

Once the data collection is complete, this data will be moved to a secure online repository (Research Data Store).

Go to SECTION F

Section F

The questions in Section F concern risks to both participants and others connected with the study.

3450.0 Participation in research can involve potential harm to participants including physical, psychological, reputational, financial, spiritual, emotional and social distress. Please outline any potential harm and justify it with regard to the potential benefits of the project. What steps will the researchers take to minimise potential harm endured as a consequence of participation? (e.g. by providing access/information to counselling)

The surveys, sleep diaries, and actigraphy that will be completed by participants will ask about and record information about sleep and mental wellbeing. There is minimal risk associated with these measures and participants will be able to complete such questions in private and will be informed their responses are made available to study personnel only.

If any participant experiences psychological distress, we will support that person to contact their usual care GP and/or any one of the following free counselling services:

- Lifeline Australia: http://www.lifeline.org.au/ ph: 13 11 14
- Australian Psychological Society: http://www.psychology.org.au/FindaPsychologist/
- The University of Sydney Student Support Services: https://www.sydney.edu.au/students/health-wellbeing.html
- Student Support Services available at their University or School

Go to question 3460.0

3460.0 Are there any other risks involved in this research? For example, to the research team, the organisation, others? What are these risks? Explain how these risks will be negated/ minimised/ managed.

There are some potential risks involved in this research to the research team. Specifically, PhD student Harley de Vos may need to travel alone to sporting organisations to conduct data collection and conduct the intervention. To minimise the risk that lone travel may possess, Harley de Vos will notify a member of his supervision team when and where data collection

occurs and within an agreed timeframe (e.g., within two hours of the expected end time). There is also the potential for risk associated with the sporting organisation pressuring the research team to disclose individual information about participants involved in the study. This risk will be mitigated by the organisational consent process, as well as making brief lay summaries with de-identified data available to sporting organisations should they desire results of the study. Finally, there is a potential risk of the emotional toll to Harley de Vos while he conducts the study should participants disclose sensitive or distressing information during the study. To minimise this risk, the supervisory team (including registered psychologists) will provide support to Harley as required. This support may include helping Harley to access The University of Sydney Student Support Services.

Go to SECTION G

Section G

The questions in Section G concern details of the research study. Please answer the following questions.

3570.0 The nature of this project is most appropriately described as research involving (more than one may apply):

- Clinical Trials
- Epidemiological studies, population health and/or public health
- Participant observation (ethnography, systematic)
- **Questionnaire/survey**
- Interviews (including oral history)
- Focus groups
- Data linkage studies
- **Psychiatric or clinical psychology studies, or psychological experiments**
- **Human physiological investigation(s)**
- Other

Go to question 3580.0

3580.0 Are you doing research in a context which requires you to get permission from an appropriate authority e.g. a school, corporation, or similar?

No - Go to question 3590.0

Yes - Go to question 3581.0

3581.0 Please provide the name/s of the appropriate authority/ies and include any relevant correspondence or approvals as attachments to your application. Note that ethics approval may be given which is conditional on these approvals being obtained prior to research being conducted.

Our organisational consent form is attached to our application. Organisational consent will be required before participants are recruited voluntarily through an appropriate sporting organisation.

Go to question 3590.0

3590.0 Outline in lay language the theoretical, empirical and/or conceptual basis, background evidence for the research proposal with reference to the relevant literature (include at least four research citations). Note, that your study should be "based on a thorough study of the current literature, as well as previous studies" (NS 1.1 c).

Sleep is an essential pillar of successful training and peak athlete performance and an essential requirement for adequate recovery (Halson, 2013). To this end, there has been a recent proliferation of research exploring how sleep impacts recovery, training and performance in elite athletes. Specifically, evaluation of the amount and quality of sleep obtained by elite athletes through objectively measured sleep actigraphy and self-report diaries noted a marked difference in sleep/wake behaviour on training and rest days (Sargent et al, 2014). Furthermore, evidence suggests athletes may display different sleeping patterns and habits compared to the non-athlete population (Leeder et al. 2012; Juliff et al 2015; Lastella et al. 2015; Driller et al 2017), likely due to the unique physiological and psychological demands of being an elite athlete. In addition to such demands, elite athletes are particularly prone to poor sleep due to rigorous training schedules, competition demands, group living arrangements, frequent travel, and academic load. Studies to date have assessed sleep quality largely through questionnaires such as the Pittsburgh Sleep Quality Index which considers sleep in the preceding month. Such enquiries have published evidence suggesting collegiate athletes are poor sleepers (42.4% reporting a score >5) and daytime sleepiness (Mah et al. 2018). Recent reviews suggest a paucity of data related to athlete sleep quality, patterns and the impact on health and performance (Brauer et al. 2019).

To date there have been a small number of intervention studies that focused on improving sleep in elite athletes (e.g., Mah et al., 2011; Van Ryswyk et al., 2017). Sleep intervention studies are showing promise for improving sleep (Driller et al., 2019), and improving sleep in elite athletes has been demonstrated to have benefits for athletic performance (Mah et al., 2011). A systematic review by Bonnar et al. (2018) focused on sleep intervention studies and the association between improved athletic performance and recovery. The review identified only ten studies suitable for inclusion. Using a quality evaluation with eight separate criteria assessing study design and methodology, the review found that only one study met criteria for “good” quality while eight of the ten included studies rated “moderate” for quality (Bonnar et al., 2018). The review strongly recommended that there is a need for further, well designed sleep intervention studies with elite athletes.

As well as a limited number of sleep intervention studies (Bonnar et al., 2018), to date there have been no intervention studies on mental health in elite athletes (Rice et al., 2016). Given that poor mental health is associated with increased risk of injury and can affect athletic performance (Schinke et al., 2017; Reardon et al., 2019), interventions designed to improve mental health may

have significant benefits for the elite athlete. Intervention studies are important to help move from theory (e.g., understanding) to practice (e.g., working with elite athletes) and improve health outcomes (i.e., mental health, sleep). To support elite athletes to help them optimally perform athletically, remain healthy, and function effectively inside and outside of their sporting environments, interventions that aim to enhance their mental health and/or sleep may be warranted. With a limited number of sleep intervention studies and no mental health intervention studies in elite athletes to date, future research is needed.

Cognitive Behavioural Therapy for Insomnia (CBT-I) has good efficacy in non-athlete populations and is recommended as the initial treatment for all adults with a chronic insomnia disorder by the American College of Physicians (Manber & Carney, 2015). This brief and structured evidence-based approach of CBT-I is used to manage insomnia symptoms that focuses on identifying and challenging thoughts, feelings, and behaviours linked to insomnia symptomology (Newsom, 2020). As a multicomponent intervention, CBT-I contains several modules that are implemented, including sleep education (psychoeducation), relaxation exercises (e.g., progressive muscle relaxation), sleep hygiene (i.e., behaviours that facilitate sleep), behavioural interventions such as sleep restriction (limiting amount of time spent in bed to increase sleep quality and efficiency), and cognitive interventions such as cognitive restructuring (e.g., challenging unhelpful thoughts about sleep and insomnia) (Lancee et al., 2016; Manber & Carney, 2015).

A systematic review by Friedrich and Schlarb (2017) on psychological interventions to improve sleep in college students (non-athletes) found that CBT-I showed large effect sizes compared to sleep hygiene interventions that showed small to medium effect sizes. Further support for CBT-I is provided by the randomised control trial by Freeman et al. (2017) with 3,755 UK university students that found that CBT-I significantly reduced insomnia over 10 weeks compared with usual practice. This study also demonstrated that CBT-I could be used as a sleep intervention to help improve mental health due to improved symptoms of paranoia and hallucinations as a result of reduced insomnia (Freeman et al., 2017). Kodsi et al.'s (2021) meta-analysis provides further support for using CBT-I to help improve sleep and mental health. The authors found that CBT-I improved both sleep (ES = -0.67, 95% CI [-0.77 – -0.57], $p<.01$) and secondary outcomes for anxiety (ES = -0.35, [-0.56 – -0.15], $p<.01$) and depression (ES = -0.41, [-0.70 – -0.13], $p<.01$) at post-intervention (Kodsi et al., 2021).

To date, CBT-I has not yet been used with elite athletes. As CBT-I has good evidence supporting its effectiveness in non-athlete populations, it is likely that it will also be helpful for elite athletes. Consequently using CBT-I with elite athletes represents a novel sleep intervention study

that would be worth considering as a strategy to improve athletes mental health and wellbeing. Our study is based on a thorough study of the current literature, as well as previous studies.

Go to question 3600.0

3600.0 Outline in lay language the methodology for the research proposal. Note, that you study should be "designed or developed using methods appropriate for achieving the aims of the proposal" (NS 1.1 b). Your response should include:

• Aims and hypotheses/research questions

• Research plan including duration of the study and/or timeline

• Participant characteristics including sex, age range and inclusion/exclusion criteria (if relevant)

• The intended sample size with a justification, and/or the particiant sampling/selection strategy (as relevant to your study)

• Details of where the study will be undertaken (location/site/URL)

• Details of how data will be collected and analysed

• Potential significance of the study

The aim of this study is to learn more about whether psychological strategies such as sleep education, behavioural strategies, relaxation exercises, and cognitive strategies that help promote good sleep can improve sleep quality and quantity and support mental wellbeing of athletes.

For our study, we hypothesise that:

1. Psychological strategies to promote good sleep will improve sleep quality as measured by the Karolinska sleep diary/sleep diary, Pittsburgh Sleep Quality Index, Insomnia Severity Index, Sleep Hygiene Index, Athlete Sleep Behaviour Questionnaire, Athlete Sleep Screening Questionnaire or Epworth Sleepiness Scale in athletes.
2. Psychological strategies to promote good sleep will improve sleep duration as measured by sleep diaries and actigraphy.
3. Psychological strategies to promote good sleep will improve athlete mental wellbeing as measured by the Athlete Psychological Strain Questionnaire.

Research Plan

This sleep intervention study will be a quasi-experimental, repeated measures design study. The study will involve weekly 30-minute group sessions, with individual follow-up as required between sessions, for 5 (five) weeks focused on strategies that can help promote good sleep, such as sleep education, sleep behaviour/sleep hygiene, and cognitive strategies. There will be baseline testing prior to the intervention (pre), post-intervention testing (at 5 weeks) and follow-up testing two-months post-intervention. The intervention will be delivered by Harley de Vos, an endorsed Sport and Exercise Psychologist who has professional training in sleep medicine, and supported by sleep experts within the research team.

This study will be conducted outside of competition schedule for athletes, in their pre-season or off-season. Participants will not be blinded as we are using a repeated measures design.

Participant Characteristics

Participants will be recruited from within the student-athlete body within Sydney Uni Sport and Fitness. All student athletes currently enrolled within a university degree while also being registered with a sporting club within Sydney Uni Sport and Fitness will be eligible to participate.

Additionally, adult and young-adult Australian athletes identified by their National Sporting Organisation, National Institute Network, or National Basketball Association Global Academy who are currently in the pre-elite or elite stages of the talent pathway are eligible to participate in our intervention sub-study. Athletes currently experiencing an injury that prevents participation in testing protocols will be excluded from the study.

Inclusion criteria

- You are at least 16 years of age; AND
- You are a student athlete competing for a sporting club within Sydney Uni Sport and Fitness; OR
- You are an athlete, including a high-school athlete, currently competing at the pre-elite or elite stages of the talent pathway identified by their National Sporting Organisation, National Institute Network or National Basketball Association Global Academy based at the Australian Institute of Sport.

Exclusion criteria

- Currently pregnant
- Suffering chronic or complex pain
- Suffers from a cognitive impairment, Autism-Spectrum Disorder, or other neurological disorder
- Not fluent in English

Sample size

Literature suggests that a good rule of thumb for determining sample size for an experimental design study is a ratio of 10:1 (10 participants for one variable) (Schreiber et al., 2006.). For our study, we will have six outcome variables (sleep duration as measured by actigraphy, sleep duration as measured by sleep diaries, sleep quality as measured by the Pittsburgh Sleep Quality Index, daytime sleepiness as measured by the Epworth Sleepiness Scale, sleep behaviours as measured by the Athlete Sleep Behaviour Questionnaire, and athlete mental wellbeing as measured by the Athlete Psychological Strain Questionnaire). This ratio means that we would aim to recruit 60 participants in total for our study.

Details of Location

This study will be conducted in-person across multiple locations. Specifically, the study will be conducted onsite at The University of Sydney and Sydney Uni Sport and Fitness facilities or the Australian Institute of Sport in Canberra. Additionally, training facilities for National Sporting Organisations, National Institute Network, and/or the NBA Global Academy may be used if required. Further, Zoom may be used to conduct this study online if required.

Outcome Measures

- **Demographics Questionnaire:** these questions will ask about your age, sex, gender, identity, sporting competition, and health status. This takes five minutes to complete at the baseline visit only.
- **Pittsburgh Sleep Quality Index:** This 19-item survey asks you to rate your sleep quality and disturbances over the last month. It takes up to 10 minutes to complete.
- **Epworth Sleepiness Scale:** this 8-question scale asks how likely you are to fall asleep in different scenarios. It takes up to three minutes to complete.
- **Athlete Sleep Behaviour Questionnaire:** This 18-item questionnaire asks about sleeping behaviours related to athletes. It takes up to five minutes to complete.
- **Sleep and Activity Monitor:** Sleep measured for a 1-week period using a wrist worn device (actigraphy) that measures movements and light. This device is won at all three timepoints.

- **Sleep Diary:** A 7-day sleep diary that asks you about you sleep behaviours and the quality and duration of your sleep. There are 9 questions in total per day and it takes up to five minutes to complete after waking.
- **Athlete Psychological Strain Questionnaire:** This 10-item questionnaire asks about athlete-specific psychological distress and is a screening instrument for elite athlete's mental health.
- **Post-Intervention Evaluation Form: T**hese questions will ask participants about their experience of the intervention, how helpful and relevant they found the strategies discussed, and what they think would help improve the intervention. It will take up to 10 minutes to complete at the post-intervention visit only.

Data collection and analysis

Data collection for our study will be by study personnel at 3 (three) discrete timepoints. These time points are baseline (pre-intervention), post-intervention (5-weeks), and follow-up (two-months post-intervention). Surveys and sleep diaries will be administered paper form where preferred. Actigraphy will be collected via wearable monitors that are set up for the participants in advance and downloaded after study data collection. All data will be uploaded securely to RDS.

Outcome data will be examined using paired t-tests and Pearson correlations. Effect sizes will be determined to examine the magnitude of change from pre- to post-intervention. Simple descriptive statistics will be used to characterise baseline outcome measures.

All data will be stored and accessible only by the research team in accordance with our data management plan.

End of Questions

Appendix 1

Women who are pregnant and the human foetus

You have indicated that Women who are pregnant and the human foetus would be included in your study. Please answer the following additional questions.

410.0 What steps will be taken to ensure that the well-being and care of the woman who is pregnant and her foetus takes precedence over the aims of the research?

Go to question 420.0

420.0 Provide a justification for the proposed research

Go to question 480.0

Appendix 2

Children and/or young people

You have indicated that Children and/or young people would be included in your study. Please answer the following additional questions.

490.0 Why is the participation of children required?

Go to question 500.0

500.0 How has this study been designed to be appropriate for children or young people?

Go to question 510.0

510.0 What is the age range of all participants involved in this study?

Go to question 520.0

520.0 Have you applied for a Working with Children check? You must complete the online form at www.newcheck.kids.nsw.gov.au and provide proof of identification with your application number to a NSW motor registry or NSW Council Agency.

No - Go to question 530.0

Yes - Go to question 540.0

530.0 Give reasons why you have not applied for a Working with Children check

Go to question 540.0

540.0 - Will consent be sought of the child/young person?

No - Go to question 560.0

Yes - Go to question 550.0

550.0 Explain how the consent of the child/young person will be sought

Go to question 570.0

560.0 Explain why the consent of the child/young person will not be sought

Go to question 570.0

570.0 Will consent be sought from the parent/guardian?

No - Go to question 580.0

Yes - Go to question 583.0

580.0 Explain why the consent of the parent/guardian will not be sought

Go to question 583.0

583.0 Will research be conducted in schools?

No - Go to question 590.0

Yes - Go to question 586.0

586.0 What type of school/s are involved? More than one may apply.

- Public schools

- Independent schools
- Catholic schools

Go to question 588.0

588.0 Please indicate what permissions will be obtained to conduct this research (more than one may apply).

- School Principal
- SERAP (State Education Research Application Process)
- CEO (Catholic Education Office)

Go to question 590.0

Appendix 3

Existing dependent or unequal relationship

You have indicated that an Existing dependent or unequal relationship would be included in your study. Please answer the following additional question

Go to question 600.0

600.0 Describe the existing dependent or unequal relationship

Go to question 610.0

610.0 How will the process of obtaining consent avoid perceived/actual coercion and enable persons in dependent relationships to give voluntary consent?

Go to question 620.0

Appendix 4

People with a cognitive impairment, an intellectual disability or a mental illness

You have indicated that People with a cognitive impairment, an intellectual disability or a mental illness would be included in your study. Please answer the following additional questions

630.0 Will there be participants who do not have capacity to give consent for themselves?

No - Go to question 670.0

Yes - Go to question 640.0

640.0 Specify why these participants do not have capacity to give consent for themselves

Go to question 650.0

650.0 Who will consent for the inclusion of these participants?

Go to question 660.0

660.0 On what basis is it believed that these people have legal authority to give consent for these participants?

Go to question 670.0

670.0 Describe the consent process

Go to question 680.0

Appendix 5

People highly dependent on medical care who may be unable to give consent

You have indicated that People highly dependent on medical care who may be unable to give consent would be included in your study. Please answer the following additional questions

690.0 Are you doing research on patients (i.e. subjects receiving health care)?

No - Go to question 710.0

Yes - Go to question 700.0

700.0 List the procedures/techniques which would not form part of the patient's routine clinical management

Go to question 710.0

Appendix 6

People who may be involved in illegal activity

You have indicated that People who may be involved in illegal activity would be included in your study. Please answer the following additional questions.

