# The Stride program: an exercise program for university students experiencing mental health challenges

**Ivan Jeftic, BSc (Hons)**


This thesis is presented for the degree of Doctor of Philosophy of The University of Western Australia

School of Human Sciences

[Exercise & Health Psychology]

2023

**Thesis Declaration**

I, *Ivan Jeftic*, certify that:

This thesis has been substantially accomplished during enrolment in this degree.

This thesis is my own work and does not contain any material previously published or written by another person, except where due reference has been made in the text or Authorship Declaration.

This thesis does not contain material which has been submitted for the award of any other degree or diploma in my name, in any university or other tertiary institution.

In the future, no part of this thesis will be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of The University of Western Australia and where applicable, any partner institution responsible for the joint-award of this degree.

This thesis does not violate or infringe any copyright, trademark, patent, or other rights whatsoever of any person.

The research involving human data reported in this thesis was assessed and approved by The University of Western Australia Human Research Ethics Committee. Approval #: RA/4/20/6055. Written patient consent has been received and archived for the research involving patient data reported in this thesis.

Signature: 

Date: 30 / 08

## Executive Summary

The research presented in this thesis was designed to build our understanding of exercise programs as an approach to support university students experiencing mental health challenges. To do so, we reviewed existing literature to develop the *Stride* program—a 12-week exercise program for students experiencing mental illness or distress. During program implementation, we evaluated the feasibility and assessed pre- to post-program change in key mental health and lifestyle variables. We also conducted an ecological momentary assessment-type study, using multiple assessments at key points throughout the program, to examine associations between Stride participants' perceptions of exercise enjoyment and wellbeing. Finally, we conducted a qualitative study investigating participants' program experiences and the factors influencing their longer-term, post-program exercise adherence.

In Chapter 1, we review literature on the implementation of on-campus exercise programs for university students experiencing mental health challenges. We outline the high prevalence of mental illness in university students, and demonstrate how exercise programs are a viable approach that may help alleviate pressure on existing support systems and promote wellbeing for students. We provide theoretical and evidence-based considerations for the development of on-campus exercise programs, and close this chapter with a description of the Stride program and the aims of this thesis. In Chapter 2, we present a study evaluating the feasibility of the Stride program and pre-to-post program change in key health-related variables. Our results demonstrate support for program feasibility and pre-to-post program changes reflecting meaningful improvements in psychological and physical health indicators including depressive symptomatology, quality of life, physical activity levels, self-efficacy, sleep, weight, and mean arterial pressure.

In Chapter 3, we present an ecological momentary assessment-type (repeated measures) study evaluating associations between exercise enjoyment, exercise session characteristics, depressive symptoms, and health indicators for participants in the Stride program. The results of this study revealed evidence of associations between exercise enjoyment and adaptive responses on depressive symptoms and health outcomes at both between- and within-person levels. In Chapter 4, we conducted a qualitative investigation of participants' experiences during the Stride program, and factors influencing their transition to self-managed exercise following program completion. Our results led to the development of two higher-order categories: (1) experiences and perceptions within the program, with themes of *program design elements, people in the program,* and *perceived effects,* and (2) post-program transition experiences, with themes of *accessibility, improvements in self-efficacy,* and *social exercise.* We discuss the importance of designing exercise programs for this population that improve participants' exercise self-efficacy and provide strong social connections.

The work presented in this thesis extends our understanding of on-campus exercise programs to support students experiencing mental health challenges. There appears to be great promise in the more widespread implementation of structured exercise programs for this purpose. Our studies also suggest that future multisite randomised controlled trials will be beneficial for determining the psychological and physical effects of participation in programs of this nature.

## Table of Contents

## List of Tables

## List of Figures

**Acknowledgements**

I was told each person's PhD journey would be different, but they would all have highs, lows, periods of indifference, and the journey will ultimately be a bastion of learning—mostly by trial and error. My journey was no different, it had the euphoria of a first publication, the depression plagued self-destruct moments, and copious amounts of professional and life lessons. But, one thing never changed throughout my PhD, and it is something I wish for every PhD: the people around me cared for my wellbeing, supported me through tough times, pushed me when success was close, and celebrated all our successes together. In these acknowledgments, I will probably continue to be my woefully forgetful self, but I hope everyone who was part of these accomplishments knows I am thankful, grateful, and that your support is valued far more than I could put in words.

Firstly, without my parents: Srdjan & Ljiljana, everything I have accomplished would not have been possible without you all. My sister, Vlasta, and her growing family (I love you heaps, Greg & Boris), you helped guide me all your life and I'm so grateful to have such a loving, caring, and thoughtful sister. And, my beautiful fiancée, Babette. You were my rock when I felt hopeless, and you always keep me honest. I love you more than you can imagine, *boobear,* thank you for your patience. I love you all, volim vas puno, Ica.

My PhD could not have been as pleasurable, or possible without our core research team: Professor Ben Jackson, Associate Professor Bonnie Furzer, Professor James Dimmock, Dr Tim Budden, and Professor Michael Rosenberg. From the first chat—over a pint—about the development of Stride; having your office doors open and welcoming for all the unplanned chats about PhD and life; the nicknames—*I-yay*—and fun banter before meetings; semi-structured interviews, as co-construction; always providing opportunities for further growth; and all the *eyyyy's* and *wop's*, it was an

honour to have created such great memories with you all (and hopefully there will be many more in the future).

To our amazing Stride program coordinator: Mr Conor Boyd. When you came aboard it all kicked off, and the program was an **amazing** service with you. Our game of golf will happen soon, the beers are on me. And, to everyone at the Exercise & Performance Centre, thanks for the chats, help, and being the friendliest group around!

Furthermore, to all the support from my extended co-authors: Dr Kemi Wright, Professor Catherine M Sabiston, Associate Professor Amanda Rebar, Mr Aaron Simpson, Ms Melissa deJonge, Mr Ben Kramer, Mr Brett Buist, and Mr Ian Fitzpatrick, thank you for all the support in putting together this thesis – I am beyond grateful.

My gratitude goes out to every single amazing person who volunteered their time to participate in our research, all of this would not have been possible without you all. Thank you for all of the surveys (I know there were a lot of them), and for the time spent in interviews with me; it was an amazing experience hearing your stories, and I wish all of you the best. To all of the services that were so kind and willing to collaborate with us on this project: UWA Sport, UWA Medical Services, UWA Counselling Services, the Robin Winkler Clinic, UWA Student Guild—thank you, the support you all provided made Stride possible, and a service loved by all.

Notwithstanding, my friends that keep standing by me: Austin, Hamish, Aaron, Sarah, Cory, Myles, Luciana, Zehra, & everyone that's been an **enormous** part of my life, I have such great memories with you all, and I hope we keep making more in the future.

Gi and Christian: you two made everything seem easy, possible, and were always there to help, thank you so much. And, to all of the UWA School of Human Sciences staff: the corridor chats, the opportunities for work and learning, the support

when life was tough, every day was a little easier having your support close by, and the great laughs between.

The important people that I did not get to see as often as I would have liked: Amanda Derbyshire, Liz Caddy, John Terry, without you three… I would probably never have attempted or completed my PhD. To the HPEU, and The Living Room teams—I am so happy to have worked with all of you (past & present) and will never forget the experience.

Finally, thank you once more to my beautiful family and partner, I love you all.

*This research is supported by an Australian Government Research Training Program (RTP) Scholarship*

## Authorship Declaration

This thesis contains work that has been published and prepared for publication.

Chapter 1:

**Jeftic, I.**, Furzer, B. J., Dimmock, J. A., Wright, K., Boyd, C., Budden, T., Rosenberg, M., Kramer, B., Buist, B., Fitzpatrick, I., Sabiston, C. M., deJonge, M., & Jackson, B. (2023). Structured exercise programs for higher education students experiencing mental health challenges: background, significance, and implementation. *Frontiers in Public Health*, 11, 1104918. https://doi.org/10.3389/fpubh.2023.1104918

Chapter 2:

**Jeftic, I.**, Furzer, B., Dimmock, J. A., Wright, K., Budden, T., Boyd, C., Simpson, A., Rosenberg, M., Sabiston, C. M., deJonge, M., & Jackson, B. (2023). The Stride program: Feasibility and pre-to-post program change of an exercise service for university students experiencing mental distress. *Psychology of Sport and Exercise*, 69, 102507. https://doi.org/10.1016/J.PSYCHSPORT.2023.102507

Chapter 3:

**Jeftic, I.**, Rebar, A., Furzer, B. J., Dimmock, J. A., Budden, T., Simpson, A., Wright, K., Boyd, C., Rosenberg, M., Sabiston, C. M., deJonge, M., & Jackson, B. (*in review*). *Exercise enjoyment, depressive symptoms, and health outcomes for university students in a mental health service: An intensive repeated measures study.* Manuscript submitted for publication.

**Bibliographic details of publication/manuscript 1:**

Structured exercise programs for higher education students experiencing mental health challenges: background, significance, and implementation.

**Location in thesis:**

Chapter 1

**Student contribution to work:**

Writing – Original Draft, and Writing – Review and Editing.

**Bibliographic details of publication/manuscript 2**

The Stride program: Feasibility and pre-to-post program change of an exercise service for university students experiencing mental distress.

**Location in thesis:**

Chapter 2

**Student contribution to work:**

Formal analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review and Editing, and Project administration.

**Bibliographic details of publication/manuscript 3**

Exercise enjoyment, depressive symptoms, and health outcomes for university students in a mental health service: An intensive repeated measures study.

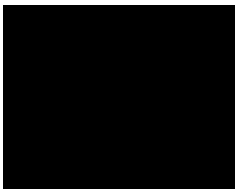
**Location in thesis:**

Chapter 3

**Student contribution to work:**

Formal analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review and Editing, and Project administration.

| **Bibliographic details of publication/manuscript 4** |
| --- |
| Structured exercise programs to support student mental health: Understanding in-program experiences and post-program exercise maintenance. |
| **Location in thesis:** |
| Chapter 4 |
| **Student contribution to work:** |
| Formal analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review and Editing, and Project administration. |

Student signature: 

Date: 30 / 08 / 2023

I, Ben Jackson, certify that the student's statements regarding their contribution to each of the works listed above are correct.

As all co-authors' signatures could not be obtained, I hereby authorise inclusion of the co-authored work in the thesis

Coordinating supervisor signature: 

Date: 30 / 08 / 2023

## Conference Proceedings Arising from this Thesis

**Jeftic, I.**, Boyd, C., Wright, K., Dimmock, J., Furzer, B., & Jackson, B. (July, 2021*). Stride: An on-campus peer-mentored exercise program for students experiencing mental illness.* Oral presentation at the annual conference of the School of Human Sciences Post-Graduate Research Expo, UWA, Perth, Australia.

**Jeftic, I.**, Boyd, C., Wright, K., Dimmock, J., Furzer, B., & Jackson, B. (November, 2021). *Feasibility and preliminary efficacy of an on-campus exercise program for students experiencing mental health challenges.* Oral presentation at the annual conference of the Telethon Kids Institute Symposium, Perth, Australia.

**Jeftic, I.**, Jackson, B., Furzer, B., & Dimmock, J. (October, 2021). The Stride program: Study protocol for an on-campus physical activity referral program for tertiary students' experiencing mental health challenges. *Journal of Science and Medicine in Sport*, *24*, S69–S70. https://doi.org/10.1016/J.JSAMS.2021.09.172. Poster presented at the annual conference of Sports Medicine Australia (SMA), Perth, Australia.