720.0 Participants may be subject to risks because of their involvement in research that uncovers illegal activity. This includes research intending to uncover illegal activity, as well as research not specifically designed to, but likely to discover, illegal activity. Please outline how these risks are justified by the benefits of the research. These risks must be specified in the PIS.

Go to question 730.0

730.0 To what extent will you keep confidential any information about illegal activity by participants or others? These details must be communicated to participants in the PIS.

Go to question 750.0

740.0 Are you aware of your legal obligations to disclose information?

No - Go to question 745.0

Yes - Go to question 750.0

745.0 You may be in a situation where there is a statutory obligation for you to disclose information revealed or discovered, or you may be subject to legal orders that compel disclosure of information obtained by a researcher. These circumstances must be clearly explained to participants. In light of this, please discuss below your response that you are not aware of your legal obligations and how you will rectify this.

Go to question 750.0

750.0 How will you respond to any legal obligation or order to disclose such information?

Go to question 760.0

Appendix 7

Aboriginal and/or Torres Strait Islander peoples

You have indicated that Aboriginal and/or Torres Strait Islander peoples would be included in your study. Please make sure you have read Values and Ethics: Guidelines for Ethical Conduct in Aboriginal and Torres Strait Islander Health Research and have considered the six core values of Spirit and Integrity, Reciprocity, Respect, Equality, Survival and Protection, and Responsibility in the design and implementation of your research. In addition, please note that all research involving the health of Aboriginal and Torres Strait Islander peoples undertaken in NSW must in the first instance be forwarded to the Aboriginal Health and Medical Research HREC for approval and/or comment.

770.0 Has there been appropriate representation of Aboriginal or Torres Strait Islander peoples in the development of the research protocol? If there has been no representation please state your reasons. If there has been representation please provide details below.

Go to question 780.0

780.0 Have Aboriginal or Torres Strait Islander peoples been involved from the early stages of the protocol development? If your response is "no" please discuss why this is appropriate for your study. If your response is "yes" please describe this involvement below

Go to question 790.0

790.0 All research involving Aboriginal and Torres Strait Islander peoples must demonstrate consultation with appropriate community groups, community representatives and/or community members. Please provide a brief description of the consultation process that you have undertaken for your proposed research.

Go to question 810.0

810.0 Do any of the researchers identify as Aboriginal or Torres Strait Islander peoples?

No

Yes

Go to question 820.0

820.0 Will the research be undertaken in partnership with Aboriginal and Torres Strait Islander peoples? If your response is "no" you should state why this is appropriate for your study. If your response is "yes" please describe the partnership below.

No

Yes

Go to question 830.0

830.0 Is there a research agreement between the participating communities and the researchers? If there is no research agreement, please discuss why this is appropriate for your study. If there is a research agreement please provide details of this agreement (where there is a written research agreement, either existing or proposed, this should be uploaded in the "documents" tab in IRMA).

No

Yes

Go to question 840.0

840.0 Please provide a brief description of the role of Aboriginal or Torres Strait Islander peoples in the research

Go to question 850.0

850.0 Will researchers acknowledge the cultural property rights of Aboriginal or Torres Strait Islander peoples in relation to knowledge, ideas, cultural expressions and cultural materials? If your response is "no" please discuss why this is appropriate for your study. If your response is "yes" please provide details below.

Go to question 860.0

860.0 How will researchers acknowledge the sources of information and those who have contributed to the research?

No

Yes

Go to question 870.0

870.0 Briefly describe how the contribution of Aboriginal and Torres Strait Islander peoples will be acknowledged

Go to question 880.0

880.0 How will the research provide benefits to the Aboriginal and Torres Strait Islander peoples?

No

Yes

Go to question 890.0

890.0 How does the research relate to the priority and needs of participant communities?

No

Yes

Go to question 900.0

900.0 How will the research build the capacity of Aboriginal people/organisations through participation?

No

Yes

Go to question 910.0

910.0 Briefly describe how the research will contribute to the advancement and well being of participants and their communities

Go to question 915

915.0 Describe how the outcomes of the research/feedback will be communicated to participants

Go to question 920

Appendix 8

Research involving travel overseas

You have indicated that your research involves travel overseas. Please answer the following additional questions.

940.0 What country/countries will you be visiting?

Go to question 950.0

950.0 What is the DFAT (Department of Foreign Affairs and Trade) alert level for the countries you will be visiting?

Go to question 960.0

960.0 Have you completed a safety protocol? Note that a safety protocol is required for all students doing research overseas. In addition a safety protocol should be provided where non-student researchers are travelling to areas with an increased DFAT (level 3 or 4) warning. This safety protocol should be attached to your application in the Documents tab.

No

Yes

Go to question 970.0

970.0 Have you obtained formal permission from relevant authorities for entry to the area to carry out the research (e.g. national or local government bodies; organisations of local communities)?

No - Go to question 990.0

Yes - Go to question 980.0

980.0 Name the relevant authorities and attach the relevant correspondence

Go to question 993.0

990.0 Please outline why you have not obtained formal permission from relevant authorities

Go to question 993.0

993.0 In the country/ies where research is intended to be conducted are there ethics approval processes that are relevant to the research and are such processes mandatory or voluntary in relation to the proposed research?

Go to question 996.0

996.0 In the country/ies where research is intended to be conducted is the proposed research lawful? Please discuss.

Go to question 998.0

998.0 Outline the experience or access to expertise that will enable researchers to engage with participants in a manner that accords them respect and protection. Where research is to be conducted overseas by a researcher who is subject to academic supervision researchers should explain how that supervision is to be effected so that due respect and protection will be accorded to participants.

Go to question 1000.0

1000.0 Outline how the researchers / investigators have taken into account the opinions and expectations of participants and their communities on:

(a) the way the research will be conducted;

(b) participants' post-research welfare;

(c) application of the results of the research;

(d) access to culturally sensitive artefacts or matters;

(e) known issues affecting a local cultural norm;

(f) any cultural, religious or political differences you may encounter.

Go to question 1010.0

1010.0 Please outline any local factors that make it problematic to comply with the ethical standards expressed in the National Statement on Ethical Conduct in Human Research (NHMRC 2007)?

Go to question 1013.0

1013.0 Has a local contact for the receipt of complaints been provided in the Participant Information Statement in accordance with 4.8.16 of the National Statement?

No - Go to question 1016.0

Yes - Go to question 1020.0

1016.0 Please explain why you have not provided a local contact for receipt of complaints in the Participant Information Statement.

Go to question 1020.0

Appendix 9

Research that could jeopardise a participant's employment

You have indicated that your study involves research that could jeopardise a participant's employment. Please answer the following additional questions.

1040.0 Indicate at whose workplace the research is to be conducted?

Go to question 1050.0

1050.0 What is the relationship of the researcher / investigator to the workplace (e.g. proprietor, student, consultant, employee - past or present)?

Go to question 1060.0

1060.0 What is the status in the workplace of all of the proposed participants (e.g. Employee, client, consultant)?

Go to question 1070.0

1070.0 What measures will be taken to minimise the risk to workplace relationships?

Go to question 1080.0

Appendix 10

Interventions and therapies, including clinical and non-clinical trials

You have indicated that your study involves interventions and therapies, including clinical and non-clinical trials. Please answer the following additional questions

1090.0 Will genetically modified organisms or other gene modification techniques be used in the research?

No - Go to question 1110.0

Yes - Go to question 1100.0

1100.0 Provide details of the genetically modified organisms or other gene modification techniques. Describe the procedures, which are in place to minimise the risks to participants and researchers.

Go to question 1110.0

1110.0 Will toxins, mutagens, teratogens or carcinogens be used?

No - Go to question 1130.0

Yes - Go to question 1120.0

1120.0 Provide details of the toxins, mutagens, teratogens or carcinogens. Describe the procedures, which are in place to minimise the risks to participants and researchers.

Go to question 1130.0

1130.0 Will biohazardous materials be used?

No - Go to question 1150.0

Yes - Go to question 1140.0

1140.0 Provide details of the biohazardous materials. Describe the procedures, which are in place to minimise the risks to participants and researchers.

Go to question 1150.0

1150.0 Does your study involve the administration of a drug / medicine (includes a complementary / alternative medicine)?

No - Go to question 1250.0

Yes - Go to question 1154.0

1154.0 Is the study using only approved drug(s) in accordance with Therapeutic Goods Administration (TGA) product information? This information is contained on the Australian Register of Therapeutic Goods (ARTG), which is available on the TGA's website.

No - Go to question 1160.0

Yes - Go to question 1157.0

1157.0 What is the approved therapeutic indication (including dose and duration) in Australia? Please note that you must upload the public ARTG summary in the Documents tab as evidence that the drug is being used in accordance with this approved therapeutic indication.

Go to question 1160.0

1160.0 How many drugs will be used in this research project?

Go to question 1170.0

1170.0 What are the Trade name/s of the drugs to be used in this research project?

Go to question 1180.0

1180.0 What is the dosage regimen?

Go to question 1190.0

1190.0 What are the known adverse effects?

Go to question 1200.0

1200.0 What are the known contra-indications/warnings?

Go to question 1210.0

1210.0 What concurrent drugs should be avoided?

Go to question 1220.0

1220.0 Describe briefly the type of study to be conducted

Go to question 1230.0

1230.0 How many participants are projected to be enrolled into the trial at this site and in total? (Please give a single figure for each, not a range)

Go to question 1240.0

1240.0 What is the projected duration of the trial, from first enrolment to the last protocol interaction with the last enrolled subject (in years)?

Go to question 1250.0

1250.0 Does your study involve the trial of a medical device?

No - Go to question 1410.0

Yes - Go to question 1254.0

1254.0 Is the study using only approved medical devices in accordance with Therapeutic Goods Administration (TGA) product information? This information is contained on the Australian Register of Therapeutic Goods (ARTG), which is available on the TGA's website.

No - Go to question 1260.0

Yes - Go to question 1257.0

1257.0 What is the approved therapeutic indication for the device in Australia? Please note that you must upload the public ARTG summary in the Documents tab as evidence that the device is being used in accordance with this approved therapeutic indication.

Go to question 1260.0

1260.0 Describe the trial phase for the medical device.

Go to question 1270.0

1270.0 How many devices, including comparators, are being tested in the trial?

Go to question 1280.0

1280.0 What are the Trade name/s of the devices?

Go to question 1290.0

1290.0 Is the device implantable?

No

Yes

Go to question 1300.0

1300.0 What are the known adverse effects?

Go to question 1310.0

1310.0 What are the known contra-indications/warnings?

Go to question 1320.0

1320.0 What is the length of time participants will be monitored for adverse reactions?

Go to question 1330.0

1330.0 Has the sponsor or manufacturer agreed to supply the device free of charge for the duration of the trial?

No

Yes

Go to question 1340.0

1340.0 Describe what arrangements have been made for the supply of the device

Go to question 1350.0

1350.0 Describe procedures for tracking participants for the life time of the device on the completion of the trial.

Go to question 1360.0

1360.0 Will the trial device/treatment be made available to participants after the completion of the trial?

No - Go to question 1380.0

Yes - Go to question 1370.0

1370.0 Explain who will have access to the trial device, under what conditions, for how long and who will pay for the device/treatment

Go to question 1390.0

1380.0 Explain why participants will not have post trial access to the device

Go to question 1390.0

1390.0 How many participants are projected to be enrolled into the trial at this site and in total? (Please give a single figure for each, not a range)

Go to question 1400.0

1400.0 What is the projected duration of the trial, from first enrolment to the last protocol interaction with the last enrolled subject (in years)?

Go to question 1410.0

1410.0 Does your study involve the administration of a therapeutic treatment (e.g. exercise intervention, speech therapy, psychotherapy etc)?

No - Go to question 1450.0

Yes - Go to question 1420.0

1420.0 Describe briefly the type of study to be conducted

Go to question 1430.0

1430.0 How many participants are projected to be enrolled into the trial at this site and in total? (Please give a single figure for each, not a range)

Go to question 1440.0

1440.0 What is the projected duration of the trial, from first enrolment to the last protocol interaction with the last enrolled subject (in years)?

Go to question 1450.0

1450.0 Is the research being conducted under the Clinical Trial Notification Scheme (CTN)? Please note that all Clinical Trials involving a CTN will be forwarded for consideration by the Clinical Trials Sub-Committee at the Sydney Local Health District Network

No

Yes

Go to question 1460.0

1460.0 Is the research being conducted under the Clinical Trial Exemption Scheme (CTX)? Please note that all Clinical Trials involving a CTX will be forwarded for consideration by the Clinical Trials Sub-Committee at the Sydney Local Health District Network

No

Yes

Go to question 1470.0

1490.0 Will this research be undertaken on behalf of (or at the request of) a company (e.g. Medical Device company)?

No - Go to question 1600.0

Yes - Go to question 1500.0

1500.0 Provide details of the name of the sponsor (and co-sponsors if any)? This information should be included in the Participant Information Statement and Consent Form. Please note that projects supported by a commercial sponsor may incur an administrative fee.

Go to question 1510.0

1510.0 Will the sponsor(s) provide any support in money or kind? Provide details

Go to question 1520.0

1520.0 Will the sponsor(s) undertake in writing to abide by either the Medicines Australia Guidelines for Injury Resulting from Participation in an Industry-Sponsored Clinical Trial (www.medicinesaustralia.com.au) or the ABPI Clinical Trial Compensation Guidelines?

No - Go to question 1540.0

Yes - Go to question 1530.0

1530.0 **Provide details**

Go to question 1540.0

1540.0 Will the sponsor(s) undertake in writing to indemnify the institution, the HREC(s) and the researchers?

No - Go to question 1560.0

Yes - Go to question 1550.0

1550.0 Provide details

Go to question 1560.0

1560.0 Does the sponsor(s) hold a current insurance policy to cover this project?

No - Go to question 1580.0

Yes - Go to question 1570.0

1570.0 Provide details

Go to question 1580.0

1580.0 If all projected participants complete the protocol, what total payment will be received from the sponsoring company? (Please give a single figure, not a range)

Go to question 1590.0

1590.0 If all projected participants complete the protocol, what additional "in kind" support (ie. free drug, equipment, etc), if any, will be provided by the sponsoring company?

(NB: after answering this question, you will be directed back to Section B)

Go to question 1600.0

Appendix 11

Human tissue samples

You have indicated that your study involves human tissue samples. Please answer the following additional questions.

1610.0 Describe the nature of the tissue samples to be used in your research study (i.e. blood, saliva, heart, brain, bone etc)?

Go to question 1620.0

1620.0 Will your tissues be collected from participants who will be recruited to this research project?

No - Go to question 1640.0

Yes - Go to question 1630.0

1630.0 By whom will the sample/s be collected? Please detail the process of collection

Go to question 1640.0

1640.0 Will your tissues be obtained from a tissue bank?

No - Go to question 1670.0

Yes - Go to question 1650.0

1650.0 Name the tissue bank from which the tissue samples are being obtained

Go to question 1660.0

1660.0 At the time of collection of the samples in the tissue bank, for which purposed was consent obtained?

Go to question 1670.0

1670.0 Will your tissue samples be sourced/obtained from overseas?

No - Go to question 1690.0

Yes - Go to question 1680.0

1680.0 Name the overseas organisation/s from which the sample/s is being obtained and outline the approval process obtained in that country

Go to question 1690.0

1690.0 Will your tissue samples be sourced from another source not mentioned above?

No - Go to question 2030.0

Yes - Go to question 1700.0

1700.0 Please describe the "other" source of tissue to be used in this research study

Go to question 1710.0

1710.0 In 2003, there were amendments to the Human Tissue Act 1983 relating to the legal requirement for consent to the use of human tissue for research purposes.

The amendments are not retrospective. That means there are different consent requirements for tissue removed before and after the commencement of the amendments.

The amendments commenced on 1 November 2003.

Were any of your samples collected before 1 November 2003?

No - Go to question 1860.0

Yes - Go to question 1720.0

1720.0 Were any of your samples removed for the purposes of a post mortem examination?

No - Go to question 1750.0

Yes - Go to question 1730.0

1730.0 Was consent obtained for use of the samples removed for the purpose of a post mortem examination for research (from the deceased person before death or their next of kin after death)?

No - Go to question 1740.0

Yes - Go to question 1750.0

1740.0 The National Statement indicates that consent should usually be obtained, unless it is suitable to waive consent. Please outline why you are seeking a waiver of consent

Go to question 1750.0

1750.0 Were any of your samples removed from a deceased person other than for the purpose of a post mortem examination?

No - Go to question 1800.0

Yes - Go to question 1760.0

1760.0 Was consent obtained for the use of samples removed from a deceased person other than for the purpose of a post mortem examination for research (from the deceased person before death or their next of kin after death)?

No - Go to question 1770.0

Yes - Go to question 1780.0

1770.0 The law does not allow consent to be waived even if the requirements of the National Statement are met. The law overrides the ability in the NS to waive consent. Consent must be obtained from the person, or in the event that the person is now deceased from their next of kin. Please comment

Go to question 1780.0

1780.0 Have you obtained the written authorisation of a designated officer of a hospital?

No - Go to question 1790.0

Yes - Go to question 1800.0

1790.0 The law requires that you obtain the written authorisation of a designated officer of a hospital. Please comment.

Go to question 1800.0

1800.0 Were any of the tissue samples removed in the course of a medical, dental or surgical procedure?

No - Go to question 1830.0

Yes - Go to question 1810.0

1810.0 Was consent obtained for the use of the tissue samples removed in the course of a medical, dental or surgical procedure for research?

No - Go to question 1820.0

Yes - Go to question 1830.0

1820.0 The National Statement indicates that consent should usually be obtained, unless it is suitable to waive consent. Please outline why you are seeking a waiver of consent

Go to question 1830.0

1830.0 Were any of the tissue samples removed for the purposes of research?

No - Go to question 1860.0

Yes - Go to question 1840.0

1840.0 Was consent obtained for the use of the tissue samples removed for the purposes of research?

No - Go to question 1850.0

Yes - Go to question 1860.0

1850.0 The common law requires the person's consent to the removal, otherwise the removal would be a battery. The law does not allow consent to be waived. Please comment.

Go to question 1860.0

1860.0 Were any of your samples collected after 1 November 2003?

No - Go to question 2030.0

Yes - Go to question 1870.0

1870.0 Were any of the tissue samples held in a block or tissue slide?

No - Go to question 1900.0

Yes - Go to question 1880.0

1880.0 Was consent obtained for the use of the tissue samples held in a block or tissue slide for research?

No - Go to question 1890.0

Yes - Go to question 1900.0

1890.0 Were tissues removed from a deceased body (either for the purposes of a post mortem examination or otherwise)?

Go to question 1900.0

1900.0 Were tissues removed from a deceased body (either for the purposes of a post mortem examination or otherwise)?

No - Go to question 1950.0

Yes - Go to question 1910.0

1910.0 Was consent obtained for use of the samples removed for the purpose of a post mortem examination for research (from the deceased person before death or their next of kin after death)?

No - Go to question 1920.0

Yes - Go to question 1930.0

1920.0 The law does not allow consent to be waived even if the requirements of the National Statement are met. The law overrides the ability in the NS to waive consent. Consent must be obtained from the person, or in the event that the person is now deceased from their next of kin. Please comment

Go to question 1930.0

1930.0 Have you obtained the written authorisation of a designated officer of a hospital?

No - Go to question 1940.0

Yes - Go to question 1950.0

1940.0 The law requires that you obtain the written authorisation of a designated officer of a hospital. Please comment.

Go to question 1950.0

1950.0 Were any of the tissue samples removed in the course of a medical, dental or surgical procedure?

No - Go to question 1980.0

Yes - Go to question 1960.0

1960.0 Was consent obtained for the use of the tissue samples removed in the course of a medical, dental or surgical procedure for research?

No - Go to question 1970.0

Yes - Go to question 1980.0

1970.0 The law does not allow consent to be waived even if the requirements of the National Statement are met. The law overrides the ability in the NS to waive consent. Consent must be obtained from the person, or in the event that the person is now deceased from their next of kin. Please comment

Go to question 1980.0

1980.0 Were any of the tissue samples removed for the purposes of research?

No - Go to question 2010.0

Yes - Go to question 1990.0

1990.0 Was consent obtained for the use of the tissue samples removed for the purposes of research?

No - Go to question 2000.0

Yes - Go to question 2010.0

2000.0 The common law requires the person's consent to the removal, otherwise the removal would be a battery. The law does not allow consent to be waived. Please comment.

Go to question 2010.0

2010.0 Were any tissue samples removed from the body of a deceased child who is or was a ward of the state for research purposes?

No - Go to question 2030.0

Yes - Go to question 2020.0

2020.0 In no circumstances is tissue to be removed from the body of a deceased child who is or was a ward of the state for research purposes, either with or without consent from any person. Please comment.

Go to question 2030.0

2030.0 Will the tissue sample(s) used for this project be destroyed once the project is completed?

No

Yes

Go to question 2040.0

2040.0 Does this research involve the development of a cell line?

No

Yes

Go to question 2050.0

2050.0 Does your study involve the creation of a human tissue bank or repository?

No

Yes

Go to question 2060.0

2060.0 Describe how you will ensure that all sample/s used in this project will be stored securely and describe how you will monitor this as well as the use of the sample/s . Note that the creation of a tissue bank requires consultation with the Tissue Bank Reference Group

Go to question 2070.0

Appendix 12

Limited disclosure involving active concealment and/or planned deception

You have indicated that your study involves limited disclosure involving active concealment and/or planned deception. Please answer the following additional questions

2090.0 The National Statement states that where research involves active concealment or explicit deception, researchers should provide an explanation of both the real aims and/ or methods and also of why the concealment or deception was necessary after participant involvement in the study has ended. Will a full explanation of the aims and methods of the research and why concealment was necessary be provided?

No - Go to question 2100.0

Yes - Go to question 2095.0

2095.0 What form of explanation will be provided regarding the aims and method of the research and why concealment was necessary (e.g. a written debrief statement)?

Go to question 2110.0

2100.0 Explain why a full explanation will not be given.

Go to question 2110.0

2110.0 Does the proposal involve the secretive use of photographs, tape-recordings, or any other form of record-taking?

No - Go to question 2130.0

Yes - Go to question 2120.0

2120.0 Please provide details and a justification for the secrecy

Go to question 2130.0

Appendix 13

Research that poses a risk to the welfare of a University of Sydney student

You have indicated that your study involves research that poses a risk to the welfare of a University of Sydney student. Please answer the following additional questions.

2140.0 There is a requirement of a duty of care for students. Please detail below the risk to the student and how this risk is being addressed/managed (e.g. providing a safety protocol, briefing/debriefing, providing specific training, provision of counselling).

Go to question 2150.0

Appendix 14

The following questions allow the HREC to determine what privacy laws apply to the data you are using in your research.

2740.0 Will you obtain consent from individual participants for the use/collection/disclosure of their information (or has consent already been obtained for this purpose)?

No - Go to question 2745.0

Yes - Go to question 3225.0

2745.0 Will this information be individually identifiable or re-identifiable? Please note this refers to the nature of the information as you initially access it, not the nature in which you will store or publish it. Individually identifiable information is that from which the identity of a specific individual can reasonably be ascertained. Re-identifiable information has had identifiers removed and replaced by a code, so it is possible to identify individuals by using the code. Non-identifiable information has had all identifiers irreversibly removed or was never identifiable (see Chapter 3.2 of the National Statement for more information).

No - Go to question 3225.0

Yes - Go to question 2750.0

2750.0 Are any of the agencies, authorities or organisations from which this personal information will be used/collected/disclosed Australian?

No - Go to question 3135.0

Yes - Go to question 2755.0

Australian agencies, authorities or organisations

2755.0 You have indicated that you will use/collect/disclose personal information without individual participant consent. Will any of this information be from Australian Commonwealth agencies?

No - Go to question 2865.0

Yes - Go to question 2765.0

Australian Commonwealth agencies, authorities or organisations

2765.0 Is this a health/medical research project? This includes epidemiological studies, interventions aiming to improve health, clinical/medical record audits that will be published, etc. Please note that your project may be a medical research project even if the personal information you are using/collecting/disclosing is not health information (e.g. if you are collecting demographic information for the purposes of a medical research project).

No - Go to question 3135.0

Yes - Go to question 2770.0

2700.0 You have indicated that you will use/collect/disclose personal information from a Commonwealth agency without individual participants' consent, for the purposes of medical research. The HREC can only approve such a request if it meets certain criteria set out in the Guidelines Under Section 95 of the Privacy Act 1988. Unless these criteria are met, carrying out the project would result in infringement of the Australian Privacy Principles (APPs), which may lead to prosecution or other serious action. Therefore please answer the following questions as honestly and accurately as possible, as they seek to determine whether your project meets the relevant criteria.

Indicate why it is necessary to use/collect/disclose this information in identifiable or re-identifiable (coded) form. More than one may apply

The project involves linkage of data

- Use of non-identifiable data would compromise the research merit of the project/result in scientific deficiencies
- Other

Go to question 2775.0

2775.0 Please explain your response to the question above. That is, justify why information needs to be collected in identifiable or re-identifiable form, and why the purpose of this project could not be achieved with non-identifiable information

Go to question 2780.0

2780.0 Please indicate why it is impracticable to seek consent from the individuals concerned to collect, use or disclose their personal information. More than one may apply.

- The size of the population involved in the research (i.e. the number of records)
- The risk of introducing bias into the research, affecting the generalisability and validity of the results
- The risk of creating additional threats to privacy by having to link information in order to locate and contact subjects to seek their consent of the results
- The risk of inflicting psychological, social or other harm by contacting participants.
- The difficulty of contacting individuals (i.e. difficulties associated with the age of records or lack of up to date contact details)
- The nature of any existing consent from this population concerning the collection, use or disclosure of their personal information
- The fact that the proposed research is minimally intrusive on the privacy and wellbeing of the individuals involved
- The fact that this research project is an extension of, or closely related to, a previously approved research project
- Other

Go to question 2785.0

2785.0 Provide details regarding your response to the question above. That is, justify why it is impracticable to seek consent from the individuals concerned and reasonable to proceed without consent.

Go to question 2790.0

2790.0 List the Australian Privacy Principles (APPs) that would be infringed as a result of carrying out this project, if the HREC did not apply the S95 Guidelines. All 13 APPs are outlined in the fact sheets on the website of the Office of the Australian Information Commissioner (OAIC).

Go to question 2795.0

2995.0 Indicate which of the following your project involves. More than one may apply. Please note that collection refers to gathering, acquiring or obtaining personal information from any source and by any means. This includes when an agency keeps personal information it has come across by accident or has not requested. Disclosure refers to the release of personal information to others outside an agency. It does not include giving individuals information about themselves. Use refers to the handling and management of information within an agency including the inclusion of information in a publication.

- Collection of personal health information by an agency
- Use/disclosure of personal health information from an agency

Go to question 2800.0

2800.0 If your project involves the COLLECTION of personal health information for research, the Australian Privacy Principles (see APP 3) state that this information must be reasonably necessary for one or more of the agency's functions or activities. If applicable to your project, please comment on how this criterion is satisfied in relation to the information and agency(ies) involved in your project. If not applicable because your project involves use/disclosure only, please write n/a.

Go to question 2805.0

2805.0 Provide the name and a description of the Commonwealth agency(ies) from which information will be collected/used/disclosed. Please note that you will also need to obtain permission from the agency(ies).

Go to question 2810.0

2810.0 Provide a description of the information to be collected/used/disclosed. Please be specific in your answer. For example, instead of simply stating 'demographic and health information', list the specific types of information such as 'gender, date of birth, physical and mental health diagnoses, number of hospital visits per year'.

Go to question 2815.0

2815.0 Indicate the number of records you are requesting access to.

Go to question 2820.0

2820.0 Describe how the personal information will be used to achieve the aims of the research project. In your answer please explain why the aims of your project cannot be achieved without the collection, use or disclosure of this particular personal information.

Go to question 2825.0

2825.0 List by name and position all research personnel and others (e.g. supervisors, research monitors) who, for the purposes of this research, will have authority to use or access the personal information involved in this project. Please also describe the nature of each person's use of, or access to, the information.

Go to question 2830.0

2830.0 Describe the qualifications, credentials and experience of the research investigators as relevant to this project. Please note that the HREC is required to consider this information under relevant privacy legislation.

Go to question 2835.0

2835.0 Outline the standards that will be applied to protect the personal health information. This should include the terms of any disclosure agreement between the organisation and the researcher to govern the limits on use and disclosure of that information. Please note that relevant privacy guidelines require that you do not disclose this information to anyone else, that you store it securely, that you destroy or de-identify it after project completion and an appropriate retention period, and that this information is not published in a form that identifies particular individuals or from which an individual's identity can be reasonably ascertained.

Go to question 2840.0

2840.0 Indicate whether the personal information will be disclosed to an overseas recipient (e.g. an overseas cloud storage provider, an overseas research collaborator).

No - Go to question 2850.0

Yes - Go to question 2845.0

2845.0 You have indicated that your project involves the disclosure of personal information overseas. Please list by name all countries to which the information will be sent, and explain how you will comply with APP 8 of the Privacy Act.

Go to question 2850.0

2850.0 In order to approve your proposal, the HREC needs to determine that the public interest in the proposed research substantially outweighs the public interest in the protection of privacy. The following questions will guide you through various criteria that are relevant in this regard. For each question, please indicate which of the criteria listed are specifically relevant to your project.

Please indicate which of the following seven criteria related to risk and potential benefits are relevant when weighing the public interest involved in your project (more than one may apply).

- Any likely benefits to individuals, to the category of persons to which they belong, or the wider community that will arise from this medical research project being undertaken in the manner proposed.
- The fact that the research design cannot be satisfied without risking infringement of privacy and that scientific defects would arise in the medical research if it was not conducted in the manner proposed
- The financial costs of not undertaking this medical research project (to the government, the public, the health care system etc
- The public importance of this medical research project
- The extent to which the data being sought are ordinarily available to the public for a similar purpose to that proposed in this project
- The fact that the project does not require an alteration of the format of the data that would constitute a breach of privacy if it were carried out by the Commonwealth agency
- The fact that the risk of harm to the people whose personal information is to be used in the proposed research is minimal, based on the criteria in section 2.4 of the S95 Guidelines

Go to question 2855.0

2855.0 Indicate which of the following specific research outcomes are relevant when weighing the public interest involved in your project. That is, the fact that this medical research project is likely to contribute to (more than one may apply):

- The identification, prevention or treatment of illness or disease.
- Scientific understanding relating to health
- The protection of the health of individuals and/or communities
- The improved delivery of health services
- Scientific understanding or knowledge.

Go to question 2860.0

2860.0 Indicate which of the following risk management strategies/standards of conduct will be employed in your project to minimise risk and maximise public benefit (more than one may apply).

- Rigorous study design and credentials of the researchers
- If the research involves contact with participants, there are protocols in place to ensure that they are treated with integrity and sensitivity. This includes careful consideration of the degree of intrusiveness of proposed questions/procedures.
- Access to information will be restricted to appropriate researchers.
- The risk of identification of a person or group in the published results will be minimal.
- Specific procedures will followed upon project completion to ensure that all personal information is at least as secure as it was in the original data source, and there is a designated date for data destruction.

Go to question 2865.0

2865.0 You have indicated that you will use/collect/disclose personal information without individual participant consent. Will any of this information be from Australian private sector organisations?

No - Go to question 2990.0

Yes - Go to question 2870.0

Australian private sector organisations

2870.0 Is the information to be used/collected/disclosed personal HEALTH information? For this purpose, health information is defined as a sub-set of personal information (as defined by the Privacy Act 1988) which pertains to a person's health or disability, their use or desired use of health services, the donation of their body parts, or genetic information in a form that is or could be predictive of the health of the individual or their genetic relatives. It includes any personal information collected by a health service provider during the course of providing treatment and care to an individual. See the Privacy Act 1988 for a full definition.

No - Go to question 3135.0

Yes - Go to question 2875.0

2875.0 You have indicated that you will use/collect/disclose personal health information from a private sector organisation without individual participants' consent. The HREC can only approve such a request if it meets certain criteria set out in the Guidelines Under Section 95A of the Privacy Act 1988. Unless these criteria are met, carrying out the project would result in infringement of the Australian Privacy Principles (APPs), which may lead to prosecution or other serious action. Therefore please answer the following questions as honestly and accurately as possible, as they seek to determine whether your project meets the relevant criteria.

Indicate why it is necessary to use/collect/disclose information in identifiable or re-identifiable (coded) form. More than one may apply.

- The project involves linkage of data.
- Use of non-identifiable data would compromise the research merit of the project/result in scientific deficiencies.
- Other

Go to question 2880.0

2880.0 Provide details regarding your response to the question above. That is, justify why information needs to be used/collected/disclosed in identifiable or re-identifiable form, and why the purpose of this project could not be achieved with non-identifiable information.

Go to question 2885.0

2885.0 Indicate why it is impracticable to seek consent from the individuals concerned to collect, use or disclose their personal information. More than one may apply.

- The size of the population involved in the research (i.e. the number of records).
- The proportion of individuals who are likely to have moved or died since the information was originally collected.
- The risk of introducing bias into the research, affecting the generalisability and validity of the results.
- The risk of creating additional threats to privacy by having to link information in order to locate and contact participants to seek their consent.
- The risk of inflicting psychological, social or other harm by contacting participants.
- The difficulty of contacting individuals directly when there is no existing or continuing relationship between the agency and the individuals (i.e. difficulties associated with the age of records or lack of up to date contact details).
- The difficulty of contacting individuals indirectly through public means, such as advertisements and notices.
- The fact that the additional resources needed to obtain consent would impose an undue hardship on the agency.
- Other

Go to question 2890.0

2890.0 Please elaborate on your response to the question above. That is, justify why it is impracticable to seek consent from the individuals concerned.

Go to question 2895.0

2895.0 List the Australian Privacy Principles (APPs) that would be infringed as a result of carrying out this project, if the HREC did not apply the S95A Guidelines. All 13 APPs are outlined in the fact sheets on the website of the Office of the Australian Information Commissioner (OAIC).

Go to question 2900.0

2900.0 Indicate which of the following your project involves. More than one may apply. Please note that collection refers to gathering, acquiring or obtaining personal information from any source and by any means. This includes when an agency keeps personal information it has come across by accident or has not requested. Disclosure refers to the release of personal information to others outside an agency. It does not include giving individuals information about themselves. Use refers to the handling and management of information within an agency including the inclusion of information in a publication.

- Collection of personal health information by an agency
- Use/disclosure of personal health information from an agency

Go to question 2905.0

2905.0 If your project involves the COLLECTION of personal health information for research, the Australian Privacy Principles (see APP 3) state that this information must be reasonably necessary for one or more of the agency's functions or activities. If applicable to your project, please comment on how this criterion is satisfied in relation to the information and agency(ies) involved in your project. If not applicable because your project involves use/disclosure only, please write n/a.