**Jeftic, I.**, Furzer, B., Dimmock, J.A., Wright, K., Budden, T., Boyd, C., Simpson, A., Rosenberg, M., Sabiston, C. M., Jackson, B. (June, 2023). *An exercise service for university students experiencing mental illness: A feasibility study of the Stride program.* Poster presented at the annual conference of North American Society for the Psychology of Sport and Physical Activity (NASPSPA), Toronto, Canada.

**Jeftic, I.**, Furzer, B., Budden, T., Simpson, A., Sabiston, C. M., Jackson, B. (July, 2023*). Stride: an exercise program for students experiencing mental distress.* Oral presentation at the annual conference of the School of Human Sciences Post-Graduate Research Expo, UWA, Perth, Australia.

## Chapter 1:

## *Structured exercise programs for higher education students experiencing mental health challenges: Background, significance, and implementation*

This chapter is based on the peer-reviewed paper published in *Frontiers in Public Health*.

Jeftic, I., Furzer, B. J., Dimmock, J. A., Wright, K., Boyd, C., Budden, T., Rosenberg, M., Kramer, B., Buist, B., Fitzpatrick, I., Sabiston, C. M., deJonge, M., & Jackson, B. (2023). Structured exercise programs for higher education students experiencing mental health challenges: background, significance, and implementation. *Frontiers in Public Health*, *11*. https://www.frontiersin.org/articles/10.3389/fpubh.2023.1104918

## 1.1 Abstract

The incidence of mental illness is greatest among young adults, and those enrolled in higher education may be particularly vulnerable compared to the general young adult population. Many higher education institutions employ student support staff tasked with implementing strategies to improve student wellbeing and mental illness. However, these strategies tend to be focused on clinical therapies and pharmacological interventions with limited lifestyle approaches. Exercise is an effective method for addressing mental illness and promoting wellbeing, yet widespread provision of structured exercise services to support treatment options for students with mental health challenges has not been fully realised. In an effort to guide exercise strategies for student mental health, we synthesise considerations for developing and delivering exercise programs in higher education settings. We draw directly from the evidence base on existing exercise programs in higher education; and the broader behaviour change, exercise adherence, health psychology, implementation science, and exercise prescription literatures. Our broad considerations cover issues regarding program engagement and behaviour change, exercise 'dose' and prescription, integration with other on-campus services, and robust research and evaluation. These considerations may provide impetus for widespread program development and implementation, as well as informing research focused on protecting and improving student mental health.

*Keywords:* college, post-secondary, physical activity, depression, anxiety, substance use

## 1.2 Introduction

Mental illness encompasses a range of conditions that adversely affect a person's psychological state, and is a leading cause of disability (James et al., 2018). There is evidence to show that, relative to other population groups, the incidence of mental illness—including, for example, anxiety, depression, and substance use disorder—is greatest among young adults (Australian Bureau of Statistics, 2018; McCance-Katz, 2019). In Australia, the prevalence of anxiety disorders among young adults (aged 18-24 years) is 15.4%, and rates of affective and substance use disorders are 6.3% and 12.7%, respectively (Australian Bureau of Statistics, 2018). Similarly high rates of mental illness are evident among young adults across the Western world, including, for instance, the UK (McManus et al., 2016), US (McCance-Katz, 2019), and Canada (Mental Health Commission of Canada, 2013). Within the young adult population, it appears that students enrolled in tertiary or higher education (e.g., at a college or university) may be particularly vulnerable to mental illness compared to the general young adult population (Blanco et al., 2008; Orygen The National Centre of Excellence in Youth Mental Health, 2017). Researchers have shown that tertiary education students experience specific risk (i.e., health and social) factors that might negatively impact their mental health (e.g., Eisenberg et al., 2018). These risks include substance use (particularly binge drinking and marijuana use), sleep problems, a lack of physical activity, experiencing assault or abuse, and financial stress (Lim et al., 2014).

Experiencing mental illness as a young adult is associated with negative short- and longer-term health outcomes. Short-term outcomes can include memory problems, increased perceptions of loneliness, and increased levels of fatigue (Oei & Notowidjojo, 1990; Wing et al., 2002). Longer-term outcomes can encompass persistent emotional and physical health problems (Scott et al., 2016), labour market marginalization (Goldman-Mellor et al., 2014), and relationship dysfunction (Kerr & Capaldi, 2011).

Additionally, adverse outcomes may arise from mental illness that are specific to student populations—including to one's academic performance and engagement (e.g., grades, attendance), and overall university experience (e.g., social isolation). For example, Bruffaerts et al. (2018) demonstrated that internalising (e.g., depression, anxiety) and externalising (e.g., inattentiveness, hyperactivity) mental health problems are associated with reduced academic functioning. This reduced academic functioning for students with mental health problems may be a result of lowered attendance and difficulties coping with their academic load (Pritchard & Wilson, 2003). In addition, Salzer (2012) reported that, relative to those students who were not experiencing mental illness, those who were experiencing mental illness displayed lower engagement and poorer relationships on campus—both factors that are associated with lower graduation rates. Indeed, there is evidence that students with mental health problems display an increased rate of attrition from their studies altogether (Auerbach et al., 2016). Efforts are needed to curb the experiences and effects of mental illness among students.

A large proportion (i.e., over one third) of young adults in Australia (Orygen The National Centre of Excellence in Youth Mental Health, 2017), the UK (Department for Education, 2020), the European Union (Eurostat, 2018), North America (Hussar et al., 2020), and Asia (e.g., Japan; MEXT, 2018) are enrolled in tertiary or higher education. These institutions, such as universities, act as a central 'hub' for a significant proportion of students' daily activities (e.g., study location and services, health care services, recreational facilities), and, therefore, represent an important context for the provision of mental health support. Universities typically employ a variety of staff who can provide students with mental health treatment and support, both in-person and virtually (i.e., online). Qualified mental health support staff (e.g., counsellors, psychologists, medical professionals) can assist by providing direct care and treatment, and/or liaising with other on- and off-campus support (e.g., psychological therapies,

pharmacotherapy treatment). Moreover, university-based administrative and academic (i.e., non-clinical) staff who are educated in available campus supports can have a positive impact on student mental health (Shannonhouse et al., 2017). There are also additional university- or campus-based strategies designed to improve student 'wellbeing'—including involvement in social activities and group skill-building sessions (Bettis et al., 2017), assistance with gender or sexual orientation services (Dunbar et al., 2017), the provision of sport, exercise, and recreation opportunities (Stanton et al., 2015), and interventions to increase physical activity and healthy eating (Brown et al., 2014). In this paper, we focus our attention on the use of structured exercise programming as an on-campus 'complement' to psychological and other medical or clinical services. There is evidence that regular exercise can be beneficial in treating mental illness (e.g., Sancassiani et al., 2018), and universities are typically well-positioned to deliver such programming. However, as we outline in the following sections, greater efforts are needed to develop, resource, and integrate exercise programming on campuses as an adjunct treatment for students experiencing mental illness.

### 1.3 Exercise, Mental Health, and Wellbeing

The effectiveness of exercise as a method to protect or improve mental health has been demonstrated in various populations and settings (Battaglia et al., 2014; Mandolesi et al., 2018; Sancassiani et al., 2018). In their systematic review, Stonerock et al. (2015) concluded that exercise is an acceptable adjunct strategy for the treatment of anxiety for a population over the age of 18. Exercise significantly reduces anxiety when compared to a placebo or waitlist control (Stubbs et al., 2017). Moreover, the anxiolytic effects of exercise may also support mental health improvement when combined with cognitive behavioural therapy (Frederiksen et al., 2021; Jayakody et al., 2013). Exercise has also been recommended as an adjunct treatment for depression

(American Psychological Association, 2019; Ravindran et al., 2016). As a treatment for major depressive disorder, exercise alone has shown similar effectiveness to pharmacotherapy in terms of remission rates (Blumenthal et al., 2007), and it has been identified that the combination of exercise and pharmacotherapy may be more effective in terms of symptomatology improvement than pharmacotherapy alone (Kvam et al., 2016). Aside from anxiety and depression, exercise participation may also offer mental health benefits for those with a substance use disorder (More et al., 2017), psychosis (Mittal et al., 2017), bipolar (Ashdown-Franks et al., 2021), posttraumatic stress disorder (Hegberg et al., 2019), and schizophrenia (Girdler et al., 2019). There are multiple psychobiological mechanisms that may explain the relationship between exercise stimuli and positive mental health—including psychoendocrinological mechanisms, cardiovascular implication models, mechanisms enhancing neuroplasticity, and neurocognitive mechanisms outcomes (for more information see: Acevedo, 2012; Ekkekakis, 2013; or Smith & Merwin, 2021). The proposed mechanisms and models can aid in our understanding of how to best support a student population.

Exercise has also been shown to provide support for mental health and lifestyle behaviours within student populations specifically. For instance, researchers have found (a) a significant negative relationship between physical activity and perceived stress (Nguyen-Michel et al., 2006), (b) that moderate-to-high level intensity physical activity is associated with better sleep quality (Memon et al., 2021), (c) that participating in tennis exercise once weekly decreases depression and anxiety symptoms, and enhances wellbeing (Yazici et al., 2016), and (d) that access to a recreation centre is suggested to contribute to a healthy campus climate (see Jaworska et al., 2016). Despite the benefits of regular exercise participation, it has been documented that students experiencing mental health problems display lower exercise participation levels than their peers who

do not have mental health problems (Eisenberg et al., 2018). Therefore, in order to provide the most comprehensive service and support for students who are experiencing mental health difficulties, it appears important that universities and other higher education institutions provide structured exercise opportunities for unique use and alongside primary clinical treatment approaches such as pharmacotherapy, psychological assessment and services, and counselling. Service provision of this kind is important in part because students value choice regarding treatment approaches and because they often desire alternatives to psychotherapy or medication—including lifestyle approaches such as exercise and diet (Cunningham et al., 2017; deJonge et al., 2020).

There are very few structured exercise programs operating on university campuses with the goal of supporting student mental wellbeing and complementing primary treatment options. We believe that only a handful of such programs have been described in the contemporary literature. Published in 2021, deJonge et al. analysed the effectiveness of *MoveU.HappyU*—a University of Toronto physical activity and behaviour change program for students who are not meeting physical activity guidelines and who are experiencing mental health challenges. *MoveU.HappyU* is a 6-week, one-on-one supervised exercise program, with each supervised session lasting one hour and autonomous exercise suggested up to 150 minutes per week. In their feasibility study, deJonge and colleagues presented preliminary evidence that the intervention positively affects students' mental wellbeing. A modified version of the *MoveU.HappyU* program was established at the University of Windsor, a mid-sized Canadian University. The program *UWorkItOut Uwin* is a 6-week exercise training and counselling intervention (Muir et al., 2020). In their feasibility work, Muir and colleagues reported significant decreases in students' anxiety and depression scores from pre-to post-intervention (Muir et al., 2020). A final intervention named *Western Wellcat* based at a U.S. west coast

university (see Keeler et al., 2019 , for more detail) is a peer-led need-supportive physical activity intervention for students who are not currently physically active and who are experiencing mild-to-moderate depression. The intervention lasts between 8 to 10 weeks, with participants completing two 60-minute sessions each week. In their report, Keeler et al. (2019) concluded that the intervention group displayed improvements in depression and distress scores relative to the control group. The approach in these three programs differed in terms of length, implementation plans (e.g., type of exercise, inclusion of other behavioural therapies), and eligibility requirements, with the first two programs accepting students with any mental health challenge who are not meeting physical activity guidelines and the final program accepting students experiencing mild-to-moderate depression. Regardless of these differences, though, all studies found evidence of positive effects of exercise on mental health.