Go to question 2910.0

2910.0 Provide the name(s) and a description of the private sector organisation(s) from which information will be used/collected/disclosed. Please note that you will also need to obtain permission from the organisation(s).

Go to question 2915.0

2915.0 Provide a description of the information to be collected/used/disclosed. Please be specific in your answer. For example, instead of simply stating 'demographic and health information', list the specific types of information such as 'gender, date of birth, physical and mental health diagnoses, number of hospital visits per year'.

Go to question 2920.0

2920.0 Indicate the number of records you are requesting access to.

Go to question 2925.0

2925.0 Describe how the personal information will be used to achieve the aims of the research project. In your answer please explain why the aims of your project cannot be achieved without the collection, use or disclosure of this particular personal information.

Go to question 2930.0

2930.0 List by name and position all research personnel and others (e.g. supervisors, research monitors) who, for the purposes of this research, will have authority to use or access the personal information involved in this project. Please also describe the nature of each person's use of, or access to, the information.

Go to question 2935.0

2935.0 Describe the qualifications, credentials and experience of the research investigators as relevant to this project. Please note that the HREC is required to consider this information under relevant privacy legislation.

Go to question 2940.0

2940.0 Outline the standards that will be applied to protect the personal health information. This should include the terms of any disclosure agreement between the organisation and the researcher to govern the limits on use and disclosure of that information. Please note that relevant privacy guidelines require that you do not disclose this information to anyone else, that you store it securely, that you destroy or de-identify it after project completion and an appropriate retention period, and that this information is not published in a form that identifies particular individuals or from which an individual's identity can be reasonably ascertained.

Go to question 2945.0

2945.0 Do you plan to use the personal health information to contact an individual?

No - Go to question 2955.0

Yes - Go to question 2950.0

2950.0 You have indicated that you plan to use the personal health information collected or disclosed for the purposes of this project to contact an individual. Relevant privacy guidelines require that you inform that individual of the information below (e.g. on the Participant Information Sheet). Please check the boxes to indicate that you will provide the individual with this information.

- That the health information is being used or disclosed in accordance with the Privacy Act 1988 and the S95A Guidelines.
- How their health information will be used or disclosed.
- That they are free to withdraw their consent at any time.
- Of the standards that will apply to protect their privacy
- Of the complaint mechanisms available to them.

Go to question 2955.0

2955.0 Indicate whether the personal information will be disclosed to an overseas recipient (e.g. an overseas cloud storage provider, an overseas research collaborator).

No - Go to question 2965.0

Yes - Go to question 2960.0

2960.0 You have indicated that your project involves the disclosure of personal information overseas. Please list by name all countries to which the information will be sent, and explain how you will comply with APP 8 of the Privacy Act.

Go to question 2965.0

2965.0 Indicate the nature of your project (please select one):

- Research relevant to public health or safety
- The compilation or analysis of statistics relevant to public health or safety
- The management, funding or monitoring of a health service

Go to question 2970.0

2970.0 In order to approve your proposal, the HREC needs to determine that the public interest in the proposed research substantially outweighs the public interest in the protection of privacy. The following questions will guide you through various criteria that are relevant in this regard. For each question, please indicate which of the criteria listed are specifically relevant to your project.

Indicate which of the following general criteria related to risk and potential benefits are relevant when weighing the public interest involved in your project. More than one may apply.

- The degree to which the proposed collection, use or disclosure of health information is necessary to the functions or activities of the organisation.
- The degree to which the project is relevant to public health or public safety.
- Any likely benefits to individuals, to the category of persons to which they belong, or the wider community that will arise from this project being undertaken in the manner proposed.
- The fact that the research design cannot be satisfied without risking infringement of privacy and scientific defects would arise if the project was not conducted in the manner proposed.
- The costs of not undertaking this project (to the government, the public, the health care system etc).
- The public importance of this project.
- The extent to which the data being sought are ordinarily available to the public for a similar purpose to that proposed in this project.
- The fact that the project does not require an alteration of the format of the data that would constitute a breach of privacy if it were carried out by the organisation.
- The fact that the risk of harm to the people whose personal information is to be used in the proposed research is minimal, based on the criteria in the relevant section(s) of the S95A Guidelines (A.2.6, A.3.6, B.2.6, B.3.6 or C.2.6).

Go to question 2975.0

2975.0 Indicate which of the following research outcomes are relevant when weighing the public interest involved in your project. That is, the fact that this project is likely to contribute to (more than one may apply):

- The identification, prevention or treatment of injury, illness or disease.
- Scientific understanding relating to public health or safety.
- The protection of the health of individuals and/or communities.
- The improved delivery of health services.
- Scientific understanding or knowledge.
- Knowledge of issues within the fields of social science and the humanities relating to public health or public safety.

Go to question 2980.0

2980.0 Indicate which of the following risk management strategies/standards of conduct will be employed in your project to minimise risk and maximise public benefit (more than one may apply).

- Rigorous study design and credentials of the researchers.
- If the research involves contact with participants, there are protocols in place to ensure that they are treated with integrity and sensitivity. This includes careful consideration of the degree of intrusiveness of proposed questions/procedures.
- Access to information will be restricted to appropriate researchers.
- The risk of identification of a person or group in the published results will be minimal.
- Specific procedures will followed upon project completion to ensure that all personal information is at least as secure as it was in the original data source, and there is a designated date for data destruction.

Go to question 2985.0

2985.0 Does your project have any likely benefits to individuals from one or more of the following groups?

- Children and young people.
- Persons with intellectual or psychiatric disability.
- Persons highly dependent on medical care.
- Persons in dependent or unequal relationships.
- Persons who are members of collectivities
- Aboriginal and Torres Strait Islander peoples
- Persons whose information relates to their mental or sexual health
- Persons who are incarcerated
- None of the above.

Go to question 2990.0

2990.0 You have indicated that you will use/collect/disclose personal information without individual participant consent. Will any of this information be from Australian state/territory agencies?

No - Go to question 3130.0

Yes - Go to question 2995.0

Australian state/ territory agencies

2995.0 Where is/are the agency(ies) located. More than one may apply.

- New South Wales
- Australian Capital Territory
- Northern Territory
- Western Australia
- South Australia
- Queensland
- Victoria
- Tasmania

Go to question 3000.0

3000.0 Is the information to be used/collected/disclosed personal HEALTH information? For this purpose (under the Privacy Act 1988), health information is defined as a sub-set of personal information which pertains to a person's health or disability, use or desired use of health services, or relating to donation of body parts and includes information collected by a health service provider during the course of providing treatment and care to an individual.

No - Go to question 3005.0

Yes - Go to question 3005.0

3005.0 You have indicated that you will use, collect or disclose personal information from an Australian state/territory agency without individual participants' consent. The HREC can only approve such a request if it meets certain criteria set out in relevant state/territory privacy guidelines. Unless these criteria are met, carrying out the project would infringe privacy principles, which may lead to prosecution or other serious action. Therefore please answer the following questions as honestly and accurately as possible, as they seek to determine whether your project meets the relevant criteria.

Indicate why it is necessary to collect information in identifiable or re-identifiable (coded) form. More than one may apply.

- The project involves linkage of data.
- Use of non-identifiable data would compromise the research merit of the project/result in scientific deficiencies.
- Other

Go to question 3010.0

3010.0 Provide details regarding your response to the question above. That is, justify why information needs to be used/collected/disclosed in identifiable or re-identifiable form, and why the purpose of this project could not be achieved with non-identifiable information.

Go to question 3015.0

3015.0 Indicate why it is impracticable to seek consent from the individuals concerned to collect, use or disclose their personal information. More than one may apply.

- The size of the population involved in the research (i.e. the number of records).
- The proportion of individuals who are likely to have moved or died since the information was originally collected.
- The risk of introducing bias into the research, affecting the generalisability and validity of the results.
- The risk of creating additional threats to privacy by having to link information in order to locate and contact participants to seek their consent.
- The risk of inflicting psychological, social or other harm by contacting participants.
- The difficulty of contacting individuals directly when there is no existing or continuing relationship between the agency and the individuals (i.e. difficulties associated with the age of records or lack of up to date contact details).
- The difficulty of contacting individuals indirectly through public means, such as advertisements and notices.
- The fact that the additional resources needed to obtain consent would impose an undue hardship on the agency.
- Other

Go to question 3020.0

3020.0 Please elaborate on your response to the question above. That is, justify why it is impracticable to seek consent from the individuals concerned.

Go to question 3025.0

3025.0 Indicate which of the following your project involves (more than one may apply); so that the HREC is able to determine which privacy principles are relevant to this project.

Please note that collection refers to gathering, acquiring or obtaining personal information from any source and by any means. This includes when an agency keeps personal information it has come across by accident or has not requested. Disclosure refers to the release of personal information to others outside an agency. It does not include giving

individuals information about themselves. Use refers to the handling of information within an agency including the inclusion of information in a publication.

- Collection of personal information about individuals.
- Use of personal information about individuals.
- Disclosure of personal information about individuals.

Go to question 3030.0

3030.0 In some states/territories, different privacy legislation applies for public sector health agencies versus other public sector agencies. Please indicate whether the agency is a health agency or some other public sector agency.

- Yes, it is a health agency
- No, it isn't a health agency

Go to question 3035.0

3035.0 In some states/territories, different privacy legislation applies when personal information is transferred outside of the state/territory where it was collected (to another state/territory in Australia or overseas). Does your project involve the transfer of personal information outside the state/territory in which it was collected (e.g. to a cloud storage provider, a research collaborator)?

No - Go to question 3050.0

Yes - Go to question 3040.0

3040.0 You have indicated that your project involves the transfer of personal information outside the state/territory in which it was collected. Please indicate whether information will be transferred within Australia or overseas. More than one may apply.

- Transfer to another state/territory within Australia
- Transfer outside of Australia

Go to question 3045.0

3045.0 Please justify the transfer of this personal information outside the state/territory in which it was collected, in light of the fact that this will remove it from the legislative protections of that state/territory. Reasons in your justification could include the privacy obligations that the recipient is subject to, and/or the steps that have been taken to protect the information (e.g. disclosure agreements).

Go to question 3050.0

3050.0 Provide the name and a description of the state/territory agency(ies) from which information will be collected. Please note that you will also need to obtain permission from the agency(ies).

Go to question 3055.0

3055.0 Provide a description of the personal information. Please be specific in your answer. For example, instead of simply stating 'demographic and academic information', list the specific types of demographic and academic information such as 'gender, date of birth, postcode, semester 1 unit of study grades'.

Go to question 3060.0

3060.0 Indicate the number of records you are requesting access to.

Go to question 3065.0

3065.0 Describe how the personal information will be used to achieve the aims of the research project. In your answer please explain why the aims of your project cannot be achieved without the collection, use or disclosure of this particular personal information.

Go to question 3070.0

3070.0 List by name and position all research personnel and others (e.g. supervisors, research monitors) who, for the purposes of this research, will have authority to use or access the personal information involved in this project. Please also describe the nature of each person's use of, or access to, the information.

Go to question 3075.0

3075.0 Describe the qualifications, credentials and experience of the research investigators as relevant to this project. Please note that the HREC is required to consider this information under relevant privacy legislation.

Go to question 3080.0

3080.0 Outline the standards that will be applied to protect the personal information. This should include the terms of any disclosure agreement between the agency and the researcher to govern the limits on use and disclosure of that information, and the proposed methods of disposal of the personal information on completion of the research. Please note that relevant privacy guidelines require that you do not disclose this information to anyone else, that you store it securely, that you destroy or de-identify it after project completion and an appropriate retention period, and that this information is not published in a form that identifies particular individuals or from which an individual's identity can be reasonably ascertained.

Go to question 3085.0

3085.0 Do you plan to use the personal information to contact an individual?

No - Go to question 3095.0

Yes - Go to question 3090.0

3090.0 You have indicated that you plan to use the personal health information collected or disclosed for the purposes of this project to contact an individual. Relevant privacy guidelines require that you inform that individual of the information below (e.g. on the Participant Information Sheet). Please check the boxes to indicate that you will provide the individual with this information.

- That the health information is being used or disclosed in accordance with the Privacy Act 1988 and the S95A Guidelines.
- How their health information will be used or disclosed.
- That they are free to withdraw their consent at any time.

- Of the standards that will apply to protect their privacy.
- Of the complaint mechanisms available to them.

Go to question 3095.0

3095.0 Indicate the nature of your project (please select one):

- Research relevant to public health or safety.
- The compilation or analysis of statistics relevant to public health or safety.

Go to question 3100.0

3100.0 In order to approve your proposal, the HREC needs to determine that the public interest in the proposed research substantially outweighs the public interest in the protection of privacy. The following questions will guide you through various criteria that are relevant in this regard. For each question, please indicate which of the criteria listed are specifically relevant to your project.

Indicate which of the following five criteria related to risk and potential benefits are relevant when weighing the public interest involved in your project (more than one may apply).

- Any likely benefits to individuals, to the category of persons to which they belong, or the wider community that will arise from this medical research project being undertaken in the manner proposed.
- The fact that the research design cannot be satisfied without risking infringement of privacy and scientific defects would arise if the project was not conducted in the manner proposed.
- The costs of not undertaking this project (to the government, the public, the health care system etc).
- The public importance of this project.
- The fact that the risk of harm to the people whose personal information is to be used in the proposed research is minimal, based on the criteria in the relevant state/territory privacy legislation guidelines.

Go to question 3105.0

3105.0 Indicate which of the following research outcomes are relevant when weighing the public interest involved in your project. That is, the fact that this project is likely to contribute to (more than one may apply):

- The identification, prevention or treatment of injury, illness or disease.
- Scientific understanding relating to public health or safety.
- The protection of the health of individuals and/or communities.
- The improved delivery of health services.
- Scientific understanding or knowledge.
- Knowledge of issues within the fields of social science and the humanities relating to public health or public safety.

Go to question 3110.0

3110.0 Indicate which of the following risk management strategies/standards of conduct will be employed in your project to minimise risk and maximise public benefit (more than one may apply).

- Rigorous study design and credentials of the researchers.
- If the research involves contact with participants, there are protocols in place to ensure that they are treated with integrity and sensitivity. This includes careful consideration of the degree of intrusiveness of proposed questions/procedures.
- Access to information will be restricted to appropriate researchers.
- Specific procedures will be followed to ensure that the information will not be published in a form that identifies particular individuals or from which an individual's identity can be reasonably ascertained.
- Specific procedures will be followed upon project completion to ensure that all personal information is at least as secure as it was in the original source, and there is a designated date of destruction for data.

Go to question 3115.0

3115.0 Does your project have any likely benefits to individuals from one or more of the following groups?

- Children and young people.
- Persons with intellectual or psychiatric disability.
- Persons highly dependent on medical care.
- Persons in dependent or unequal relationships.
- Persons who are members of collectivities.
- Aboriginal and Torres Strait Islander peoples.

- Persons whose information relates to their mental or sexual health.
- Persons who are incarcerated.
- None of the above.

Go to question 3130.0

3130.0 Thank you for responding to the questions about personal information from Australian agencies, authorities and organisations. Will you also use/collect/disclose personal information from an international agency, authority or organisation without individual participants' consent?

No - Go to question 3275.0

Yes - Go to question 3135.0

International agencies, authorities or organisations

3135.0 You have indicated that your project involves the use of identifiable or re-identifiable information about participants without their consent. This needs to be justified with reference to the criteria outlined in the National Statement Section 2.3.6/2.3.7. The following questions will gather relevant information about your project and guide you through these criteria. If you have already provided details on your use of information from one agency, authority or organisation earlier in the form and are now declaring a different source of information, please just provide details for the new agency, authority or organisation.

Provide the name and a description of the agency(ies), authority(ies) or organisation(s) from which the information will be collected. Please note that you will also need to obtain permission from them.

Go to question 3140.0

3140.0 Which best describes the agency(ies), authority(ies) or organisation(s)?

- International agency, authority or organisation
- Australian private sector organisation
- Australian state/territory agency
- Australian Commonwealth agency

3145.0 Provide a description of the information to be collected from each agency, authority or organisation. Please be specific in your answer (e.g. instead of simply stating 'demographic information', list the specific types of demographic information such as 'gender, date of birth, level of education').

Go to question 3150.0

3150.0 Indicate the number of records you are requesting access to for each agency, authority or organisation.

Go to question 3155.0

3155.0 Describe the specific uses to which the personal information involved in this project will be applied.

Go to question 3160.0

3160.0 Explain why it is necessary to collect information in identified or potentially identifiable (coded) form. For example, the project involves data linkage; or use of non-identifiable data would result in scientific deficiencies in the project.

Go to question 3165.0

3165.0 Explain why it is impracticable to seek consent from the individuals concerned. For example, the number of records involved makes it impracticable to seek consent; or there is a risk of harm/distress to participants in raising the matters about which the research is concerned; or seeking consent would alert participants in a way which would affect the behavior being researched.

Go to question 3170.0

3170.0 Explain why the collection, use or disclosure of this information is in the public interest, and why the public interest in the project substantially outweighs the public interest in the protection of privacy. That is, how do the potential benefits of this research outweigh the risks associated with not seeking consent? In responding to this question applicants should refer to the ethical framework of the National Statement on Ethical

Conduct in Human Research, specifically Section 1 on values and principles and Section 2 on risk and benefits.

Go to question 3175.0

3175.0 Describe the measures that will be taken to protect participants' privacy throughout the course of the project, and the measures that will be taken to protect the confidentiality of data. Please note that it is not permissible to publish or disclose information in identifiable or potentially identifiable form without participants' consent.

Go to question 3180.0

3180.0 The NHMRC requires that the waiver of consent is not prohibited by state, federal or international law. Please confirm this using the check box below. If the waiver is prohibited by law, your application cannot be granted approval.