Despite compelling arguments for the role of structured on-campus exercise programs, there is little evidence to directly inform optimal program design and delivery. As such, it is important (and timely) to offer best practice principles that could be used to underpin on-campus exercise and mental health programs. Therefore, we present a series of theory- and research-informed considerations for the development and delivery of exercise-as-treatment programs for mental illness and psychological distress in tertiary education settings. In presenting these considerations, we were guided by two key principles—first, that structured exercise participation is an important adjunct treatment approach for mental illness among students and student-aged populations; and second, that exercise appears to be overlooked by many tertiary institutions in terms of their mental illness treatment plans. These considerations are presented as a summary of contemporary literature in the fields of psychology, exercise physiology and prescription, behaviour change, and implementation science. We also studied literature regarding the development of on-campus programs of this kind, and

consulted with ‘consumers’ in the form of discussions with participants in and deliverers of two such programs (i.e., *MoveU.HappyU* and a similar program that is currently being trialled at The University of Western Australia).

## 1.4 Program Considerations

Outlined below are four broad considerations intended to inform the development of on-campus exercise programs to support student mental health treatment services (see Table 1). The four broad considerations below are not intended to encompass *all* the idiosyncrasies associated with on-campus exercise programs but are designed to provide programmers with a framework to tailor their unique programs to their institution and facilities.

### 1.4.1 Consideration #1: Elements that Support Program Engagement and Behaviour Change

The provision of a structured service offers routine and accountability for individuals who are ‘prescribed’ with exercise (Carpiniello et al., 2013). Prescribed exercise (or, exercise prescription) refers to the development of a tailored exercise routine, specific to the holistic needs of an individual (e.g., goals, presentation, health outcomes), often administered by an allied health exercise-based specialist (e.g., exercise physiologist, physiotherapist, or physical trainer). In that sense, those seeking to support exercise participation for students with mental illness may be more likely to generate engagement and adherence through directly referring students to a structured service compared to solely connecting to, or raising awareness of, leisure-time exercise options (deJonge et al., 2020). However, even with a structural scaffold in place to guide people’s exercise behaviour, it remains important to be aware of challenges associated with (a) promoting continued engagement in any referral program, and (b) realising the full potential of a service by encouraging exercise participation *outside and*

*beyond* one's involvement in the program. In the material that follows, we broadly consider ways that program designers and researchers might, at least in part, address these challenges by drawing from psychological and behaviour change principles. In doing so (here and throughout), we aim to provide practical suggestions that aid the development and structure of such programs.

Our first consideration in this section focuses on the value of suitable, trained, and supportive *exercise mentors*—to support accountability during a program, to encourage engagement in the program, and to help build and reinforce exercise habits outside the program. Within exercise and other health promotion contexts, there are well-established benefits associated with the use of peer mentors (e.g., significant increases in exercise frequency; see Martin Ginis et al., 2013). On many university and higher education campuses, there are likely to be suitable undergraduate or postgraduate candidates for peer mentoring roles. And, in some institutions, expert mentors may be sourced and trained through cohorts studying in the fields of exercise and health sciences, sport science or kinesiology, and other exercise-related health sciences. It is a requirement for many of the students in these exercise-related fields that they undertake work-integrated learning placements, and accruing experiences within a mental health-support service is typically a growing requirement in these activities (Lederman et al., 2016). Ideally, these peer mentors would not only occupy a role as an expert prescriber and manager of a student's exercise activities, but would also provide compassion and social support through the development of caring relationships with student 'mentees'. In such instances, peer mentors may benefit by obtaining valuable practical experience and developing their confidence and competence working with clients experiencing mental health challenges (Leenstra et al., 2019). Indeed, industry experience outside of the exercise setting specifically has been shown to broadly assist in the development of students' self-efficacy regarding their workplace competencies (e.g., Reddan, 2016).

Similarly, student 'mentees' (i.e., those experiencing mental health problems) benefit from the ongoing and consistent guidance and support of their mentor (Glazzard et al., 2021), as well as potentially increasing their openness and ability to share their experiences by working with the mentor who is 'close' to them and able to empathise and build rapport (e.g., Mead et al., 2001).

A skilled peer mentor may also play a role in supporting our second broad consideration in this section—specifically that programs are designed and delivered in ways that foster *high levels and quality of motivation*. Self-determination theory (Deci & Ryan, 2012) is a framework for understanding human functioning in which it is proposed that individuals' motivation for an activity may vary in strength (i.e., from low to high motivation) *and* quality (i.e., reflecting their 'reason for doing' something). Researchers have demonstrated, in exercise (Wilson et al., 2008) and other related fields (Roth, 2019), that higher quality motivational profiles are associated with greater behavioural engagement and persistence, as well as other desirable outcomes (e.g., enjoyment, sense of purpose) that are key to mental health support (Keeler et al., 2019). These higher quality motivational profiles are characterised by strong autonomous (relative to controlled) motives. Autonomous motives represent engagement in an activity because (a) one derives inherent enjoyment and interest from the activity, (b) one feels the activity aligns with their sense of self, and/or (c) the activity generates valued outcomes. These motives are considered more desirable than those that are more 'controlled' in nature—such as pursuing an activity because of external pressure, guilt, or a desire to obtain reward or avoid punishment.

There are established ways through which program leaders may support more autonomous motivational patterns. These methods are focused on creating environments that support individuals' basic psychological needs—for autonomy (i.e., a sense of volition), competence (i.e., feeling capable in a pursuit), and relatedness (i.e.,

meaningful, close connections to others). For a comprehensive overview of practical need-support recommendations in exercise settings, see Ntoumanis et al. (2018). Briefly though, methods to support autonomy within a structured exercise program for students experiencing mental health difficulties may include the provision of choice regarding exercise timing and modality, inviting questions and conversation, and the provision of strong rationales for any program recommendations. Competence-supportive techniques may include providing adequate challenge, positive reinforcement, recognition of progress, and structured goal setting and monitoring. Finally, relatedness-support may be facilitated directly using skilled mentors, intentional pair- or group-based exercise, and/or specific actions such as showing appreciation, listening and empathising, taking an interest in the students' (mental health, educational, and exercise) progress, and accommodating individual's preferences.

Beyond the use of mentors and motivationally-informed program delivery, there are a number of other considerations and behaviour change techniques that may support program engagement—including providing feedback on behaviour, demonstration of behaviours, action planning with the client, and information about consequences (for a list of behaviour change techniques, see Michie et al., 2015). First, it is important to comment on the value of *exercise goals*. Traditionally, exercise goal setting recommendations have been focused on formulating specific and measurable actions (Bovend'Eerdt et al., 2009). More recently, however, evidence has emerged for the benefits of 'open', or more loosely defined, goals (e.g., "I want to be more active"). In their systematic review and meta-analysis, McEwan et al. (2015) reported that goal setting interventions are effective for promoting physical activity participation *regardless* of goal specificity. A subsequent program of research has demonstrated further support for the benefits of 'open' (i.e., non-specific or -measurable) exercise goals, particularly when individuals are in the early stages of learning or activity

adoption (see Swann et al., 2020). Additionally, these goals may be more likely to be 'flexible' in nature within a population experiencing mental illness. In addition to providing program participants with input into their exercise goals (i.e., autonomy-support), and providing positive feedback relating to goal attainment (i.e., competence-support), program leaders may also encourage participants to consider open alternatives to the more traditional prescriptive and specific goals (e.g., "I'm going to see how many steps I can reach", or "…to see how many new activities I can try"). And, to assist participants in reaching these goals, mentors may engage in appropriate *planning* activities—focusing not only on how, when, with whom, and where activities will be performed, but also 'if—then' contingencies (e.g., "if I miss my session this week, then I'll…"). For an overview of planning activities with respect to exercise participation, see Sniehotta et al. (2005), or Gollwitzer et al. (2004).

Other features that may benefit engagement in programs of this nature include the appropriate use of *variety and novelty* during structured sessions. There are well-established 'vitalising' effects associated with expecting and experiencing variety in exercise (Dimmock et al., 2013; Sylvester et al., 2018), and these benefits may be particularly pronounced for those who are not regular (i.e., 'routinised') exercisers. Moreover, building novel and/or varied experiences into an exercise program may also support participant adherence (see Sylvester et al., 2018). In a practical sense, a focus on variety in session content may also appeal to those participants who form open goals relating to 'trying out' different or new activities. On a separate theme, it has also been demonstrated—within what is often referred to as the 'green exercise' literature (e.g., Pretty et al., 2005)—that *exercising in nature* may promote exercise enjoyment, mood benefits, and self-efficacy (e.g., Lahart et al., 2019). For example, exercising near, or in, water has been shown to reduce anxiety (Bowler et al., 2010), which may be particularly desirable for those experiencing mental health difficulties. As such,

harnessing the natural environment and exposing participants to parks, trees, water, and other natural features, may be a widely feasible program consideration (Bélanger et al., 2019).

There may also be engagement-related benefits associated with the use of gamification principles, mobile technology, and music. *Gamification* involves the application of general elements of game-play (e.g., competition, points, unlocking activities or levels) to various activities (Fitzgerald & Ratcliffe, 2020; Zuckerman & Gal-Oz, 2014). Strategies to accommodate gamification in exercise and mental health programs for students on campuses may include 'friendly' exercise competition with a mentor, the use of real or virtual teams or groups to work together in pursuit of an exercise goal (e.g., "your task is to collectively run 10 kilometres"), unlocking challenges at different stages in a program, and/or an activity-based points tally that results in program completion or advancements. With or without gamification, the use of *mobile technology* (e.g., activity trackers, smart watches, mobile applications) may also encourage engagement-related benefits (Fanning et al., 2012). Mobile technology may promote physical activity participation and adherence (for an example of an application with game play, see Althoff et al., 2016), and may be used to help track exercise and provide feedback. Approaches to integrate mobile technology in this way should be driven by the provision of choice and training for any intended user, as well as being mindful of the potential (positive or negative) role of the technology in relation to the user's mental health (Aschbrenner et al., 2016).

There is also an extensive literature demonstrating the benefits of using *music* in exercise (see Karageorghis & Priest, 2012). Music in exercise can be integrated prior to a session or activity to have stimulatory effects, especially in relation to high-intensity exercise (Eliakim et al., 2007). Asynchronous music can have both stimulatory and motivational effects depending on whether stimulatory or motivational music is chosen

(Crust, 2004; McCown et al., 1997). And, in-task synchronous music can assist in an individual's ability to regulate exercise intensity (Shaykevich et al., 2015). Researchers have also demonstrated mental health improvements through the use of music therapy (see Keen, 2005). Importantly, music may also provide program leaders with an opportunity to cater to participant autonomy through user selection of musical accompaniments (Hutchinson et al., 2018), and could contribute indirectly to relatedness-building if music selection is used as an opportunity by mentors to explore musical interests.

It is also important to briefly highlight that a 'successful' program for students with mental health difficulties should also seek to encourage behaviour change—that is, to stimulate positive exercise habits and behaviours outside and beyond the program itself. Many of the strategies outlined above are likely to enhance the probability of longer-term behaviour change at the same time as building in-program engagement (e.g., promoting motivation, setting goals and making plans). Nevertheless, it is also desirable that programs of this nature also feature explicit *'transition-focused'* content, stages, and strategies. An in-program transition phase prior to the 'removal' of structured programming (i.e., when a student completes the program) is key for implementing and retaining lifestyle change (Firth et al., 2019; Sunesson et al., 2021). Such a phase may be targeted towards (a) identifying and overcoming barriers that clients may face outside of the program, (b) connecting 'graduating' participants to those who have previously completed the program and who may become exercise partners or groupmates, and (c) building 'bridges' to established community- or other campus-based exercise opportunities. Establishing this process before the end of the structured program may also enable exercise mentors to physically attend community-based sessions alongside participants and to actively transition them into such services or facilities.

**Table 1**

*A Summary of Considerations and Specific Recommendations*

| Broad Consideration | Specific Recommendation | Example or Additional Detail |
|---|---|---|
| *Elements that Support Program Engagement and Behaviour Change* | Use of trained peer mentors | Undergraduate or postgraduate; potential for expert mentors available in institutions with exercise-related health courses |
| | Implement motivationally-supportive strategies | Provision of need-supportive intruction to encourage high quality motivation for exercise (see Ntoumanis et al., 2018, for practical recommendations) |
| | Cater for variety and novelty in exercise | Build novel and/or varied experiences into an exercise program; use nature (green exercise) |
| | Harness gamification, mobile technology, and music | Friendly exercise competition with a mentor, using real or virtual teams or groups to work together in pursuit of an exercise goal; consider appropriate mobile applications, smart watches, activity trackers, or online supplementary materials; use self-selected music before and/or during exercise |
| | Dedicate attention and resources to successful 'transitions' | Include a specific and defined transition phase during the program to promote maintenance of exercise habits |
| *The Best Exercise 'Dose'?* | Session length | Suggested minimum exercise session length should be 30 minutes, with improved outcomes from sessions 45 minutes to 1 hour in duration |
| | Session frequency | Multiple exercise sessions per week; some sessions may be prescribed but not supervised |
| | Program length | 10-week program length has been suggested, with effects shown from programs as short as 6-weeks; longer programs, if feasible, may support efficacy |
| | Training modality | Aerobic and anaerobic both show improvement in mental health outcomes; allows for choice |
| | Appropriate measurement protocols | Physical (e.g., body weight, BMI), and mental (e.g., DASS-21, IDS, K10) indicators |
| *Whole-of-Campus Integration in Design and Delivery* | Applying co-design for campus sensitivity | Ensure engagement of key on-campus stakeholders (students, medical staff, research experts, student welfare) throughout design, delivery, and evaluation process |
| | Safety and wellbeing of mentees | Embed exercise service within campus safety protocols; ensure connectivity and responsiveness for those involved |
| | Safety and wellbeing of program providers | Clear reporting protocols (incidents, deterioration); provision of clinical supervision for mentors |
| *Build the Evidence Base with Thorough Research and Evaluation* | Use of best-practice research and reporting strategies | Consider process evaluations (Moore et al., 2005); CONSORT guidelines (Schulz et al., 2010; Eldridge et al., 2016); integrate comprehensive feasibility studies |
| | Methodological considerations | Consider qualitative and quantitative designs; ecological momentary assessments; consult expert Recommendations for Implementing Change Project (Powell et al., 2015) |

### 1.4.2 Consideration #2: The Best Exercise 'Dose'?

In addition to some of the environmental, interpersonal, and perceptual factors that may support engagement in an exercise program for students with mental health difficulties, it is also important to consider the exercise dose that is recommended to elicit meaningful change in mental health outcomes for these individuals. We now turn our attention to this issue and draw from the exercise prescription literature to inform our considerations. Exercise prescription includes a specific plan of physical fitness-related activities, often administered by a rehabilitation specialist (e.g., exercise physiologist, physiotherapist, physical trainer), and designed for a specific purpose. The goals of exercise prescription vary according to the patient or client's needs and health status, and the intended or desired health outcome change (i.e., clinician goals). When working with students who are experiencing mental health problems, a primary goal is to improve their psychological wellbeing and mental health; secondary goals may also include increasing exercise participation levels, improving physical fitness indicators, improving physical health outcomes, and developing a sense of community and social support.

In comparison to exercise prescription for physical or movement-related goals (e.g., increasing range of motion in a joint or overall cardiovascular capacity), there can be more ambiguity regarding exercise prescription for a psychologically-framed goal (e.g., alleviating anxiety or stress symptoms). However, guidelines regarding the preferred exercise treatment plan for individuals with mental health challenges have been proposed. It has been recommended that, where feasible, a minimum of three exercise sessions are provided per week (Morgan et al., 2013), and that in intensive programs up to five sessions per week may be provided (Rethorst & Trivedi, 2013). With respect to session length, it has been suggested that, at a minimum, exercise should be performed for 30 minutes, but it has also been reported that improved

outcomes may be derived from sessions lasting between 45 minutes and one hour (Penedo & Dahn, 2005; Rethorst & Trivedi, 2013; Ströhle, 2008). And, in terms of program duration, periods of 4 to 12 weeks in length have been suggested (Penedo & Dahn, 2005; Ströhle, 2008), with the possibility to achieve improved efficacy for client outcomes through longer (e.g., >12-week) programs (Trivedi et al., 2011). Accordingly, with recognition towards resources and time-restraints, an ideal approach for number of sessions, length of sessions, and program length may likely be *"the longer, the better",* where session facilitators may supplement program sessions with other exercise programs available on-campus (e.g., social competitions).

Physical activity interventions for individuals experiencing mental health challenges have utilised a variety of training modalities, and there is evidence for the effectiveness of anaerobic (e.g., weight-based) and aerobic (e.g., cardiovascular) activities in improving mental health outcomes (Mikkelsen et al., 2017; O'connor et al., 2010). As such, it may be most desirable for program leaders to find a balance between the imposition of some best-practice program/session structural features (e.g., 'prescription' in a classic sense) and the provision of autonomy-supportive strategies. For example, it is likely to be beneficial to have predetermined structure in terms of session length and duration, and for program duration, but client engagement and motivation may be boosted if there is also scope for client input into specific activities and modality (e.g., selecting activity types and time of day, determining variety, selecting natural environments and music). Additionally, the inclusion of affect-based prescription (i.e., exercise that is pleasurable and derives pleasant affective experiences) as part of client input can also assist in engagement and adherence (Murri et al., 2019). It is also important here to recognise that financial, staffing, and facility restraints may restrict any given organisation's capacity to meet best-practice exercise prescription recommendations for this population. As such, although adhering to these

recommendations may increase the likelihood of achieving desirable program outcomes, we do not seek to dissuade researchers and organisations from developing programs in instances when it is known that all of these recommendations cannot be met. Indeed, we adopt the guiding principle that "*some is better than none, and more is better than some*" (for recent evidence in support of simple messaging such as this around exercise prescription, see Jones et al., 2019; Nobles et al., 2020; and for policy-level support, see Brown et al., 2012; US Department of Health and Human Services, 2018).

One important aspect to consider within the broader issue of determining an adequate exercise 'dose' is the associated need to demonstrate (through assessment) the nature and magnitude of any exercise-induced changes in mental health indicators. As a result, when considering scheduling and other programming issues, program deliverers should be mindful to build in appropriate and sensitive health measurement protocols (e.g., at intake, mid-point, and completion of the program). These measurements are particularly key at the beginning of a program in order to understand a participant's 'baseline' on relevant physiological assessments, health assessments, and mental health variables, and to inform appropriate exercise prescription (e.g., the Preference for and Tolerance of the Intensity of Exercise Questionnaire; Zhang et al., 2022). Relevant physiological assessments may include cardiovascular fitness (e.g., cardiopulmonary exercise test, aerobic power index assessment) and strength (e.g., grip strength, three-repetition maximum test) testing (McMahen et al., 2022). Health assessments may include indicators of metabolic health (e.g., body composition, blood pressure, cardiovascular function; Firth et al., 2019). Meanwhile, psychological instruments that are sensitive to change and appropriate for this population may include the Depression, Anxiety, and Stress Scale (DASS-21 or DASS-42; Henry & Crawford, 2005), the Inventory of Depressive Symptomology (IDS-Clinician, IDS-Self Report; or Quick-IDS, such as QIDS-Clinician, QIDS-Self Report; Rush et al., 1996), the Kessler

Psychological Distress Scale (K10; Andrews & Slade, 2001), the Patient Health Questionnaire (Kroenke et al., 2001), the Generalised Anxiety Disorder scale (Spitzer et al., 2006), and the Major Depressive Inventory (Bech et al., 2001). Clearly, building rapport and showing compassion are key qualities for any program coordinator who may be charged with obtaining these assessments—placing individuals through a battery of some or all of these tests is potentially demanding and may be confronting in some respects (e.g., weight assessment; Alimoradi et al., 2020). That being the case, prior to administering these surveys or tests, it would be valuable to 'get to know' the client, perhaps through an informal open-ended discussion. Parenthetically, such a discussion may also support priorities relating to psychological need support, safety, and exercise prescription by way of providing information about the participant's exercise history, preparedness, and preferences. The aforementioned assessments, and open-ended discussions, can also help the exercise mentor provide a more tailored 'dose' (e.g., time spent exercising within and outside of the program) of exercise for each individual.

### 1.4.3 Consideration #3: Whole-of-Campus Integration in Design and Delivery

University and other higher education campuses are culturally and vocationally diverse environments, housing students, academic and administrative staff, and services and providers (e.g., medical facilities, social hubs, student body representation, sport and recreational clubs and facilities). As a result of this diversity within and across campuses, it is unlikely that there exists an effective 'one size fits all' approach to the development and delivery of exercise programs designed to support students experiencing mental health difficulties. Accordingly, in order to optimise program feasibility and effectiveness, and to appropriately address the needs of stakeholders and end users, a process of 'co-design' may be a desirable program feature. Co-design is an increasingly popular implementation method within health promotion settings (Larkin et

al., 2015; Steen et al., 2011). Health promotion settings on campus are likely to include (for example) a medical centre, psychological services, and sports and recreation services. Individuals within each of these settings should be involved with program design, alongside other student wellbeing initiatives that may be offered on-campus (e.g., interventions targeting stress, peer support, academic engagement, and other lifestyle behaviours such as sleep or alcohol intake). Although specific co-design stages and recommendations vary between (the many) frameworks available in the literature, there are often consistent themes that pervade these models. Boyd et al. (2012) for example, outlined six core elements in their co-design process, each of which involves discussion with stakeholders and end-users: (1) engage, (2) plan, (3) explore, (4) develop, (5) decide, and (6) change. Similarly, Eyles and colleagues (2016) outline their six-step process involving the assessment of evidence and user needs, development of the intervention or service, and prototype and pilot testing with continuous feedback. Key to the conduct of co-design, therefore, are recommendations to meaningfully engage with relevant stakeholders, respond to this engagement, and to regularly repeat this process throughout the development and delivery (and optimisation) of a health service or program.