- I can confirm that the waiver is not prohibited by law.
- The waiver is prohibited by law.

Go to question 3185.0

3185.0 Does your research intend to expose illegal activity? Please note this does not refer to research that does not specifically intend to discover illegal activity, but may or is likely to do so. Rather, it refers to research where the specific purpose is to study and expose illegal activity.

No - Go to question 3195.0

Yes - Go to question 3190.0

3190.0 Outline why the value of exposing the illegal activity justifies any potential adverse effects on the people involved.

Go to question 3275.0

3195.0 Explain how your research project carries no more than 'negligible risk' or 'low risk' to participants, as defined in section 2.1.6 and 2.1.7 of the National Statement.

Go to question 3200.0

3200.0 Is there any reason why participants would not have consented to this use of their information if they had been asked? Please give details.

Go to question 3205.0

3205.0 If the results have significance for participants' welfare, please describe the plan for making information from the research available to them (e.g. via regional news media), if practicable.

Go to question 3210.0

3210.0 If relevant, please confirm that the possibility of commercial exploitation of derivatives of the data or tissue involved in the project will not deprive the participants of any financial benefits to which they would be entitled.

Go to question 3275.0

Appendix Q: Is my study a clinical trial?

As outlined in the University of Sydney's Clinical Trials Policy 2016, the University has adopted the following definition of a clinical trial:

> Clinical trial means *any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes. Clinical trial interventions include, but are not limited to:*
> - *experimental drugs*
> - *cells and other biological products*
> - *vaccines*
> - *medical devices*
> - *surgical and other medical treatments and procedures*
> - *psychotherapeutic and behavioral therapies*
> - *health-related service changes*
> - *health-related preventive care strategies*
> - *health-related educational interventions*

Instructions for use

1. *The (Coordinating) Principal Investigator (CPI) and another member of the investigator team can use this form to assess if a research study meets the clinical trial definition.*
2. *Upon completion, the form should be signed by the CPI and retained by the investigator team in their study records.*

   Should the investigators require further advice on whether a research study meets the clinical trial definition, the signed form can be submitted to Risk and Governance, RP Clinical Trials Support. If this advice has been requested by others outside of the investigator team, please notify Risk and Governance at the time of submission.
3. *Certain sections of this form are read only and cannot be edited. Please enter your responses in the highlighted fields, additional guidance is provided in* blue italics.
4. *Please ensure that you provide detailed responses to all questions and submit the signed form in Word format. If only yes/no answers are provided, or clarification is required, the research team will be asked to provide further information. This may result in delays during review. Risk and Governance will completed the final section of the form with the outcome of their assessment.*

5.

Research Study Details *Enter sufficient information to unequivocally identify the research project, e.g. title of the research, HREC name & reference code*		Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study
Coordinating (Principal) Investigator *enter name & review date* Associate Professor Suzi Edwards		**Study Investigator** *enter name & review date* Harley de Vos, December 21 2023
Documents reviewed: *List all documents include date identifiers) relied on for the review e.g.* • *Research plan / study protocol version [number], [date]* • *HREC application [date]* • *Email correspondence [names / dates of email(s)]*		
HREC Application, December 21 2023 Sleep Intervention Materials, December 21 2023 Participant Information Statement, December 21 2023		HREC Application, December 21 2023 Sleep Intervention Materials, December 21 2023 Participant Information Statement, December 21 2023
1	**Does the research involve human participants?**	
	YES Comments: Yes	Choose an item. Comments: Yes
2	**Are participants prospectively assigned to one or more interventions?** *List in comments research-directed intervention(s) identified by your review*	
	NO Comments: No, participants are not prospectively assigned to one or more interventions	Choose an item. Comments: No, participants are not prospectively assigned to one or more interventions

Research Study Details *Enter sufficient information to unequivocally identify the research project, e.g. title of the research, HREC name & reference code*		Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study
3	**Is at least one intervention health-related?** *A "**health-related**" intervention is an act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health condition.* *List in comments health-related intervention(s) identified by your review e.g. immediate vs delayed treatment, drug (paracetamol or matching placebo), CBT, Exercise program etc.*	
	YES Comments: Cognitive Behavioural Therapy for Insomnia	Choose an item. Comments Cognitive Behavioural Therapy for Insomnia
4	**Is the research measuring health outcomes?** *"**Health outcome**" means a change or absence of change in the physical, mental or social wellbeing of an individual, group or population as a direct consequence of the health-related intervention.* *Document in comments the health outcomes measured in this research as identified by your review, e.g. headache frequency & intensity change in anxiety score*	
	YES Comments: Sleep quality, sleep duration, athlete-specific psychological distress, daytime sleepiness, athlete-specific sleep behaviours	Choose an item. Comments: Sleep quality, sleep duration, athlete-specific psychological distress, daytime sleepiness, athlete-specific sleep behaviours
5	**Do the health outcomes relate to any of the intervention(s)?** *Document the health outcomes and the linked intervention identified by your review*	
	YES Comments: All of the health outcomes relate to the intervention proposed	Choose an item. Comments: All of the health outcomes relate to the intervention proposed

Research Study Details *Enter sufficient information to unequivocally identify the research project, e.g. title of the research, HREC name & reference code*	Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study
RESULT: If the answers to <u>all 5</u> questions are YES, the research study is a clinical trial.	
This research project **IS NOT a clinical trial** (*select one*) *Please document the reasons for the option you have selected:* This research project is not a clinical trial because there is no control group and all participants will be exposed to the intervention. This is a repeated measures, within-subjects study.	This research project **IS NOT a clinical trial** (*select one*) *Please document the reasons for the option you have selected:* This research project is not a clinical trial because there is no control group and all participants will be exposed to the intervention. This is a repeated measures, within-subjects study

(Coordinating) Principal Investigator Signature		
Associate Professor Suzi Edwards		*21/12/2023*

Please submit the completed form and all relevant attachments to Risk and Governance, either by:

- Email: clinical-trials.research@sydney.edu.au or,
- <u>Portal:</u> https://sydneyuni.service-now.com/sm

END OF FORM

PLEASE RETAIN A COPY FOR YOUR RECORDS

The following section of the form to be left blank unless there is a request for Risk and Governance review

Risk and Governance Review Outcome	1. Based on the information provided in this form, the research study does not meet the University's definition of a clinical trial. The Clinical Trials Policy and Procedures do not apply and no further review by Risk and Governance, RP Clinical Trials Support is required. 2. Based on the information provided in this form, the research study meets the definition of a clinical trial. The Clinical Trials Policy and Procedures will apply and a submission to Risk and Governance, RP Clinical Trials Support will be required. Please visit the RP Clinical Trials Support intranet page and contact the Risk and Governance team for more advice. 3. Further review has been undertaken by Risk and Governance. Please refer to the supporting documents attached in the section below for the outcome of the assessment.

Reviewer comments and sign-off

Details regarding referral and advice provided e.g. from FMH, HREC (if applicable):
Supporting documents reviewed (to be included as attachments to the PDF before signing):
R&G Reviewer 1 (Name / Signature / Date): **Comments:**
R&G Reviewer 2 (Name / Signature / Date): **Comments:**

Appendix R: ANZCTR Registration

Dear Harley de Vos and Suzi Edwards,

Re: Efficacy of using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep quality: A sleep intervention study

Thank you for submitting the above trial for inclusion in the Australian New Zealand Clinical Trials Registry (ANZCTR).

Your trial has now been successfully registered and allocated the ACTRN: ACTRN12624000286549p

Web address of your trial: https://www.anzctr.org.au/ACTRN12624000286549p.aspx
Date submitted: 20/02/2024 12:45:31 PM
Date registered: 20/03/2024 11:06:49 AM
Registered by: Harley de Vos
Principal Investigator: Suzi Edwards

If you have already obtained Ethics approval for your trial, please send a copy of at least one Ethics Committee approval letter to info@anzctr.org.au or by fax to (+61 2) 9565 1863, attention to ANZCTR.

Note that updates should be made to the registration record as soon as any trial information changes or new information becomes available. Updates can be made at any time and the quality and accuracy of the information provided is the responsibility of the trial's primary sponsor or their representative (the registrant). For instructions on how to update please see https://www.anzctr.org.au/Support/HowToUpdate.aspx.

Please also note that the original data lodged at the time of trial registration and the tracked history of any changes made as updates will remain publicly available on the ANZCTR website.

The ANZCTR is recognised as an ICMJE acceptable registry (http://www.icmje.org/about-icmje/faqs/clinical-trials-registration/) and a Primary Registry in the WHO registry network (https://www.who.int/ictrp/network/primary/en/index.html).

If you have any enquiries please send a message to info@anzctr.org.au or telephone +61 2 9562 5333.

Kind regards,
ANZCTR Staff
T: +61 2 9562 5333
F: +61 2 9565 1863
E: info@anzctr.org.au
W: www.ANZCTR.org.au

ANZCTR
Australian New Zealand Clinical Trials Registry

Appendix S: Study 3 Participant Information Statement

Participant Information Statement

Research Study: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

Associate Professor Suzi Edwards (Responsible Researcher)
Discipline of Exercise and Sport Sciences, Sydney School of Health Sciences, Faculty of Health and Medicine, The University of Sydney
Phone: +61 2 86277895 | Email: suzi.edwards@sydney.edu.au

1. What is this study about?

We are conducting a research study to better understand sleep and mental wellbeing in athletes. Sleep is an essential part of successful training and peak athlete performance. Good quality and adequate sleep are also important to support good mental health and wellbeing. There is not much information about sleep interventions to enhance sleep quality and quantity in elite/pre-elite athletes. Nor is there much information about the way that sleep affects mental health in elite/pre-elite athletes.

The aim of this study is to learn more about whether a sleep intervention protocol based on Cognitive Behavioural Therapy for Insomnia (CBT-I) can improve sleep and mental health in elite athletes. We want to find out more about how sleep education, sleep hygiene/sleep behaviour strategies, and cognitive strategies can improve sleep quality and quantity in athletes. In particular, athletes are susceptible to poor sleep quality and/or inadequate sleep at key performance times, such as during heavy training periods or around competitions. We hope that gaining a better understanding of strategies that can help improve sleep and potentially support good mental health in athletes might help to improve sporting performance and athlete mental health, and reduce athlete-specific psychological distress.

Please read this sheet carefully and ask questions about anything that you don't understand or want to know more about.

By giving consent to take part in this study you are telling us that you:

- ✓ Understand what you have read.
- ✓ Agree to take part in the research study as outlined below.
- ✓ Agree to the use of your personal information as described.

You will be given a copy of this Participant Information Statement to keep.

Who is running the study?

The study is being carried out by the following researchers:

- Associate Professor Suzi Edwards, Senior Lecturer, Discipline of Exercise and Sport Science, Faculty of Medicine and Health, University of Sydney
- Mr Harley de Vos (he/him), PhD Candidate, Faculty of Medicine and Health, University of Sydney; Australian Institute of Sport.
- Dr Kotryna Fraser (she/her), Lecturer, Discipline of Exercise and Sport Science, Faculty of Medicine and Health, University of Sydney.
- Professor Shona Halson, Deputy Director & Recovery Program Lead SPRINT Research Centre, Australian Catholic University.
- Dr Liam Toohey, Clinical Epidemiologist, Adjunct Associate Professor, University of Canberra.
- Dr Renee Appaneal, Sport & Exercise Psychologist, Private Practice, Canberra.
- Dr Shane Ball, Lecturer, Discipline of Exercise and Sport Science, Faculty of Medicine and Health, University of Sydney; Sydney Uni Sport and Fitness.
- Dr Elizabeth Cayanan, Lecturer, School of Medical Sciences, Faculty of Medicine and Health, University of Sydney; Honorary Affiliate Woolcock Institute of Medical Research

Mr Harley de Vos (he/him) is conducting this study as the basis for the degree of Doctor of Philosophy (Health Sciences) at The University of Sydney.

2. Who can take part in the study?

You are eligible to participate in this study if:

1. You are at least 16 years of age; AND
2. You are a student athlete competing for a sporting club within Sydney Uni Sport and Fitness; OR
3. You are an athlete, including a high-school athlete, currently competing at the pre-elite or elite stages of the talent pathway identified by their National Sporting Organisation, National Institute Network or National Basketball Association Global Academy based at the Australian Institute of Sport.

If you are currently pregnant, have chronic or complex pain, an intellectual impairment, Autism-Spectrum Disorder, or another neurological disorder, or are not fluent in English, you are not eligible to participate.

If you are unsure if you are eligible to participate in the study, please email Harley de Vos at hade6638@uni.sydney.edu.au to clarify.

3. What will the study involve for me?

If you decide to take part in this study, you will be asked to complete a series of written questionnaires before the intervention begins. These questionnaires will be related to your sleep behaviour, sleep quality, and athlete specific psychological distress and will take up to 30 minutes to complete. These questionnaires will include completing written informed consent and brief demographic information.

The study will involve:

- Participation will involve completion of surveys and attending testing sessions at three (3) timepoints during the sleep intervention:
    - One (1) week prior to the sleep intervention commencing (i.e., baseline);
    - End of five (5) week sleep intervention; and
    - Two (2) months after the end of the five (5) week sleep intervention.
- Testing will be completed at the either the TAG High Performance Gym run by Sydney Uni Sport and Fitness, or at your National Sporting Organisation's training base or online at a convenient time similar to your sport's training session.
- These three (3) visits will involve:
    - Completion of surveys - approximately 30 minutes to complete.
    - Complete a daily written sleep diary for seven (7) days before attending each testing visit. The diary will take up to 5 minutes to complete each day after you wake up from sleeping.
    - You will also be asked to wearable sleep sensor watch on your wrist that measures your movement while you are sleeping to record the quantity and quality of your sleep for seven (7) days before attending each testing visit.
- The sleep intervention will involve:
    - Attending five (5) weekly 30 minutes sleep strategy sessions to help teach you strategies to help you promote good sleep quality and quantity at your key performance times. These sessions will occur in a group setting, and will be delivered in-person or online depending on your location by an endorsed sport psychologist.
- At testing visit number two (2), the post-intervention testing, you will be invited to complete a feedback form on the sleep intervention and how useful you have found the intervention content.
- The total time commitment for the study is approximately 5 hours.
- The study activities include:
  Baseline Visit Activities (prior to sleep strategy sessions commencing):
    - **Demographics Questionnaire:** these questions will ask about your age, sex, gender identity, sporting competition, and health status. This takes five minutes to complete at the baseline visit only.
    - **Pittsburgh Sleep Quality Index:** This 19-item survey asks you to rate your sleep quality and disturbances over the last month. It takes up to 10 minutes to complete.
    - **Epworth Sleepiness Scale:** this 8-question scale asks how likely you are to fall asleep in different scenarios. It takes up to three minutes to complete.
    - **Athlete Sleep Behaviour Questionnaire:** This 18-item questionnaire asks about sleeping behaviours related to athletes. It takes up to five minutes to complete.

- **Sleep and Activity Monitor:** Sleep measured for a 1-week period using a wrist worn device that measures movements and light. This device is won at all three timepoints.
- **Sleep Diary -** a 7-day sleep diary that asks you about you sleep behaviours and the quality and duration of your sleep. There are 9 questions in total per day and it takes up to five minutes to complete after waking.
- **Athlete Psychological Strain Questionnaire –** This 10-item questionnaire asks about athlete-specific psychological distress and is a screening instrument for elite athlete's mental health.

Testing Timepoint Visit Activities (at two timepoints following the conclusion of the sleep intervention)

- **Athlete Sleep Behaviour Questionnaire:** This 18-item questionnaire asks about sleeping behaviours related to athletes. It takes up to five minutes to complete.
- **Epworth Sleepiness Scale:** this 8-question scale asks how likely you are to fall asleep in different scenarios. It takes up to three minutes to complete.
- **Pittsburgh Sleep Quality Index:** This 19-item survey asks you to rate your sleep quality and disturbances over the last month. It takes up to 10 minutes to complete.
- **Sleep and Activity Monitor:** Sleep measured for a 1-week period using a wrist worn device that measures movements and light. This device is won at all four timepoints.
- **Sleep Diary -** a 7-day sleep diary that asks you about you sleep behaviours and the quality and duration of your sleep. There are 9 questions in total per day and it takes up to five minutes to complete after waking.
- **Athlete Psychological Strain Questionnaire –** This 10-item questionnaire asks about athlete-specific psychological distress and is a screening instrument for elite athlete's mental health.

4. Can I withdraw once I've started?

Being in this study is completely voluntary and you do not have to take part.

Your decision will not affect your current or future relationship with the researchers or anyone else at The University of Sydney, or your National Sporting Organisation. We do not anticipate your decision will affect your relationship with Sydney Uni Sport and Fitness, your National Sporting Organisation, or your university or school.

If you decide to take part in the study and then change your mind, you can withdraw by notifying the lead researchers by email that you no longer wish to take part in the study. From the point of withdrawal, the researchers will no longer contact you in relation to the research study.

If you choose to withdraw, we will not collect any more information from you. Please let us know at the time you withdraw what you would like us to do with information we have collected about you up to that point.

Any information that we have already collected may be kept in our study records with your permission and may be included in the study results.

5. Are there any risks or costs?

The surveys you will be asked to complete are about sleep and athlete-specific psychological distress. Please notify study staff if you are negatively impacted by these questions. All answers can be made in privacy.

If you experience distress from any of our procedures or surveys, we advise you to contact your usual care GP and/or any one of the following free counselling services:

- Lifeline Australia: http://www.lifeline.org.au/ ph: 13 11 14
- Australian Psychological Society: http://www.psychology.org.au/FindaPsychologist/
- The University of Sydney Student Support Services: https://www.sydney.edu.au/students/health-wellbeing.html
- Student Support Services available at your University or School

Aside from giving up your time, we do not expect that there will be any other risks or costs associated with taking part in this study.