In the case of an exercise program for students with mental health difficulties, initial co-design activities may focus on devising the scope of the program, searching relevant literature, and soliciting information—through focus groups or one-to-one discussion—from students, student bodies and representatives, medical personnel, and campus services relating to sport, recreation, disability (also see, in a related sense, ‘co-production’; Smith & Wightman, 2019), minority groups, and student wellness. These groups should also be consulted regularly through any subsequent planning and development stage, with a focus on driving feasibility, acceptability, reach, inclusivity, and accounting for student experiences stemming from intersectionality considerations

(Mulvale et al., 2019). It would also be valuable at this stage to seek input from diverse populations on campus regarding people's experiences of any similar programs (previously or on other campuses or in other workplaces). This stage also provides an opportunity for groups to ensure the program provides connectedness to the cohort it represents, and that it reflects the university culture (e.g., through the name of the program). Importantly, in a robust co-design process, these consultation activities continue well beyond the preparatory phase of an intervention or program, and are maintained with the purpose of seeking feedback and continual improvement (Bovaird, 2007). When these co-design processes operate most effectively (e.g., Move with Recovery, Matthews et al., 2022; Staying Strong Toolbox, Carr et al., 2021; or Girls Active programme, O'Reilly et al., 2023), they increase the likelihood of developing a service that is built on previous successful programs, is tailored to the host institution, meets the needs of stakeholders and end users, and is integrated within and implemented alongside existing on-campus (e.g., medical, psychological, counselling, disability support, health and safety, and recreation) services.

Whilst considering the importance of integrating exercise with existing on-campus services, it is necessary to comment on the value that a 'connected' exercise service brings in supporting student safety and wellbeing. First, by building input from experts in student welfare into a co-design process, program leaders may be more likely to avoid pitfalls with respect to student safety and wellbeing (e.g., ensuring adequate insurance, screening, referral pathways, and facilities; see, for example, Hetrick et al., 2018). In addition, by embedding an exercise service alongside existing safety and wellness groups on campus, program leaders ensure greater connectivity and responsiveness for those involved (see, for example, Thompson et al., 2010). The completion of mental health first aid courses (see, for example, mhfa.com.au), or equivalent, is a critically important training requirement for those involved in the

delivery and management of such a program (Hadlaczky et al., 2014). Clearly, in developing a program that supports students who may be experiencing severe mental illness, suicide (and other critical incident) risk is an important consideration. These risks may be mitigated through the identification of suicidal ideation and harmful behaviours, and through well-documented contingency plans for people who display suicidal tendencies at any stage of program involvement.

With the purpose of ensuring participant safety and efficient reporting protocols (e.g., in the case of deterioration, missed exercise sessions, crises or critical incidents, or for onward referral), exercise mentors and program leaders should be closely connected to other medical, student welfare, and mental health professionals. And, a program structure should be implemented that allows for a clear reporting chain for any adverse incidents (e.g., through critical incidence reports passed onto the program coordinator). In the case of the pilot program of this nature currently underway at The University of Western Australia, for instance, a program advisory group with representatives from these groups meets regularly, and efficient bi-directional referral and reporting is possible between the exercise program, student medical centre, student psychological services, and all other health and welfare programs on campus. Finally, it is important to note that the risk of harm within programs of this nature is not limited only to clients (e.g., through self-harm), but also extends to those in a support role (e.g., program coordinators, exercise mentors) by way of negative psychological impact, compassion fatigue, or distress (Collins & Long, 2003). Any exercise mentors involved in the program should be guided with self-care strategies and plans, and provided with an opportunity for clinical supervision (e.g., meeting regularly with a professional to discuss casework and other professional issues in a structured way; Milne et al., 2007). A program lead, such as an Exercise Physiologist (Lederman et al., 2020), would also insulate mentors and enable them to share client- or program-related concerns.

### 1.4.4 Consideration #4: Build the Evidence Base with Thorough Research and Evaluation

Our final consideration relates to the role of researchers (and research) in the development and optimisation of such exercise programs. It is a recognised priority in health promotion settings that researchers provide robust evaluation evidence regarding program feasibility and effectiveness—such activity is valuable not least because it aids with increasing the effectiveness and pace of uptake of complex interventions (Eccles et al., 2009). Given that the academic literature regarding on-campus exercise programs for students with mental health challenges is at a developmental stage, there are important gaps in our knowledge about the implementation and efficacy of such interventions. Broad considerations in this respect include the need to demonstrate the effects of different program structures, exercise 'doses', and delivery styles on primary (i.e., mental health symptomatology) and secondary (e.g., social support, academic engagement, flourishing) outcomes. Researchers seeking to demonstrate these effects through, for example, randomised controlled trials, would be encouraged to pre-register their efforts, integrate process evaluation protocols into the design of such work (Moore et al., 2015), and adhere to best-practice design, analysis, and reporting standards (i.e., Consolidated Standards of Reporting Trials, Schulz et al., 2010; Grant et al., 2018). Similarly, given that programs of this nature are yet to become commonplace on university and other higher education campuses, there is significant scope for research focused on assessing feasibility (see Eldridge et al., 2016; and for an example of such work, deJonge et al., 2021), implementation issues (e.g., Glasgow et al., 2019), implementation-effectiveness hybrid questions (see Curran et al., 2012; Landes et al., 2020), and important considerations regarding the sustainability, scale-up, and scale-out

(for an overview and example, see Aarons et al., 2017; Smith et al., 2018) of programs of this nature. Program of this nature also provide the opportunity for collaboration through the integration of researchers in various fields including behavioural science (e.g., those housed in population health, psychology, public health, medicine, kinesiology, etc.), physiology, and implementation science.

There are important recommendations within the implementation science literature that may also aid in the design and development of research relating to these programs. For example, the 73 implementation strategies outlined in the Expert Recommendations for Implementing Change Project may provide a platform that (a) helps inform the design of engaging and effective programs in this area (Powell et al., 2015), and (b) provides insight into evaluation targets for researchers and identifies methods for program optimisation. Finally, it is worth briefly commenting on the potential design of such evaluation activity. Intuitively, many researchers often consider quantitative, pre-and-post, controlled designs when seeking to demonstrate effectiveness of a program or service. Notwithstanding the value of such work, it is also beneficial to develop research protocols that are more sensitive to change and that provide more in-depth insight into participants' experiences in such programs. To achieve greater sensitivity to change, repeated measures assessments (e.g., ecological momentary assessments built around weekly session attendance; see, for example, Furzer et al., 2021) may provide insight into fluctuations in exercise experiences and mental health symptoms, as well as the inter-relations between those trajectories (Stone & Shiffman, 1994). And, to enable better insight into participants' experiences, qualitative approaches may be best suited to provide researchers with an ability to understand how, when, and why these programs work (or do not work) at their best (see, for example: Budden et al., 2020; More et al., 2018; deJonge et al., 2021; or Ashdown-Franks et al., 2022).

## 1.5 Aims and Overview of Thesis Structure

The use of on-campus exercise programs to support students experiencing mental health challenges exists in relatively few locations (e.g., Canada; deJonge et al., 2021). Prior to the studies in this thesis, and to the best of our knowledge, no such exercise programs existed or were widely promoted at any Australian University. The preceding four considerations helped guide the development of the Stride program, based at the University of Western Australia, that is described in detail in Chapter 2. At the beginning of this thesis, there was no insight into any aspects of on-campus exercise programs, nor was there significant understanding of participants' experiences in such programs, or the factors that shape post-program transitions into self-managed exercise. In this thesis, we address the key issues mentioned above:

- In Chapter 2, we evaluate the feasibility of the program and provide pre- to post-program assessment of health indicators.
- In Chapter 3, we explore the between- and within-person associations between exercise enjoyment, exercise session characteristics, and perceived health outcomes.
- In Chapter 4, we investigate, through qualitative methods, participants' experiences in the program and post-program exercise transition experiences.
- In Chapter 5, we conclude with a brief general discussion of the practical and conceptual implications, limitations, and broad future research directions.

## 1.6 References


Aarons, G. A., Sklar, M., Mustanski, B., Benbow, N., & Brown, C. H. (2017). "Scaling-out" evidence-based interventions to new populations or new health care delivery systems. *Implementation Science : IS*, *12*(1), 111. https://doi.org/10.1186/s13012-017-0640-6

Acevedo, E. O. (2012). The Oxford handbook of exercise psychology. In *Exercise psychology*. Oxford University Press.

Alimoradi, Z., Golboni, F., Griffiths, M. D., Broström, A., Lin, C.-Y., & Pakpour, A. H. (2020). Weight-related stigma and psychological distress: A systematic review and meta-analysis. *Clinical Nutrition*, *39*(7), 2001–2013. https://doi.org/10.1016/j.clnu.2019.10.016

Althoff, T., White, R. W., & Horvitz, E. (2016). Influence of Pokémon Go on Physical Activity: Study and Implications. *Journal of Medical Internet Research*, *18*(12), e315–e315. https://doi.org/10.2196/jmir.6759

American Psychological Association. (2019). *Clinical practice guideline for the treatment of depression across three age cohorts*. https://www.apa.org/depression-guideline

Andrews, G., & Slade, T. (2001). Interpreting scores on the Kessler Psychological Distress Scale (K10). *Australian and New Zealand Journal of Public Health*, *25*(6), 494–497. https://doi.org/10.1111/j.1467-842x.2001.tb00310.x

Aschbrenner, K. A., Naslund, J. A., Shevenell, M., Mueser, K. T., & Bartels, S. J. (2016). Feasibility of Behavioral Weight Loss Treatment Enhanced with Peer Support and Mobile Health Technology for Individuals with Serious Mental Illness. *The Psychiatric Quarterly*, *87*(3), 401–415. https://doi.org/10.1007/s11126-015-9395-x

Ashdown-Franks, G., deJonge, M., Arbour-Nicitopoulos, K. P., & Sabiston, C. M. (2022). Exploring the feasibility and acceptability of a physical activity programme for individuals with serious mental illness: A case study. *Qualitative Research in Sport, Exercise and Health*, 1–23. https://doi.org/10.1080/2159676X.2021.2019098

Ashdown-Franks, G., Pilieci, C., & Sabiston, C. M. (2021). *Chapter 33 - Physical activity and exercise in the pathophysiology and treatment of bipolar disorder* (J. Quevedo, A. F. Carvalho, & E. B. T.-N. of B. D. Vieta, Eds.; pp. 373–381). Academic Press. https://doi.org/https://doi.org/10.1016/B978-0-12-819182-8.00035-1

Auerbach, R. P., Alonso, J., Axinn, W. G., Cuijpers, P., Ebert, D. D., Green, J. G., Hwang, I., Kessler, R. C., Liu, H., Mortier, P., Nock, M. K., Pinder-Amaker, S., Sampson, N. A., Aguilar-Gaxiola, S., Al-Hamzawi, A., Andrade, L. H., Benjet, C., Caldas-de-Almeida, J. M., Demyttenaere, K., … Bruffaerts, R. (2016). Mental disorders among college students in the World Health Organization World Mental Health Surveys. *Psychological Medicine*, *46*(14), 2955–2970. https://doi.org/10.1017/S0033291716001665

Australian Bureau of Statistics. (2018). *National Health Survey First Results 2017-18*. National Health Survey 2017-18. https://www.abs.gov.au/statistics/health/health-conditions-and-risks/national-health-survey-first-results/latest-release

Battaglia, C., di Cagno, A., Fiorilli, G., Giombini, A., Borrione, P., Baralla, F., Marchetti, M., & Pigozzi, F. (2014). Participation in a 9-month selected physical exercise programme enhances psychological well-being in a prison population. *Criminal Behaviour and Mental Health*, *25*(5), 343–354. https://doi.org/10.1002/cbm.1922

Bech, P., Rasmussen, N.-A., Olsen, L. R., Noerholm, V., & Abildgaard, W. (2001). The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. *Journal of Affective Disorders*, *66*(2–3), 159–164.