6. Are there any benefits?

Participation in this study may help you to improve your strategies to support good sleep, particularly at times of heightened stress such as around competitions and during periods of heavy training and/or academic loads. It is also possible that there may be no direct benefit to you for participating in this study.

Your participation could potentially help in the development of guidelines to governing sports bodies and clubs to guide the promotion of good sleep and/or mental health for athletes.

7. What will happen to information that is collected?

By providing your consent, you are agreeing to us collecting information about you for the purposes of this study.

Any information you provide us will be stored securely and we will only disclose it with your permission, unless we are required by law to release information. The collected data will be reported in Mr Harley de Vos's Doctor of Philosophy thesis (primary use) and further disseminated via scientific journals, conference presentations, social media, news reports or similar. You will not be individually identifiable in these publications.

The data we will collect from the surveys noted in section 4 of this document will be unique to this study. No recordings will be collected in this study and there will be no third-party access to your information during or after the study. Electronic information collected during the study will be stored in an electronic repository which only researcher staff on this project

will have access to. After the completion of the study and the appropriate approved retention period has passed, this encrypted information will be digitally destroyed. Data collected from this study is not intended to be used for any purpose beyond that described in this information sheet.

8. Will I be told the results of the study?

You have a right to receive feedback about the overall results of this study. You can indicate you are interested in receiving feedback by answering the relevant question in an online questionnaire. This feedback will be in the form of a brief lay summary.

In the instance that any of your responses to surveys are cause for concern for your individual health or community safety, researcher personnel will provide you with individual feedback and refer you to see your usual GP or Chief Medical Officer of your National Sporting Organisation to discuss. No member of the research team will share any of your information with any medical providers without your prior consent.

9. What if I would like further information?

When you have read this information regarding this sleep intervention study, the following researcher/s will be available to discuss it with you further and answer any questions you may have:

- Associate Professor Suzi Edwards, Faculty of Medicine of Health: suzi.edwards@sydney.edu.au
- Mr Harley de Vos, Faculty of Medicine of Health: hade6628@uni.sydney.edu.au

10. What if I have a complaint or any concerns?

The ethical aspects of this study have been approved by the Human Research Ethics Committee (HREC) of The University of Sydney [INSERT HREC Approval No. once obtained] according to the *National Statement on Ethical Conduct in Human Research (2007).*

If you are concerned about the way this study is being conducted or you wish to make a complaint to someone independent from the study, please contact the University:

Human Ethics Manager
human.ethics@sydney.edu.au
+61 2 8627 8176

This information sheet is for you to keep.

Appendix T: Study 3 Participant Consent Form

Participant Consent Form

Research Study: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

Associate Professor Suzi Edwards (Responsible Researcher)
Discipline of Exercise and Sport Sciences, Sydney School of Health Sciences, Faculty of Health and Medicine, The University of Sydney
Phone: +61 2 8627 7895 | Email: suzi.edwards@sydney.edu.au

Participant Name

_____

I agree to take part in this research study. In giving my consent, I confirm that:

- The details of my involvement have been explained to me, and I have been provided with a written Participant Information Statement to keep.
- I understand the purpose of the study is to investigate the impact of sleep education and sleep strategies designed to help improve sleep for athletes.
- I acknowledge that the risks and benefits of participating in this study have been explained to me to my satisfaction.
- I understand that in this study I will be required to attend up to three (3) in-person testing sessions: one (1) week prior to the sleep intervention commencing (i.e., baseline); End of five (5) week sleep intervention; And two (2) months after the end of the five (5) week sleep intervention. Each testing session will involve me to complete:
    - Sleep assessment through diary and sleep watch for seven (7) days before attending the testing sessions, and
    - Surveys about sleep, as well as an athlete-specific psychological distress survey.
- I understand that in this study I will be required to attend five (5) weekly 30 minutes sleep strategy group sessions (online or in-person) to help teach strategies to promote good sleep quality and quantity at key performance times.
- I understand that my participation may involve collection of my answers to questions in a secure digital form.

- I understand that being in this study is completely voluntary.

- I am assured that my decision to participate will not have any impact on my relationship with the research team or the University of Sydney, Sydney Uni Sport and Fitness or my National Sporting Organisation, National Institute Network and/or National Basketball Association Global Academy, or any other school or university or sporting organisation I am affiliated with.

- I understand that I am free to withdraw from this study and that I can choose to withdraw any information I have already provided (unless the data has already been de-identified or published).

- I have been informed that the confidentiality of the information I provide will be protected and will only be used for purposes that I have agreed to. I understand that information about me will only be told to others with my permission, except as required by law.

- I understand that the results of this study may be published, and that publications will not contain my name or any identifiable information about me.

I would like feedback on the overall results of this study Yes ☐ No ☐

If you answered **yes**, please provide your preferred contact details (email/telephone/postal address):

_____

_____

_____

_____

- I understand that after I sign and return this consent form it will be retained by the researcher, and that I may request a copy at any time.

Participant Name _____

Signature _____

Date _____

Appendix U: Study 3 Organisational Consent Form

Organisational Consent Form

Research Study: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

Associate Professor Suzi Edwards (Responsible Researcher)
Discipline of Exercise and Sport Sciences, Sydney School of Health Sciences, Faculty of Health and Medicine, The University of Sydney
Phone: +61 2 8627 7895 | Email: suzi.edwards@sydney.edu.au

This is to certify that I, _____ (*organisation representative*) hereby agree that participants affiliated with _____ (*organisation*) may volunteer to participate in the above research project.

The investigation and requirements for participants have been defined and fully explained to me by _____ (*recruiter/researcher)* and I understand the explanation. A copy of the procedures of this investigation and a description of any risks and discomforts has been provided to me and has been discussed in detail with me.

- The details of our organisation's involvement have been explained to me, and I have been provided with a hard copy of the written Organisation Information Statement to keep.

- The organisation understands that the organisation and any of our athletes can withdraw from the project at any time and do not have to give any reason for withdrawing.

- I understand the purpose of the study is to investigate the impact of sleep education and sleep strategies designed to help improve sleep for athletes.

- I acknowledge that the risks and benefits of our organisation participating in this study have been explained to me to my satisfaction.

- I understand that in this study that athletes who consent to participant in the study will be required to complete surveys, actigraphy, and testing attendance at three (3) timepoints during the sleep intervention. These three (3) times points will occur: one (1) week prior to the sleep intervention commencing (i.e., baseline); End of five (5) week sleep intervention; And two (2) months after the end of the five (5) week sleep intervention.

- I understand that in this study that athletes who consent to participant in the study will attend five (5) weekly 30 minutes sleep strategy sessions to help teach them strategies to help promote good sleep quality and quantity at key performance times. These sessions will occur in a group setting and will be delivered in-person or online depending on your athlete's location by an endorsed sport psychologist.

- I understand that being in this study is completely voluntary.

- I am assured that our organisation's decision to participate will not have any impact on my relationship with the research team or the University of Sydney, Sydney University Sport and Fitness, the Australian Institute of Sport, National Institute Networks, or any other sporting organisation we are associated with.

- I have been informed that the confidentiality of the information provide will be protected and will only be used for purposes that our organisation has agreed to. I understand that information about our organisation and our organisation's athletes will only be disclosed to others with permission, except as required by law.

- I understand that the results of this study may be published, and that publications will not contain names or any identifiable information about our athletes or our organisation.

- I acknowledge that I have read the submission and am satisfied that the area of research is supported by our organisation.

- I understand that after I sign and return this consent form it will be retained by the researcher, and that I may request a copy at any time.

Name _____

Position Held within the Organisation _____

Signature _____

Date _____

Appendix V: Study 3 Parent/Guardian Consent Form

Parent/Guardian Consent Form

Research Study: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

Associate Professor Suzi Edwards (Responsible Researcher)
Discipline of Exercise and Sport Sciences, Sydney School of Health Sciences, Faculty of Health and Medicine, The University of Sydney
Phone: +61 2 86277895 | Email: suzi.edwards@sydney.edu.au

Participant Name _____

Parent/Guardian Name _____

Guardianship Status (parent/carer/legal guardian) _____

I agree that my child may participate in this research study. In giving my consent, I confirm that:

- The details of my involvement have been explained to me, and I have been provided with a written Participant Information Statement to keep.
- I understand the purpose of the study is to investigate the impact of sleep education and sleep strategies designed to help improve sleep for athletes.
- I acknowledge that the risks and benefits of participating in this study have been explained to me to my satisfaction.
- I understand that in this study my child/the person under my care will be required to attend up to three (3) in-person testing sessions: one (1) week prior to the sleep intervention commencing (i.e., baseline); End of five (5) week sleep intervention; And two (2) months after the end of the five (5) week sleep intervention. Each testing session will involve my child/the person under my care to complete:
    - Sleep assessment through diary and sleep watch for seven (7) days before attending the testing sessions, and
    - Surveys about sleep, as well as an athlete-specific psychological distress survey.

- I understand that in this study my child/the person under my care will be required to attend five (5) weekly 30 minutes sleep strategy group sessions (online or in-person) to help teach them strategies to promote good sleep quality and quantity at their key performance times.

- I understand that my child's/the person under my care participation may involve collection of their answers to questions in a secure digital form.

- I understand that being in this study is completely voluntary.

- I am assured that my decision to let my child/the person under my care participate will not have any impact on my/our relationship with the research team or the University of Sydney, Sydney Uni Sport and Fitness or my National Sporting Organisation, National Institute Network and/or National Basketball Association Global Academy, or any other school or university or sporting organisation I/we are affiliated with.

- I understand that we (myself and/or my child/the person under my care) are free to withdraw from this study and that we can choose to withdraw any information we have already provided (unless the data has already been de-identified or published).

- I have been informed that the confidentiality of the information provided by myself and/or my child/the person under my care will be protected and will only be used for purposes that I have agreed to. I understand that information about me and/or my child/the person under my care will only be told to others with my permission, except as required by law.

- I understand that the results of this study may be published, and that publications will not contain my child's/the person's under my care name or any identifiable information about me or my child/the person under my care.

  I would like feedback on the overall results of this study Yes ☐ No ☐

  If you answered **yes**, please provide your preferred contact details (email/telephone/postal address):

  _____

  _____

  _____

  _____

- I understand that after I sign and return this consent form it will be retained by the researcher, and that I may request a copy at any time.

Parent/Guardian Name _____

Signature _____

Date _____

Appendix W: Study 3 Recruitment Flyer

RESEARCH PARTICIPANTS WANTED!

- Are you an elite/pre-elite Australian athlete?
- Are you at least 16 years old?
- Would you like to learn strategies to help you sleep better?

Sleep is crucial for optimal physical and mental health, recovery, and athletic performance.

Take part in our research study that involves weekly 30-minute sessions for **five weeks** to learn strategies to help improve your sleep!

Please contact PhD candidate Harley de Vos for more info or to express your interest in participating in this study - hade6628@uni.sydney.edu.au

THE UNIVERSITY OF SYDNEY

Appendix X: CBT-I Training Certificate

UNIVERSITY OF OXFORD

CERTIFICATE OF ATTENDANCE

This is to certify that

Harley de Vos

attended the

Two-Day Masterclass in Cognitive Behavioural Therapy for Insomnia (CBT-I)

November 1st – 2nd 2021

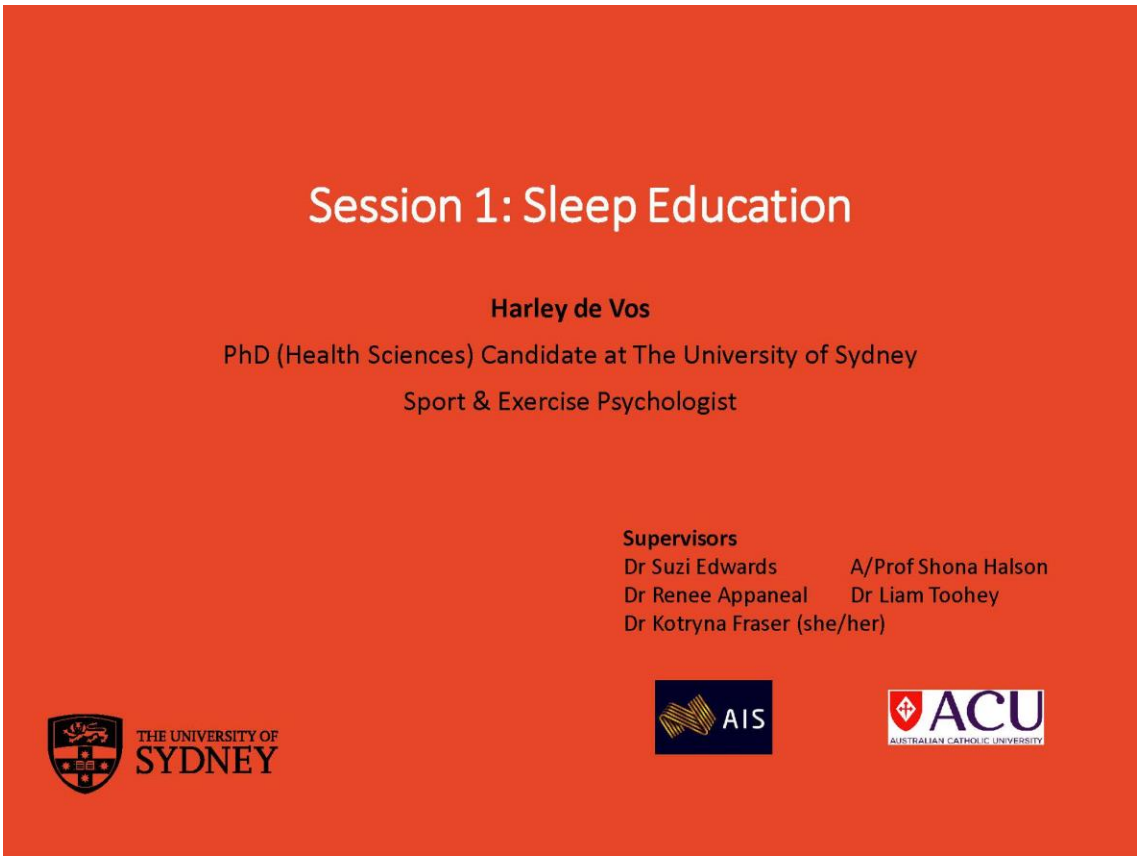
SCNi

ESRS European Sleep Research Society
Sleep Research and Sleep Medicine Europe

Prof Colin Espie **Associate Prof Simon Kyle** **Dr Dimitri Gavriloff** **Dr Lizzie Hill**

[redacted]

Appendix Y: CBT-I Intervention Material



What is Sleep?

- State of reduced mental and physical activity
  - Unresponsiveness to environment
- Altered state of consciousness

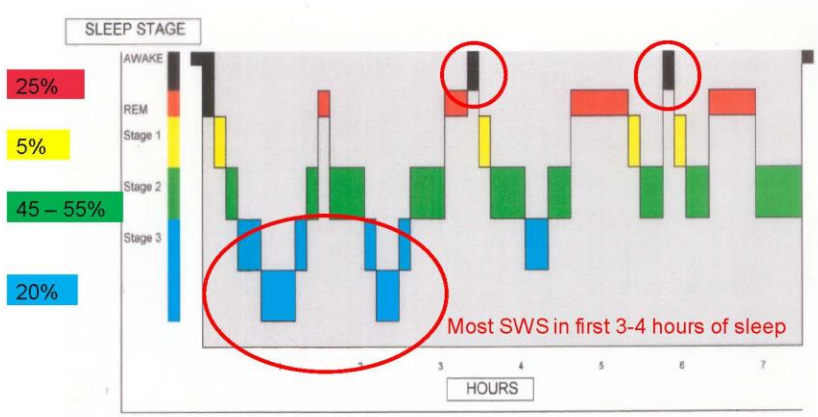
- Essential for life
- Universal across all animals

Stages of Sleep

- NREM
  - Physiological
- REM
  - Psychological

- Sleep cycle comprising both NREM and REM approx. **90 minutes**
- 4-6 sleep cycles per night

Young Adult Sleep Cycle



Graph courtesy of www.woolcock.org.au

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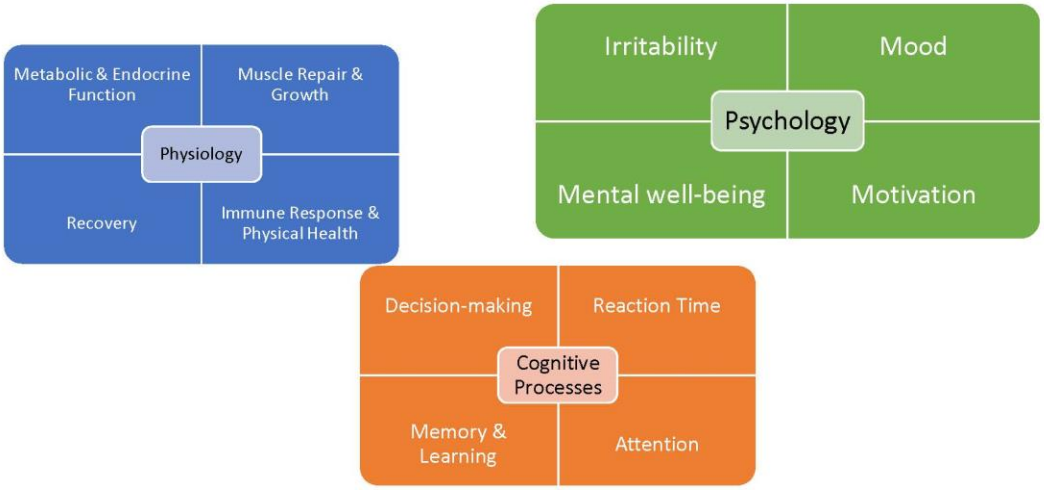
How Much Sleep Do We Need?