Bélanger, M., Gallant, F., Doré, I., O'Loughlin, J. L., Sylvestre, M.-P., Abi Nader, P., Larouche, R., Gunnell, K., & Sabiston, C. M. (2019). Physical activity mediates the relationship between outdoor time and mental health. *Preventive Medicine Reports*, *16*, 101006. https://doi.org/https://doi.org/10.1016/j.pmedr.2019.101006

Bettis, A. H., Coiro, M. J., England, J., Murphy, L. K., Zelkowitz, R. L., Dejardins, L., Eskridge, R., Adery, L. H., Yarboi, J., Pardo, D., & Compas, B. E. (2017). Comparison of two approaches to prevention of mental health problems in college students: Enhancing coping and executive function skills. *Journal of American College Health*, *65*(5), 313–322. https://doi.org/10.1080/07448481.2017.1312411

Blanco, C., Okuda, M., Wright, C., Hasin, D. S., Grant, B. F., Liu, S.-M., & Olfson, M. (2008). Mental health of college students and their non-college-attending peers: results from the National Epidemiologic Study on Alcohol and Related Conditions. *Archives of General Psychiatry*, *65*(12), 1429–1437. https://doi.org/10.1001/archpsyc.65.12.1429

Blumenthal, J. A., Babyak, M. A., Doraiswamy, P. M., Watkins, L., Hoffman, B. M., Barbour, K. A., Herman, S., Craighead, W. E., Brosse, A. L., Waugh, R., Hinderliter, A., & Sherwood, A. (2007). Exercise and pharmacotherapy in the treatment of major depressive disorder. *Psychosomatic Medicine*, *69*(7), 587–596. https://doi.org/10.1097/PSY.0b013e318148c19a

Bovaird, T. (2007). Beyond Engagement and Participation: User and Community Coproduction of Public Services. *Public Administration Review*, *67*(5), 846–860. https://doi.org/10.1111/j.1540-6210.2007.00773.x

Bovend'Eerdt, T. J. H., Botell, R. E., & Wade, D. T. (2009). Writing SMART rehabilitation goals and achieving goal attainment scaling: a practical guide. *Clinical Rehabilitation*, *23*(4), 352–361. https://doi.org/10.1177/0269215508101741

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, *10*(1), 1–10.

Boyd, H., McKernon, S., Mullin, B., & Old, A. (2012). Improving healthcare through the use of co-design. *NZ Med J*, *125*(1357), 76–87.

Brown, D. M. Y., Bray, S. R., Beatty, K. R., & Kwan, M. Y. W. (2014). Healthy Active Living: A residence community-based intervention to increase physical activity and healthy eating during the transition to first-year university. *Journal of American College Health*, 62(4), 234–242. https://doi.org/10.1080/07448481.2014.887572

Brown, W., Bauman, A., Bull, F., & N., B. (2012). *Development of Evidence-based Physical Activity Recommendations for Adults (18-64 years)*.

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Nock, M. K., & Kessler, R. C. (2018). Mental health problems in college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders*, *225*, 97–103. https://doi.org/10.1016/j.jad.2017.07.044

Budden, T., Dimmock, J. A., Smith, B., Beauchamp, M., Rosenberg, M., & Jackson, B. (2020). Overweight and obese men's experiences in a sport-based weight loss

intervention for men. *Psychology of Sport and Exercise*, *50*, 101750. https://doi.org/10.1016/j.psychsport.2020.101750

Carpiniello, B., Primavera, D., Pilu, A., Vaccargiu, N., & Pinna, F. (2013). Physical activity and mental disorders: A case–control study on attitudes, preferences and perceived barriers in Italy. *Journal of Mental Health*, *22*(6), 492–500. https://doi.org/10.3109/09638237.2013.815330

Carr, J. J., Lalara, J., Lalara, G., Lalara, G., Daniels, B., Clough, A. R., Lowell, A., & Barker, R. N. (2021). Staying Strong Toolbox: Co-design of a physical activity and lifestyle program for Aboriginal families with Machado-Joseph disease in the Top End of Australia. *PLOS ONE*, *16*(2), e0244311-. https://doi.org/10.1371/journal.pone.0244311

Collins, S., & Long, A. (2003). Working with the psychological effects of trauma: consequences for mental health-care workers - a literature review. *Journal of Psychiatric and Mental Health Nursing*, *10*(4), 417–424. https://doi.org/10.1046/j.1365-2850.2003.00620.x

Crust, L. (2004). Carry-Over Effects of Music in an Isometric Muscular Endurance Task. *Perceptual and Motor Skills*, *98*(3), 985–991. https://doi.org/10.2466/pms.98.3.985-991

Cunningham, C. E., Zipursky, R. B., Christensen, B. K., Bieling, P. J., Madsen, V., Rimas, H., Mielko, S., Wilson, F., Furimsky, I., Jeffs, L., & Munn, C. (2017). Modeling the mental health service utilization decisions of university undergraduates: A discrete choice conjoint experiment. *Journal of American College Health*, *65*(6), 389–399. https://doi.org/10.1080/07448481.2017.1322090

Curran, G. M., Bauer, M., Mittman, B., Pyne, J. M., & Stetler, C. (2012). Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and

implementation research to enhance public health impact. *Medical Care*, *50*(3), 217.

Deci, E. L., & Ryan, R. M. (2012). *Self-determination theory.*

deJonge, M. L., Jain, S., Faulkner, G. E., & Sabiston, C. M. (2021). On campus physical activity programming for post-secondary student mental health: Examining effectiveness and acceptability. *Mental Health and Physical Activity*, *20*, 100391. https://doi.org/10.1016/j.mhpa.2021.100391

deJonge, M. L., Omran, J., Faulkner, G. E., & Sabiston, C. M. (2020). University students' and clinicians' beliefs and attitudes towards physical activity for mental health. *Mental Health and Physical Activity*, *18*, 100316.

Department for Education. (2020). *Higher Education Statistics: Student Data*. https://www.dese.gov.au/higher-education-statistics/student-data

Dimmock, J., Jackson, B., Podlog, L., & Magaraggia, C. (2013). The effect of variety expectations on interest, enjoyment, and locus of causality in exercise. *Motivation and Emotion*, *37*(1), 146–153.

Dunbar, M. S., Sontag-Padilla, L., Ramchand, R., Seelam, R., & Stein, B. D. (2017). Mental Health Service Utilization Among Lesbian, Gay, Bisexual, and Questioning or Queer College Students. *Journal of Adolescent Health*, *61*(3), 294–301. https://doi.org/10.1016/j.jadohealth.2017.03.008

Eccles, M. P., Armstrong, D., Baker, R., Cleary, K., Davies, H., Davies, S., Glasziou, P., Ilott, I., Kinmonth, A.-L., Leng, G., Logan, S., Marteau, T., Michie, S., Rogers, H., Rycroft-Malone, J., & Sibbald, B. (2009). An implementation research agenda. *Implementation Science : IS*, *4*, 18. https://doi.org/10.1186/1748-5908-4-18

Eisenberg, D., Lipson, S. K., Ceglarek, P., Kern, A., & Phillips, M. V. (2018). College Student Mental Health. In *Promoting Behavioral Health and Reducing Risk*

*Among College Students* (pp. 75–86). Routledge. https://doi.org/10.4324/9781315175799-5

Ekkekakis, P. (2013). *Routledge Handbook of Physical Activity and Mental Health*. Taylor & Francis Group. http://ebookcentral.proquest.com/lib/uwa/detail.action?docID=1356328

Eldridge, S. M., Chan, C. L., Campbell, M. M. J., Bond, C. M., Hopewell, S., Thabane, L., Lancaster, G. A., O'Cathain, A., Altman, D., Bretz, F., Campbell, M. M. J., Cobo, E., Craig, P., Davidson, P., Groves, T., Gumedze, F., Hewison, J., Hirst, A., Hoddinott, P., … on behalf of the, P. consensus group. (2016). CONSORT 2010 statement: Extension to randomised pilot and feasibility trials. *Pilot and Feasibility Studies*, *2*(1), 1–32. https://doi.org/10.1186/s40814-016-0105-8

Eliakim, M., Meckel, Y., Nemet, D., & Eliakim, A. (2007). The effect of music during warm-up on consecutive anaerobic performance in elite adolescent volleyball players. *International Journal of Sports Medicine*, *28*(04), 321–325.

Eurostat. (2018). *Share of those aged between 15 to 64 with tertiary educational attainment in selected European countries in 2020*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Tertiary_education_statistics

Eyles, H., Jull, A., Dobson, R., Firestone, R., Whittaker, R., Te Morenga, L., Goodwin, D., & Mhurchu, C. N. (2016). Co-design of mHealth Delivered Interventions: A Systematic Review to Assess Key Methods and Processes. *Current Nutrition Reports*, *5*(3), 160–167. https://doi.org/10.1007/s13668-016-0165-7

Fanning, J., Mullen, S. P., & McAuley, E. (2012). Increasing physical activity with mobile devices: a meta-analysis. *Journal of Medical Internet Research*, *14*(6), e161–e161. https://doi.org/10.2196/jmir.2171

Firth, J., Siddiqi, N., Koyanagi, A., Siskind, D., Rosenbaum, S., Galletly, C., Allan, S., Caneo, C., Carney, R., Carvalho, A. F., Chatterton, M. Lou, Correll, C. U., Curtis, J., Gaughran, F., Heald, A., Hoare, E., Jackson, S. E., Kisely, S., Lovell, K., … Stubbs, B. (2019). The Lancet Psychiatry Commission: a blueprint for protecting physical health in people with mental illness. *The Lancet. Psychiatry*, *6*(8), 675–712. https://doi.org/10.1016/S2215-0366(19)30132-4

Fitzgerald, M., & Ratcliffe, G. (2020). Serious Games, Gamification, and Serious Mental Illness: A Scoping Review. *Psychiatric Services*, *71*(2), 170–183. https://doi.org/10.1176/appi.ps.201800567

Frederiksen, K. P., Stavestrand, S. H., Venemyr, S. K., Sirevåg, K., & Hovland, A. (2021). Physical exercise as an add-on treatment to cognitive behavioural therapy for anxiety: a systematic review. *Behavioural and Cognitive Psychotherapy*, *49*(5), 626–640. https://doi.org/10.1017/S1352465821000126

Furzer, B., Rebar, A., Dimmock, J. A., More, A., Thornton, A. L., Wright, K., Colthart, A., & Jackson, B. (2021). Exercise is medicine… when you enjoy it: Exercise enjoyment, relapse prevention efficacy, and health outcomes for youth within a drug and alcohol treatment service. *Psychology of Sport and Exercise*, *52*, 101800. https://doi.org/10.1016/j.psychsport.2020.101800

Girdler, S. J., Confino, J. E., & Woesner, M. E. (2019). Exercise as a Treatment for Schizophrenia: A Review. *Psychopharmacology Bulletin*, *49*(1), 56–69.