- Teenagers = 8 – 10 hours per night
- Adults = 7 – 9 hours per night
- Elite athletes = ??
  - Often report less sleep compared to general population
  - Avg 6.7 hours per night (Sargent et al., 2021)

Why Is Sleep So Important?



Sleep and Athletic Performance

The Effects of Sleep Extension on the Athletic Performance of Collegiate Basketball Players FREE

Cheri D. Mah, MS ✉, Kenneth E. Mah, MD, MS, Eric J. Kezirian, MD, MPH, William C. Dement, MD, PhD

Sleep, Volume 34, Issue 7, 1 July 2011, Pages 943–950,

Results:

Total objective nightly sleep time increased during sleep extension compared to baseline by 110.9 ± 79.7 min ($P < 0.001$). Subjects demonstrated a faster timed sprint following sleep extension (16.2 ± 0.61 sec at baseline vs. 15.5 ± 0.54 sec at end of sleep extension, $P < 0.001$). Shooting accuracy improved, with free throw percentage increasing by 9% and 3-point field goal percentage increasing by 9.2% ($P < 0.001$). Mean PVT reaction time and Epworth Sleepiness Scale scores decreased following sleep extension ($P < 0.01$). POMS scores improved with increased vigor and decreased fatigue subscales ($P < 0.001$). Subjects also reported improved overall ratings of physical and mental well-being during practices and games.

Sleep and Athletic Performance

Longer Sleep Durations Are Positively Associated With Finishing Place During a National Multiday Netball Competition

Laura E. Juliff,[1,2] Shona L. Halson,[3] Jeffrey J. Hebert,[1,2] Peta L. Forsyth,[2] and Jeremiah J. Peiffer[1]

[1]School of Psychology and Exercise Science, Murdoch University, Perth, Western Australia; [2]Department of Physiology, Australian Institute of Sport, Belconnen, Australia; and [3]Faculty of Kinesiology, University of New Brunswick, Fredericton, New Brunswick, Canada

Abstract

Juliff, LE, Halson, SL, Hebert, JJ, Forsyth, PL, and Peiffer, JJ. Longer sleep durations are positively associated with finishing place during a national multiday netball competition. *J Strength Cond Res* 32(1): 189–194, 2018–Sleep is often regarded as the single best recovery strategy available to an athlete, yet little is known about the quality and quantity of sleep in athletes during multiday competitions. This study objectively evaluated sleep characteristics of athletes during a national netball tournament. Using wrist actigraphy monitors and sleep diaries, 42 netballers from 4 state teams were monitored for the duration of a tournament (6 days) and 12 days before in home environments. Significant differences were found between teams based on final competition standings, suggesting enhanced sleep characteristics in athlete's whose team finished higher in the tournament standings. The top 2 placed teams when compared with the lower 2 placed teams slept longer (8:02 ± 36:43; 7:01 ± 27:33), had greater time in bed (9:03 ± 0:52; 7:59 ± 0:54) and reported enhanced subjective sleep ratings (2.6 ± 0.5; 2.3 ± 0.6). Sleep efficiency was no different between teams. A strong correlation ($r = -0.68$) was found indicating longer sleep durations during competition were associated with higher final tournament positions. Encouraging athletes to aim for longer sleep durations in competition, where possible, may influence the outcome in tournament style competitions.

Key Words athletes, recovery, sleep quality, tournament

Take Home Messages

- We spend most of the night in relative light sleep
- Most of our deep sleep occurs early in our sleep
- We dream more the longer we are asleep
- Waking 1-2 times per night is normal

Questions?

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Session 2: Sleep Environment

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Recap

- Two stages of sleep – NREM and REM
- Most deep sleep occurs in first part of the night
- About 20% (or less) of our total sleep per night is deep sleep
- REM sleep increases throughout the night
- Sleep cycle = approx. 90 minutes
- 4-6 sleep cycles per night sleep
- Waking 1-2 times per night is normal

Environmental Factors

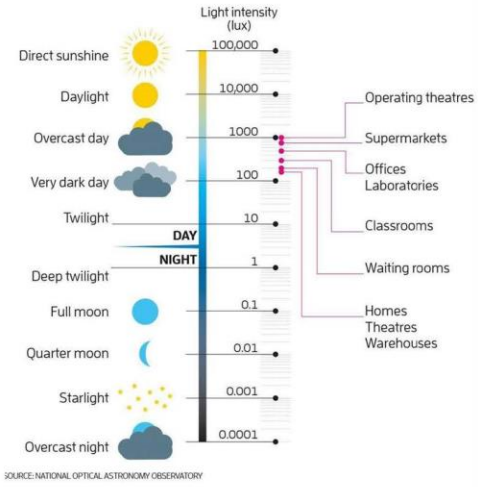
- Our ideal sleep environment..

Environmental Factors

- Light
- Temperature
- Noise
- Bedroom

Light Exposure

- **Morning exposure to sunlight**
  essential to reset circadian rhythm

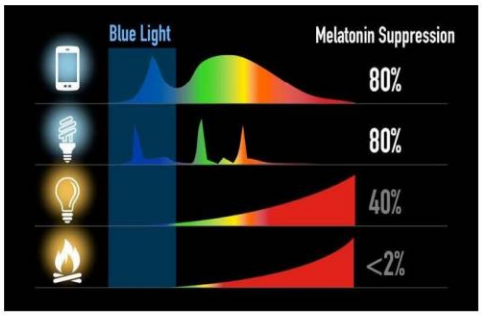


Practical Ideas

- Walk to school
- Walk around block before/after breakfast
- Stretch outside
- Part of morning training session (e.g., warm-up) performed outdoors

Light at Night

- Exposure to light close to bedtime can disrupt our body's natural sleep process
- Devices don't just produce light… stimulate our brains too!



Practical Ideas

- Limit light exposure close to bedtime (9pm onwards)
  - Use a lamp instead
  - Dim lights (if possible)
- Ideally, give your eyes (and brain) a break from devices at least 30 minutes before bed

Light Exposure

- **Morning**
  - Outside 10-15 minutes in the hour after waking
  - No sunglasses!
- **Daytime**
  - As much natural light as possible
- **Evening**
  - Outside during twilight
  - Consider light environment after 9pm

Temperature

- Cool room temperature ideal for sleeping
  - Not too hot!
  - Not too cold!
- Core body temperature needs to drop 1-3° at night for sleep onset
- Core body temperature rising 1-3° in morning triggers wakefulness

Practical Ideas

- Hot shower/bath before bed can help with body temp. drop
- Warm drink (e.g., herbal tea) 60 minutes before bed
- If room too cold, use heater to warm room and turn off prior to bed
- If room too hot, use fan/open window/air con to cool

Bedroom Environment

- If you were designing a space to promote sleep and restfulness, what would it look like?

Bedroom Environment

- Only use your bed for sleeping!
  - Not space for gaming, studying, watching TV etc.
- Ensure your bed and pillow are comfortable
- As much as possible, limit studying and recreation in bedroom (especially if getting to sleep can be a challenge)
- Be conscious of cleanliness and impact mess may have
- Clean, fresh sheets more comfortable

Sleep Tips when Travelling

- Eye mask
- Ear plugs
- Bring a jumper
- Bring your own pillow

Take Home Message

- Consistent sleep time (± 30 mins) important
- Get outside in morning to get sunlight exposure to your eyes
- Limit light at night
- Bedroom like a cave
  - Cool, dark, quiet
- Hot shower before bed
- Only use bed for sleeping

Questions?

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Session 3: Behavioural Strategies to Support Sleep

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Recap

- Morning sunlight exposure important for regulating sleep/wake cycle
- Limit light exposure at night
- Bedroom like a cave
  - Cool, dark, quiet, clean
- Hot shower before bed
- Only use bed for sleeping

Pre-Bed Routine

- To help unwind from the day and prepare our minds and bodies for sleep, it can be helpful to develop a pre-bed routine
- 30-60 mins before bed (ideally)
- Be mindful of environmental factors – light, noise, temperature

Pre-Bed Routine

- Examples of activities that can help us unwind and prepare for sleep
  - Hot shower
  - Warm drink (i.e., herbal caffeine free tea)
  - Reading (with soft light!)
  - Journalling
  - To-do list
  - Calming music
  - Meditation
  - Relaxation exercises

- Try to limit exposure to screens and stimulation during this time

Pre-Bed Routine

- Example:
  - 9.30pm – Peppermint tea and read book (lights dimmed)
  - 9.40pm – Shower
  - 9.50pm – To-do list for tomorrow and pack bag(s)
  - 10pm – Calming meditation
  - 10.15pm – Lights off

Consistency

- Keep bedtime the same each night (± 30 mins)
- Maintain consistent wake time each day
  - (± 60 mins on weekend)
  - Same when travelling
- 80% rule
  - Adequate, good quality sleep 80% of our nights

#1 Behavioural Strategy

- **Only go to bed when sleepy!**

- If not sleepy at "bed time", keep engaging in relaxing pre-bed activities until you feel sleepy and ready for bed
- If not sleepy, don't continue to engage in activities that are likely to keep you stimulated

#2 Behavioural Strategy

- **If can't fall asleep within 20 minutes of being in bed, get up and out of bed**

- Move into another room (ideally) or different part of bedroom
- Sit quietly and engage in relaxing activity
  - E.g., reading, journalling, meditation, relaxation exercise
  - Try to limit bright light
- Boring is better!

- Return to bed and try again when feeling sleepy

Stimulus Control

=

#3 Behavioural Strategy

- **Don't watch the clock!**

- Checking the time during the night, especially if having trouble getting to or staying asleep, can reinforce thoughts about not getting enough sleep
- Perpetuates the cycle of difficulty getting to sleep

#4 Behavioural Strategy

- **"Dump Pad"**

- On bedside table or close to bed, keep a notepad and pen
  - If having trouble falling asleep, or woken and can't get back to sleep
  - Grab notepad and pen and write down everything on your mind
  - Purpose is to get thoughts/worries out of your mind and on to paper
  - No need to solve problems at this time
- Try to avoid using light when doing this

Recap

- Be consistent!
  - Sleep time and wake time same/similar each day
- Pre-Bed Routine
  - Wind down and prepare mind and body for sleep
- Only go to bed when sleepy
- Don't lie awake in bed for long periods (>20 mins)
- Develop association between bed and sleeping
- Avoid clocks in bedroom
- Keep notepad and pen handy if can't sleep

Questions?

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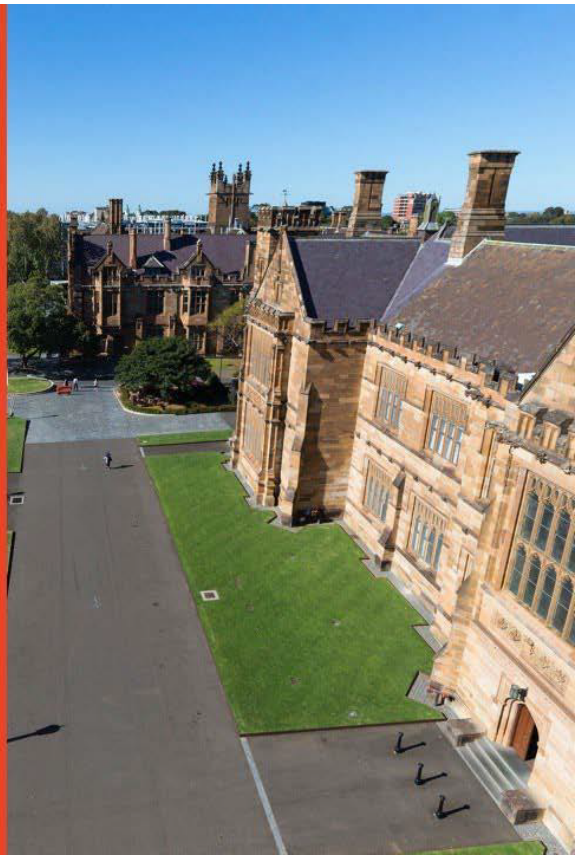
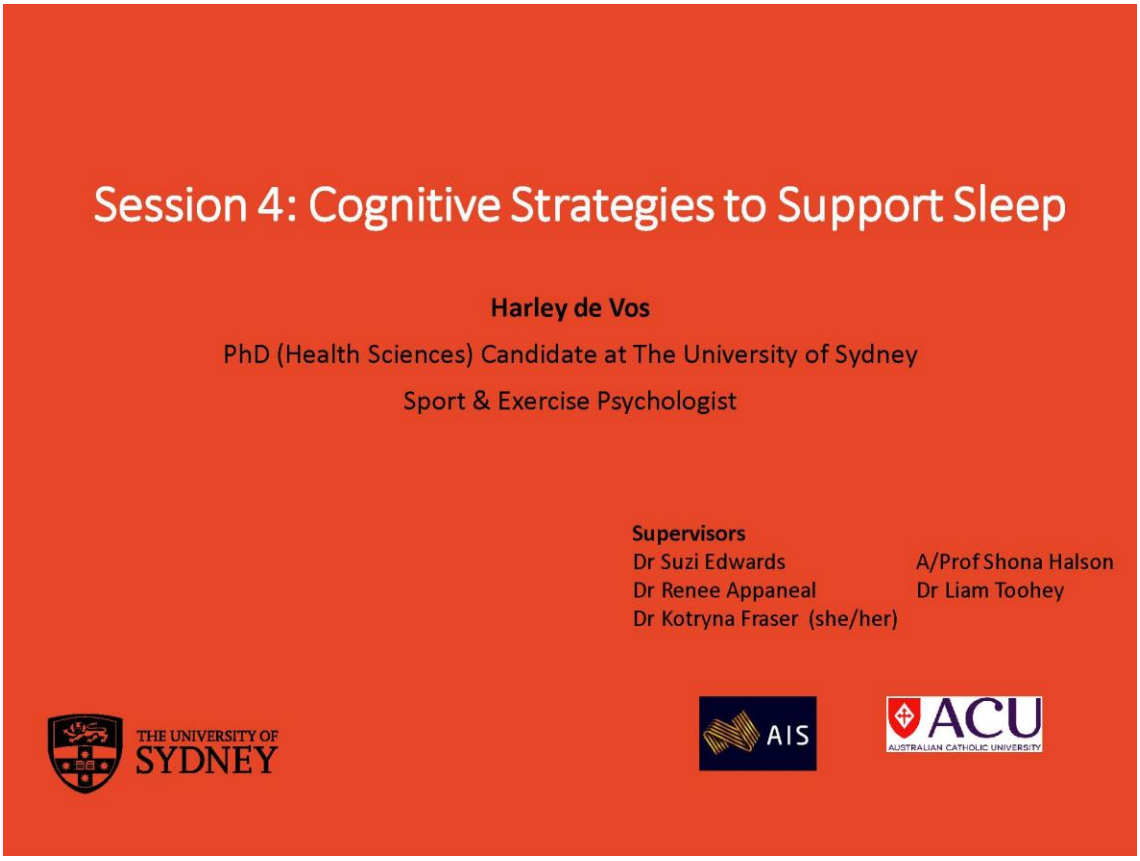




Recap

- Consistency is key
  - Sleep/wake time consistent each day
- Pre-bed Routine
- Only go to bed when sleepy
- Avoid spending long periods of time in bed not asleep (>20 mins)
- Bed = sleep
- Avoid clocks and looking at the time when in bed
- Keep notepad and pen handy if can't sleep

Journaling / Constructive Worry

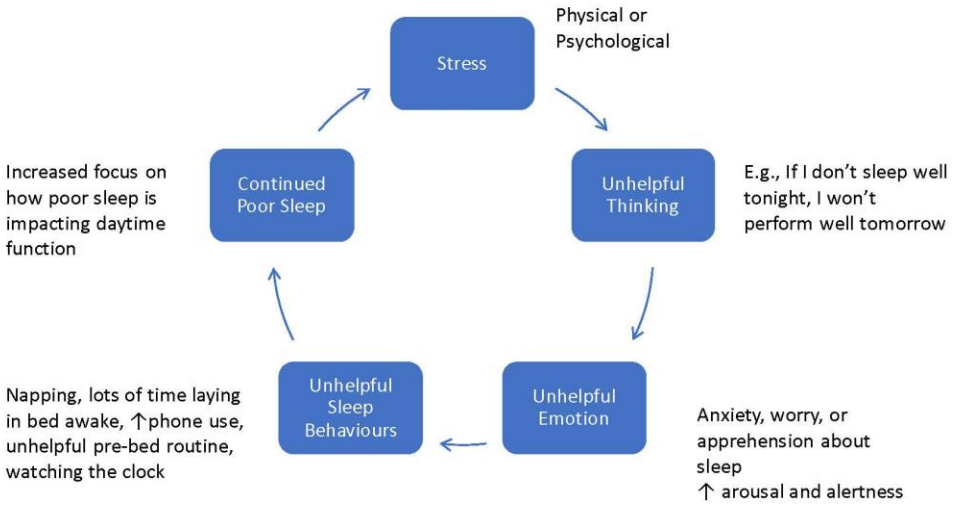
- 15-20 mins, ideally in the early evening (e.g., after dinner)
- Quiet space free from distractions (ideally not in bedroom)
- Notebook / diary and pen

- Reflect on the day you had just had
  - How events went
  - How you feel about the day
  - What went well?
  - What bothered you?

To-Do List

- As part of your Worry Time routine, spend some time thinking about tomorrow
  - What are you looking forward to?
  - What may cause you worry?
- Write down your schedule / key priorities for tomorrow
- Write reminders to follow-up for anything you're unsure about (e.g., chat to coach about next game)
- 'Close the book' on the day
  - Remind yourself when in bed that you have already dealt with any thoughts you may have
- Keep notepad and pen close to bed for any new or difficult thoughts

Cycle of Insomnia



What thought(s) can keep you awake?

"Golden Rule"

- One night of less-than-optimal sleep ≠ poor performance
  - You can still perform well even if you haven't had the best sleep the night before!
- One night of less-than-optimal does not undo years of training and preparation

Cognitive Restructuring

- Notice and change unhelpful thinking patterns
- Unhelpful thoughts can be restructured with more realistic and balanced self-talk

- Example:
  - Situation - laying in bed unable to sleep
  - Unhelpful Thought – "I won't be able to perform tomorrow" or "I'm going to be so tired. Tomorrow will be so hard"
  - **Alternative Thought – "I've functioned after a bad night's sleep before. I can do it again tomorrow"**

Cognitive Restructuring

- Ways that we can challenge and restructure our thinking to be more helpful:
  - Is there another way of seeing this?
  - Is this really as important as it seems?
  - What advice would I give someone else?
  - What would someone else say about this situation?
  - What is the worst-case scenario that could happen if you don't get enough sleep?

Acceptance

- Acceptance = let go of the struggle
- Non-judgemental and kind to yourself

- Accept that you might have trouble getting to sleep
- Accept any unhelpful thoughts or emotions (e.g., stress or anxiety) that you have about sleep
- Accept that you may feel tired tomorrow
- Accept that you can still function and perform even if you are tired

Paradoxical Intention

- As sleep is essentially an involuntary process, attempts to voluntarily induce sleep can make it worse
  - The harder you try to fall asleep, the less likely you are to fall asleep
- Ho  eper 

Golden Rule #2

- Law of Reversed Effect
  - Harder you try, the worse you perform
- Don't try too hard!
- Your body knows how to sleep. It has been sleeping all your life. When you are ready, your body will fall asleep.

Paradoxical Intention

- "Give up" trying to sleep
  - Try to stay awake
  - Lie comfortably in bed in the dark but with your eyes open
  - Give up any effort to fall asleep
  - When your eyelids want to close, say to yourself "just stay awake for a couple more minutes. I'll fall asleep naturally when I am ready"
- Think of wakefulness as an opportunity, not a disaster
  - Can you use the time constructively?
  - Imagine as many catastrophes as you possibly can that will happen just because you are awake
- Make use of humour

(Espie, 2006)

Take-Home Messages

- If falling asleep can be difficult, consider the following:
  - Journaling / Constructive Worry / Worry Time
  - Give up trying to sleep
- You can still function and perform well even after one bad night of sleep
- Don't try too hard or force sleep
- You will sleep when your body is ready

Questions?

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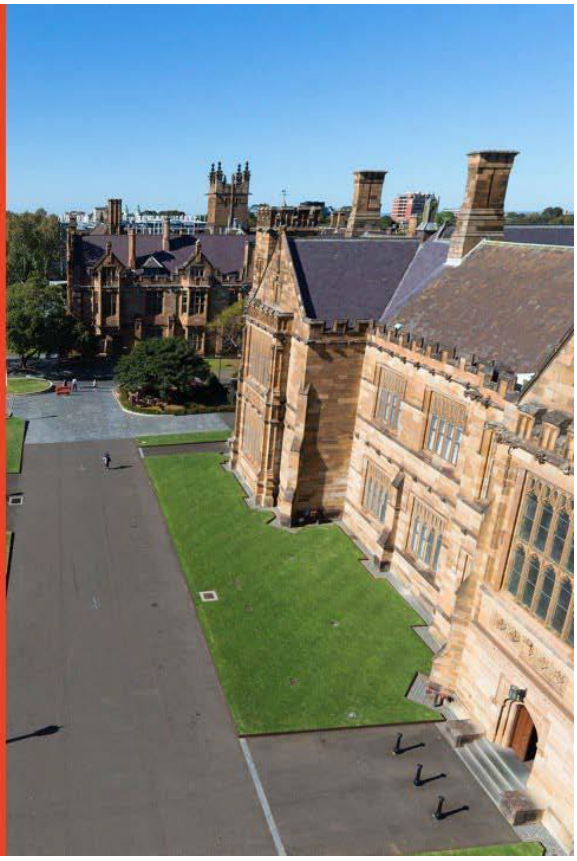

Session 5: Relaxation Techniques

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Recap

- Cognitive Strategies
  - 'Golden Rule' #1 – you can still perform well after one night of bad sleep
  - 'Golden Rule' #2 – don't try too hard to fall asleep. Let it happen
    - Your body knows how to sleep
  - If getting to sleep is proving difficult, consider the following:
    - Journaling / Constructive Worry
    - Give up trying to sleep

Relaxation Techniques

- Techniques/activities designed to:
  - Help someone relax
  - Attain increased level of calm
  - Reduce levels of stress, anxiety, and pain

- Progressive Muscle Relaxation
- Autogenic
- Imagery
- Deep Breathing
- Mindfulness / Meditation

Progress Muscle Relaxation

- Our bodies often store stress and anxiety in our muscles as tension
- PMR involves systematically tensing muscles and then relaxing them
- Best performed either laying down somewhere comfortable (maybe on the floor with a pillow) or sitting
- Consider environmental factors (i.e., light, noise, distractions)
- Avoid PMR if injured or muscles sore

Progressive Muscle Relaxation

- Focus attention on muscle group
- Tense muscle group (one at a time) for **approx. 5 secs**
- Relax muscle group and keep it relaxed for approx. 10 secs
- Maintain attention on muscle group as it relaxes

- Start with dominant hand, then forearm, bicep
- Non-dominant hand etc.
- Move to forehead and slowly and progressively work down your body
- Finish with non-dominant foot

Progress Muscle Relaxation

- How to do Progressive Muscle Relaxation:

https://www.youtube.com/watch?v=1nZEdqcGVzo

Autogenic Training

- More cognitive than PMR
- Work through a series of self-statements about **heavy** and **warm** in different parts of the body
- Instructs body to state of low arousal and focus on sensations
- Form of self-hypnosis

- Autogenic Training 1: total relaxation – your first step into deep relaxation
  - https://www.youtube.com/watch?v=E_sdaDwa2Ek

Imagery

- Just as you might use imagery or visualisation to help mentally prepare to perform, we can also use imagery to help us relax
- Focus is on creating image in our mind of a place that is calming for you(e.g., beach, mountain, at home with a pet)
- Use all of your senses to recreate this scene in your mind
  - The more detail, the better!

Deep Breathing

- Deep breathing can also be an effective strategy to help lower arousal and relax
  - Slow, controlled, deep breaths
  - Attention on the breath/act of breathing
- Breathe in slowly (ideally through nose) for 5 secs, attention on the breath (e.g., air going in through nose, tummy filling up)
- Hold breath for 5 secs
- Breath out slowly (ideally through nose) for 5 secs, attention on breathe
- Hold
- Repeat process

Mindfulness / Meditation

- Mindfulness = present moment awareness
- Guided mindfulness or meditation exercises can be really effective at helping us to relax
- Focus point to direct your attention
  - Breath
  - Body scan
  - Mantra

Mindfulness / Meditation

- Apps to consider:
  - CALM
  - Smiling Mind
  - Headspace
  - Insight Timer
  - 10% Happier
  - Oura Ring

Napping

- Naps are great supplementation to get additional sleep as needed
  - Avoid using naps to replace sleep
- If have trouble falling asleep at night, avoid napping
- When napping, ideally we want to be asleep for 90 mins (one sleep cycle)
- If 90 mins is not possible, nap for no longer than 30 mins (to avoid getting into deep sleep and waking from here)

Napping

- Earlier in the day is better for napping
- Avoid late afternoon naps which make it harder to fall asleep that night
- If napping before training or a game, must wake at least 60 mins prior to ensure you are fully alert

Travel Tips

- Take ear plugs, eye mask to ensure light and noise are minimised
- If possible, take your own pillow
- Make sure your bed is comfortable and appropriate size
- If arrive in morning, try to stay awake until that evening to help adjust your circadian rhythm
- Walk/stretch/exercise first morning
- Remember pre-bed routine and sleep strategies discussed in these sessions
  - They will work when you are travelling too!

Take-Home Messages

- Relaxation exercises can be really helpful for relaxing and unwinding after the day, and help to prepare our bodies and minds for sleep
- Best performed as part of wind-down routine, before getting into bed
- Guided exercises very helpful, especially if new to relaxation
  - Consider apps and YouTube videos
- Regular practice makes relaxation exercises more effective
- Try different ones until you find one that works for you!

Questions?

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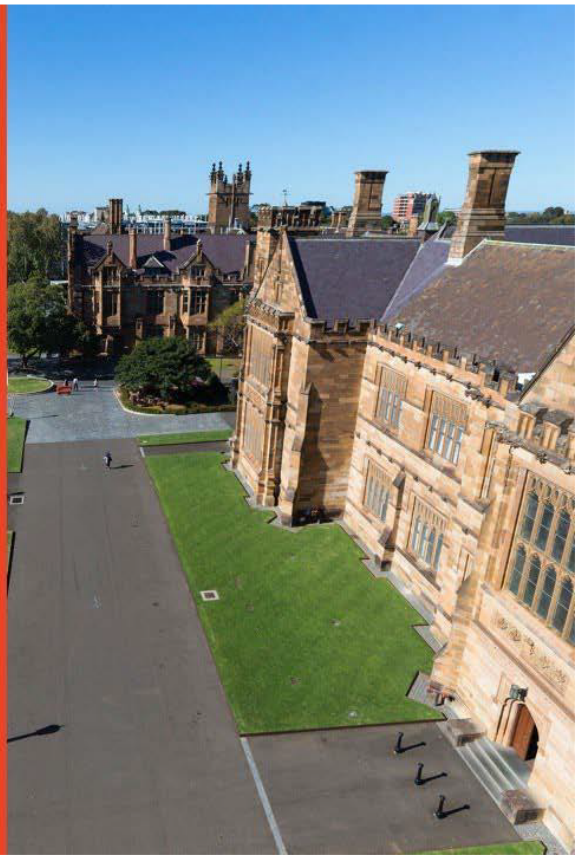

Appendix Z: Study 3 Survey Booklet

Research Study: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

Dr Suzi Edwards (Responsible Researcher)

Discipline of Exercise and Sport Sciences, Sydney School of Health Sciences, Faculty of Health and Medicine, The University of Sydney

Phone: +61 2 8627 7895 | Email: suzi.edwards@sydney.edu.au

Survey Booklet

Participant ID: _____

Date: _____

The following information will be collected for purposes of the research project only. All information will remain confidential, and your answers will not be shared with anyone outside of the research team. Your answers will not have any impact on your current or future sporting selection.

Please complete the following surveys about your sleep and wellbeing. Please be as honest as possible with your answers. If you are unsure how to answer a question, please ask the researcher. Please find at the end of your survey booklet instructions for using the sleep watches.

If you have any questions about any of the surveys after completing them, please email Harley de Vos at hade6628@uni.sydney.edu.au to clarify.

Athlete Psychological Strain Questionnaire

Instructions for completion: Please think back over the last **four weeks** and respond to each item considering how often it applied to you. Please respond where 1 = *none of the time*; 5 = *all of the time*.

	None of the time	**A little of the time**	**Some of the time**	**Most of the time**	**All of the time**
1. It was difficult to be around teammates	1	2	3	4	5
2. I found it difficult to do what I needed to do	1	2	3	4	5
3. I was less motivated	1	2	3	4	5
4. I was irritable, angry or aggressive	1	2	3	4	5
5. I could not stop worrying about injury or my performance	1	2	3	4	5
6. I found training more stressful	1	2	3	4	5
7. I found it hard to cope with selection pressures	1	2	3	4	5
8. I worried about life after sport	1	2	3	4	5
9. I needed alcohol or other substances to relax	1	2	3	4	5
10. I took unusual risks off-field	1	2	3	4	5

Epworth Sleepiness Scale

The following questions relate to your perception of daytime sleepiness. For each question, please answer how likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times (i.e., in the past month).

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

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

0 = would never doze

1 = slight chance of dozing

2 = moderate chance of dozing

3 = high chance of dozing

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

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

THANK YOU FOR YOUR COOPERATION

Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. **Please answer all questions** by ticking the box that indicates the most accurate reply for you**.**

1. During the past month, what time have you usually gone to bed at night? _____
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? _____
3. During the past month, what time have you usually gotten up in the morning? _____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.) ___

5. During the past month, how often have you had trouble sleeping because you…	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				

i. Have pain				
j. Other reason(s), please describe:				
6. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
9. During the past month, how would you rate your sleep quality overall?				

	No bed partner or room mate	Partner/room mate in other room	Partner in same room but not same bed	Partner in same bed
10. Do you have a bed partner or room mate?				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
If you have a room mate or bed partner, ask him/her how often in the past month you have had:				
a. Loud snoring				
b. Long pauses between breaths while asleep				
c. Legs twitching or jerking while you sleep				
d. Episodes of disorientation or confusion during sleep				
e. Other restlessness while you sleep, please describe:				

The Athlete Sleep Behavior Questionnaire (ASBQ)

No.	In recent times (over the last month)…	Never	Rarely	Sometimes	Frequently	Always
1	I take afternoon naps lasting two or more hours					
2	I use stimulants when I train/compete (e.g., caffeine)					
3	I exercise (train or compete) late at night (after 7pm)					
4	I consume alcohol within 4 hours of going to bed					
5	I go to bed at different times each night (more than ±1 hour variation)					
6	I go to bed feeling thirsty					
7	I go to bed with sore muscles					
8	I use light-emitting technology in the hour leading up to bedtime (e.g., laptop, phone, television, video games)					
9	I think, plan, and worry about my sporting performance when I am in bed					
10	I think, plan, and worry about issues not related to my sport when I am in bed					
11	I use sleeping pills/tablets to help me sleep					
12	I wake to go to the bathroom more than once per night					

13	I wake myself and/or my bed partner with my snoring					
14	I wake myself and/or my bed partner with my muscle twitching					
15	I get up at different times each morning (more than ±1 hour variation)					
16	At home, I sleep in a less than ideal environment (e.g., too light, too noisy, uncomfortable bed/pillow, too hot/cold)					
17	I sleep in foreign environments (e.g., hotel rooms)					
18	Travel gets in the way of building a consistent sleep-wake routine					

Sleep Watches (Actigraphy)

Instructions for Participants

Over the next week (i.e., seven (7) nights), please wear the sleep watch that you have been given by the research team while you are in bed sleeping.

You only need to wear the watch at nighttime while you are in bed. It may be helpful to put the watch on once you brush your teeth and/or have put on your pajamas.

As wearing a sleep watch may be different from your regular sleep routine, it may be helpful to set an alarm(s) or a reminder(s) on your phone to remember to put the watch on before you go to bed.

Please do not wear the watches in the shower or during a recovery session. They are not waterproof!

You do not need to wear the watches during the day. Only while you are in bed sleeping.

You do not need to press any buttons when you put the watch on.

If you have any questions about the sleep watch you have been allocated, please contact Harley de Vos on hade6628@uni.sydney.edu.au or [Redaction]

Thank you for your participation in this research study!

Appendix AA: Study 3 Demographics Questionnaire

Research Study: Using Cognitive Behavioural Therapy for Insomnia to improve athlete sleep: A sleep intervention study

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Demographics Questionnaire

The following information will be collected for purposes of the research project only. All information will remain confidential, and your answers will not be shared with anyone outside of the research team. Your answers will not have any impact on your current or future sporting selection.

Surname: _____
First name: _____

Preferred name: _____

Age (years only): _____

Sport: _____

Email: _____

1. How do you describe yourself?
   - □ As a man
   - □ As a woman
   - □ In any other way (please specify: _____)
   - □ Prefer not to say
2. Is your gender the same as your sex recorded at birth?
   - □ Yes
   - □ No
   - □ Prefer not to say
3. What is your preferred personal pronoun(s)? (E.g., she/her, he/him, they/them)

   _____
4. How do you describe your sexuality?
   - □ Heterosexual or straight
   - □ Gay
   - □ Lesbian
   - □ Bisexual
   - □ In any other way (please specify: _____)
   - □ Prefer not to say

5. How do you describe your ethnic identity?

   _____

   _____
6. Are you an AIS, NSO or NIN (i.e., state sporting institute) scholarship holder?
   - □ Yes (please proceed to Q7)
   - □ No (please proceed to Q8)
7. What level in the talent pathway are you currently?
   - □ T1
   - □ T2
   - □ T3
   - □ T4
   - □ E1
   - □ E2
   - □ M1
   - □ Other (please specify: _____)
   - □ Prefer not to say

8. How many years have you been competing at your current talent pathway or competition level?
   - □ Less than 12 months
   - □ 1 – 2 years
   - □ 2 – 3 years
   - □ 3 – 4 years
   - □ 4 – 5 years
   - □ More than 5 years

9. How many years have you been competing at any level within or outside the talent pathway?
   - ☐ Less than 12 months
   - ☐ 1 – 2 years
   - ☐ 2 – 3 years
   - ☐ 3 – 4 years
   - ☐ 4 – 5 years
   - ☐ More than 5 years

10. Have you had any medical issues within the past 12 months? (E.g., physical injury sustained in or outside your sport, illness, mental health symptoms and/or disorder)
    - ☐ Yes (go to question 11)
    - ☐ No
    - ☐ Prefer not to say

11. If you have had any medical issues within the past 12 months, please provide information about the nature of the issue or condition, severity of the issue, treatment you received (if any), or any other information you feel may be relevant.

_____
_____
_____
_____
_____
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