Glasgow, R. E., Harden, S. M., Gaglio, B., Rabin, B., Smith, M. L., Porter, G. C., Ory, M. G., & Estabrooks, P. A. (2019). RE-AIM Planning and Evaluation Framework: Adapting to New Science and Practice With a 20-Year Review. *Frontiers in Public Health*, *7*, 64. https://doi.org/10.3389/fpubh.2019.00064

Glazzard, J., Rose, A., & Ogilvie, P. (2021). The impact of peer mentoring on students' physical activity and mental health. *Journal of Public Mental Health*, *20*(2), 122–131. https://doi.org/10.1108/jpmh-10-2018-0073

Goldman-Mellor, S. J., Caspi, A., Harrington, H., Hogan, S., Nada-Raja, S., Poulton, R., & Moffitt, T. E. (2014). Suicide attempt in young people: a signal for long-term health care and social needs. *JAMA Psychiatry*, *71*(2), 119–127. https://doi.org/10.1001/jamapsychiatry.2013.2803

Gollwitzer, P. M., Fujita, K., & Oettingen, G. (2004). *Planning and the implementation of goals*.

Grant, S., Mayo-Wilson, E., Montgomery, P., Macdonald, G., Michie, S., Hopewell, S., & Moher, D. (2018). CONSORT-SPI 2018 Explanation and Elaboration: guidance for reporting social and psychological intervention trials. *Trials*, *19*(1), 406. https://doi.org/10.1186/s13063-018-2735-z

Hadlaczky, G., Hökby, S., Mkrtchian, A., Carli, V., & Wasserman, D. (2014). Mental Health First Aid is an effective public health intervention for improving knowledge, attitudes, and behaviour: A meta-analysis. *International Review of Psychiatry*, *26*(4), 467–475.

Hegberg, N. J., Hayes, J. P., & Hayes, S. M. (2019). Exercise Intervention in PTSD: A Narrative Review and Rationale for Implementation. *Frontiers in Psychiatry*, *10*, 133. https://doi.org/10.3389/fpsyt.2019.00133

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, *44*(2), 227–239. https://doi.org/10.1348/014466505x29657

Hetrick, S. E., Robinson, J., Burge, E., Blandon, R., Mobilio, B., Rice, S. M., Simmons, M. B., Alvarez-Jimenez, M., Goodrich, S., & Davey, C. G. (2018). Youth

Codesign of a Mobile Phone App to Facilitate Self-Monitoring and Management of Mood Symptoms in Young People With Major Depression, Suicidal Ideation, and Self-Harm. *JMIR Mental Health*, *5*(1), e9–e9. https://doi.org/10.2196/mental.9041

Hussar, B., Zhang, J., Hein, S., Wang, K., Roberts, A., Cui, J., Smith, M., Bullock Mann, F., Barmer, A., & Dilig, R. (2020). *The condition of education 2020*.

Hutchinson, J. C., Jones, L., Vitti, S. N., Moore, A., Dalton, P. C., & O'Neil, B. J. (2018). The influence of self-selected music on affect-regulated exercise intensity and remembered pleasure during treadmill running. *Sport, Exercise, and Performance Psychology*, *7*(1), 80–92. https://doi.org/10.1037/spy0000115

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R. S., Abebe, Z., Abera, S. F., Abil, O. Z., Abraha, H. N., Abu-Raddad, L. J., Abu-Rmeileh, N. M. E. E., Accrombessi, M. M. K., … Murray, C. J. L. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 Diseases and Injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, *392*(10159), 1789–1858. https://doi.org/10.1016/S0140-6736(18)32279-7

Jaworska, N., De Somma, E., Fonseka, B., Heck, E., & MacQueen, G. M. (2016). Mental health services for students at postsecondary institutions: A national survey. *The Canadian Journal of Psychiatry*, *61*(12), 766–775.

Jayakody, K., Gunadasa, S., & Hosker, C. (2013). Exercise for anxiety disorders: systematic review. *British Journal of Sports Medicine*, *48*(3), 187–196. https://doi.org/10.1136/bjsports-2012-091287

Jones, M., Bright, P., Hansen, L., Ihnatsenka, O., & Carek, P. J. (2019). Promoting Physical Activity in a Primary Care Practice: Overcoming the Barriers. *American Journal of Lifestyle Medicine*, *15*(2), 158–164. https://doi.org/10.1177/1559827619867693

Karageorghis, C. I., & Priest, D.-L. (2012). Music in the exercise domain: a review and synthesis (Part I). *International Review of Sport and Exercise Psychology*, *5*(1), 44–66. https://doi.org/10.1080/1750984X.2011.631026

Keeler, L. A., Skidmore, B., Leenstra, T., MacDonald, J. R., & Stewart, D. (2019). Treating University Students' Depression using Physical Activity with Peers: Two Field-Based Quasi-Experiments Grounded in the Self-Determination Theory. *Journal of College Student Psychotherapy*, *35*(3), 205–223. https://doi.org/10.1080/87568225.2019.1660293

Keen, A. W. (2005). Using music as a therapy tool to motivate troubled adolescents. *Social Work in Health Care*, *39*(3–4), 361–373.

Kerr, D. C. R., & Capaldi, D. M. (2011). Young men's intimate partner violence and relationship functioning: long-term outcomes associated with suicide attempt and aggression in adolescence. *Psychological Medicine*, *41*(4), 759–769. https://doi.org/10.1017/S0033291710001182

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606–613.

Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A. (2016). Exercise as a treatment for depression: A meta-analysis. *Journal of Affective Disorders*, *202*, 67–86. https://doi.org/10.1016/j.jad.2016.03.063

Lahart, I., Darcy, P., Gidlow, C., & Calogiuri, G. (2019). The Effects of Green Exercise on Physical and Mental Wellbeing: A Systematic Review. *International Journal*

*of Environmental Research and Public Health*, *16*(8), 1352. https://doi.org/10.3390/ijerph16081352

Landes, S. J., McBain, S. A., & Curran, G. M. (2020). Reprint of: An introduction to effectiveness-implementation hybrid designs. *Psychiatry Research*, *283*, 112630. https://doi.org/10.1016/j.psychres.2019.112630

Larkin, M., Boden, Z. V. R., & Newton, E. (2015). On the brink of genuinely collaborative care: experience-based co-design in mental health. *Qualitative Health Research*, *25*(11), 1463–1476.

Lederman, O., Grainger, K., Stanton, R., Douglas, A., Gould, K., Perram, A., Baldeo, R., Fokas, T., Nauman, F., & Semaan, A. (2016). Consensus statement on the role of Accredited Exercise Physiologists within the treatment of mental disorders: a guide for mental health professionals. *Australasian Psychiatry*, *24*(4), 347–351.

Lederman, O., Ward, P. B., Rosenbaum, S., Maloney, C., Watkins, A., Teasdale, S., Morell, R., & Curtis, J. (2020). Stepping up early treatment for help-seeking youth with at-risk mental states: Feasibility and acceptability of a real-world exercise program. *Early Intervention in Psychiatry*, *14*(4), 450–462.

Leenstra, T., Keeler, L., Arthur-Cameselle, J., & Russell, K. (2019). The peer mentor experience in a physical activity intervention for mental health. *Mentoring & Tutoring: Partnership in Learning*, *27*(1), 68–87. https://doi.org/10.1080/13611267.2019.1583410

Lim, H., Heckman, S. J., Letkiewicz, J. C., & Montalto, C. P. (2014). Financial Stress, Self-Efficacy, and Financial Help-Seeking Behavior of College Students. *Financial Counseling and Planning*, *25*(2), 148.

Mandolesi, L., Polverino, A., Montuori, S., Foti, F., Ferraioli, G., Sorrentino, P., & Sorrentino, G. (2018). Effects of Physical Exercise on Cognitive Functioning

and Wellbeing: Biological and Psychological Benefits. *Frontiers in Psychology*, *9*(509). https://doi.org/10.3389/fpsyg.2018.00509

Martin Ginis, K. A., Nigg, C. R., & Smith, A. L. (2013). Peer-delivered physical activity interventions: an overlooked opportunity for physical activity promotion. *Translational Behavioral Medicine*, *3*(4), 434–443. https://doi.org/10.1007/s13142-013-0215-2

Matthews, E. W., Cowman, M., Brannigan, M., Rosenbaum, S., Sloan, D., Ward, P. B., & Denieffe, S. (2022). Implementing experience-based co-design to develop a physical activity programme in recovery-focused outpatient mental health services. *International Journal of Therapy and Rehabilitation*, *29*(4), 1–16. https://doi.org/10.12968/ijtr.2021.0101

McCance-Katz, E. F. (2019). *The national survey on drug use and health: 2017*. Substance Abuse and Mental Health Services Administration.

McCown, W., Keiser, R., Mulhearn, S., & Williamson, D. (1997). The role of personality and gender in preference for exaggerated bass in music. *Personality and Individual Differences*, *23*(4), 543–547. https://doi.org/10.1016/s0191-8869(97)00085-8

McEwan, D., Harden, S. M., Zumbo, B. D., Sylvester, B. D., Kaulius, M., Ruissen, G. R., Dowd, A. J., & Beauchamp, M. R. (2015). The effectiveness of multi-component goal setting interventions for changing physical activity behaviour: a systematic review and meta-analysis. *Health Psychology Review*, *10*(1), 67–88. https://doi.org/10.1080/17437199.2015.1104258

McMahen, C., Wright, K., Stanton, R., Lederman, O., Rosenbaum, S., McKeon, G., & Furzer, B. (2022). Outcome assessments used in studies examining the effect of prescribed exercise interventions for people living with severe mental illness, a

scoping review. *Mental Health and Physical Activity*, *22*, 100438. https://doi.org/https://doi.org/10.1016/j.mhpa.2021.100438

McManus, S., Bebbington, P., Jenkins, R., & Brugha, T. (2016). *Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014*.

Mead, S., Hilton, D., & Curtis, L. (2001). Peer support: A theoretical perspective. *Psychiatric Rehabilitation Journal*, *25*(2), 134–141. https://doi.org/10.1037/h0095032

Memon, A. R., Gupta, C. C., Crowther, M. E., Ferguson, S. A., Tuckwell, G. A., & Vincent, G. E. (2021). Sleep and physical activity in university students: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *58*, 101482. https://doi.org/10.1016/j.smrv.2021.101482

Mental Health Commission of Canada. (2013). *Making the Case for Investing in Mental Health in Canada*. https://mentalhealthcommission.ca/resource/making-the-case-for-investing-in-mental-health-in-canada/

MEXT. (2018). *Overview of the Ministry of Education, Culture, Sports, Science and Technology*.

Michie, S., Wood, C. E., Johnston, M., Abraham, C., Francis, J., & Hardeman, W. (2015). Behaviour change techniques: the development and evaluation of a taxonomic method for reporting and describing behaviour change interventions (a suite of five studies involving consensus methods, randomised controlled trials and analysis of qualitative da. *Health Technology Assessment*, *19*(99). http://openaccess.city.ac.uk/id/eprint/13435/

Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. (2017). Exercise and mental health. *Maturitas*, *106*(August), 48–56. https://doi.org/10.1016/j.maturitas.2017.09.003

Milne, L., Keating, S., & Gabb, R. (2007). Student peer mentoring at Victoria University. *Victoria University*.

Mittal, V. A., Vargas, T., Osborne, K. J., Dean, D., Gupta, T., Ristanovic, I., Hooker, C. I., & Shankman, S. A. (2017). Exercise Treatments for Psychosis: A Review. *Current Treatment Options in Psychiatry*, *4*(2), 152–166. https://doi.org/10.1007/s40501-017-0112-2

Moore, G. F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., Moore, L., O'Cathain, A., Tinati, T., Wight, D., & Baird, J. (2015). Process evaluation of complex interventions: Medical Research Council guidance. *BMJ (Clinical Research Ed.)*, *350*, h1258–h1258. https://doi.org/10.1136/bmj.h1258

More, A., Jackson, B., Dimmock, J. A., Thornton, A. L., Colthart, A., & Furzer, B. J. (2017). Exercise in the Treatment of Youth Substance Use Disorders: Review and Recommendations. *Frontiers in Psychology*, *8*, 1839. https://doi.org/10.3389/fpsyg.2017.01839

More, A., Jackson, B., Dimmock, J. A., Thornton, A. L., Colthart, A., & Furzer, B. J. (2018). "It's like a counselling session … but you don't need to say anything:" Exercise program outcomes for youth within a drug and alcohol treatment service. *Psychology of Sport and Exercise*, *39*, 1–9. https://doi.org/https://doi.org/10.1016/j.psychsport.2018.07.002

Morgan, A., Parker, A. G., Alvarez-Jimenez, M., & Jorm, A. (2013). Exercise and Mental Health: An Exercise and Sports Science Australia Commissioned Review. *Journal of Exercise Physiology Online*, *16*, 64–73.

Muir, I. L., Munroe-Chandler, K. J., Loughead, T. M., Sutherland, C. A., & Hawksley, K. G. (2020). The UWorkItOut UWin Program: Improving University Students' Psychological Distress through Physical Activity. *International Journal of*

*Kinesiology and Sports Science*, *8*(3), 36. https://doi.org/10.7575/aiac.ijkss.v.8n.3p.36

Mulvale, G., Moll, S., Miatello, A., Murray-Leung, L., Rogerson, K., & Sassi, R. B. (2019). Co-designing Services for Youth With Mental Health Issues: Novel Elicitation Approaches. *International Journal of Qualitative Methods*, *18*, 160940691881624. https://doi.org/10.1177/1609406918816244

Murri, M. B., Ekkekakis, P., Magagnoli, M., Zampogna, D., Cattedra, S., Capobianco, L., Serafini, G., Calcagno, P., Zanetidou, S., & Amore, M. (2019). Physical exercise in major depression: Reducing the mortality gap while improving clinical outcomes. *Frontiers in Psychiatry*, *9*, 762. https://doi.org/10.3389/fpsyt.2018.00762

Nguyen-Michel, S. T., Unger, J. B., Hamilton, J., & Spruijt-Metz, D. (2006). Associations between physical activity and perceived stress/hassles in college students. *Stress and Health*, *22*(3), 179–188. https://doi.org/10.1002/smi.1094

Nobles, J., Thomas, C., Banks Gross, Z., Hamilton, M., Trinder-Widdess, Z., Speed, C., Gibson, A., Davies, R., Farr, M., Jago, R., Foster, C., & Redwood, S. (2020). "Let's Talk about Physical Activity": Understanding the Preferences of Under-Served Communities when Messaging Physical Activity Guidelines to the Public. *International Journal of Environmental Research and Public Health*, *17*(8), 2782. https://doi.org/10.3390/ijerph17082782

Ntoumanis, N., Carr, R. M., Hall, L. H., Gucciardi, D. F., Thøgersen-Ntoumani, C., Kwasnicka, D., Prestwich, A., & Quested, E. (2018). Dyadic interventions to promote physical activity and reduce sedentary behaviour: systematic review and meta-analysis. *Health Psychology Review*, *13*(1), 91–109. https://doi.org/10.1080/17437199.2018.1532312

O'connor, P. J., Herring, M. P., & Caravalho, A. (2010). Mental Health Benefits of Strength Training in Adults. *American Journal of Lifestyle Medicine*, *4*(5), 377–396. https://doi.org/10.1177/1559827610368771

Oei, T. P. S., & Notowidjojo, F. (1990). Depression and Loneliness in Overseas Students. *International Journal of Social Psychiatry*, *36*(2), 121–130. https://doi.org/10.1177/002076409003600205

O'Reilly, M., Wiltshire, G., Kiyimba, N., & Harrington, D. (2023). "Is Everybody Comfortable?"#xd; Thinking Through Co-design Approaches to Better Support Girls' Physical Activity in Schools. *Qualitative Research in Sport, Exercise and Health*, *15*(2), 248–263. https://doi.org/10.1080/2159676X.2022.2083663

Orygen The National Centre of Excellence in Youth Mental Health. (2017). Under the radar. The mental health of Australian university students. In *Orygen, The National Centre of Excellence in Youth Mental Health*.

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, *18*(2).

Powell, B. J., Waltz, T. J., Chinman, M. J., Damschroder, L. J., Smith, J. L., Matthieu, M. M., Proctor, E. K., & Kirchner, J. E. (2015). A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. *Implementation Science : IS*, *10*, 21. https://doi.org/10.1186/s13012-015-0209-1

Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, *15*(5), 319–337. https://doi.org/10.1080/09603120500155963

Pritchard, M. E., & Wilson, G. S. (Gregory S. (2003). Using Emotional and Social Factors to Predict Student Success. *Journal of College Student Development*, *44*(1), 18–28. https://doi.org/10.1353/csd.2003.0008

Ravindran, A. v, Balneaves, L. G., Faulkner, G., Ortiz, A., McIntosh, D., Morehouse, R. L., Ravindran, L., Yatham, L. N., Kennedy, S. H., & Lam, R. W. (2016). Canadian Network for Mood and Anxiety Treatments (CANMAT) 2016 clinical guidelines for the management of adults with major depressive disorder: section 5. Complementary and alternative medicine treatments. *The Canadian Journal of Psychiatry*, *61*(9), 576–587.

Reddan, G. (2016). The Role of Work-Integrated Learning in Developing Students' Perceived Work Self-Efficacy. *Asia-Pacific Journal of Cooperative Education*, *17*(4), 423–436.

Rethorst, C. D., & Trivedi, M. H. (2013). Evidence-Based Recommendations for the Prescription of Exercise for Major Depressive Disorder. *Journal of Psychiatric Practice*, *19*(3), 204–212. https://doi.org/10.1097/01.pra.0000430504.16952.3e

Roth, G. (2019). Beyond the Quantity of Motivation: Quality of Motivation in Self-Determination Theory. In *Social Psychology in Action* (pp. 39–49). Springer International Publishing. https://doi.org/10.1007/978-3-030-13788-5_3

Rush, A. J., Gullion, C. M., Basco, M. R., Jarrett, R. B., & Trivedi, M. H. (1996). The inventory of depressive symptomatology (IDS): psychometric properties. *Psychological Medicine*, *26*(3), 477–486.

Salzer, M. S. (2012). A Comparative Study of Campus Experiences of College Students With Mental Illnesses Versus a General College Sample. *Journal of American College Health*, *60*(1), 1–7. https://doi.org/10.1080/07448481.2011.552537

Sancassiani, F., Machado, S., & Preti, A. (2018). Physical Activity, Exercise and Sport Programs as Effective Therapeutic Tools in Psychosocial Rehabilitation.

*Clinical Practice and Epidemiology in Mental Health : CP & EMH*, *14*, 6–10. https://doi.org/10.2174/1745017901814010006

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. *BMJ*, *340*(7748), c332. https://doi.org/10.1136/bmj.c332

Scott, K. M., Lim, C., Al-Hamzawi, A., Alonso, J., Bruffaerts, R., Caldas-de-Almeida, J. M., Florescu, S., de Girolamo, G., Hu, C., de Jonge, P., Kawakami, N., Medina-Mora, M. E., Moskalewicz, J., Navarro-Mateu, F., O'Neill, S., Piazza, M., Posada-Villa, J., Torres, Y., & Kessler, R. C. (2016). Association of Mental Disorders With Subsequent Chronic Physical Conditions: World Mental Health Surveys From 17 Countries. *JAMA Psychiatry*, *73*(2), 150–158. https://doi.org/10.1001/jamapsychiatry.2015.2688

Shannonhouse, L., Lin, Y.-W. D., Shaw, K., Wanna, R., & Porter, M. (2017). Suicide intervention training for college staff: Program evaluation and intervention skill measurement. *Journal of American College Health*, *65*(7), 450–456. https://doi.org/10.1080/07448481.2017.1341893

Shaykevich, A., Grove, J. R., Jackson, B., Landers, G. J., & Dimmock, J. (2015). Auditory Feedback Improves Heart Rate Moderation during Moderate-Intensity Exercise. *Medicine & Science in Sports & Exercise*, *47*(5), 1046–1051. https://doi.org/10.1249/mss.0000000000000490

Smith, B., & Wightman, L. (2019). Promoting physical activity to disabled people: messengers, messages, guidelines and communication formats. *Disability and Rehabilitation*, *43*(24), 3427–3431. https://doi.org/10.1080/09638288.2019.1679896

Smith, J. D., Berkel, C., Rudo-Stern, J., Montaño, Z., St George, S. M., Prado, G., Mauricio, A. M., Chiapa, A., Bruening, M. M., & Dishion, T. J. (2018). The

Family Check-Up 4 Health (FCU4Health): Applying Implementation Science Frameworks to the Process of Adapting an Evidence-Based Parenting Program for Prevention of Pediatric Obesity and Excess Weight Gain in Primary Care. *Frontiers in Public Health*, *6*, 293. https://doi.org/10.3389/fpubh.2018.00293

Smith, P., & Merwin, R. (2021). The Role of Exercise in Management of Mental Health Disorders: An Integrative Review. *Annual Review of Medicine*, *72*(1), 45–62. https://doi.org/10.1146/annurev-med-060619-022943

Sniehotta, F. F., Schwarzer, R., Scholz, U., & Schüz, B. (2005). Action planning and coping planning for long-term lifestyle change: theory and assessment. *European Journal of Social Psychology*, *35*(4), 565–576. https://doi.org/10.1002/ejsp.258

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097.

Stanton, R., Rosenbaum, S., Kalucy, M., Reaburn, P., & Happell, B. (2015). A call to action: exercise as treatment for patients with mental illness. *Australian Journal of Primary Health*, *21*(2), 120. https://doi.org/10.1071/py14054

Steen, M., Manschot, M., & Koning, N. (2011). Benefits of Co-design in Service Design Projects. *International Journal of Design*, *5*.

Stone, A. A., & Shiffman, S. (1994). Ecological Momentary Assessment (Ema) in Behavioral Medicine. *Annals of Behavioral Medicine*, *16*(3), 199–202. https://doi.org/10.1093/abm/16.3.199

Stonerock, G. L., Hoffman, B. M., Smith, P. J., & Blumenthal, J. A. (2015). Exercise as Treatment for Anxiety: Systematic Review and Analysis. *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, *49*(4), 542–556. https://doi.org/10.1007/s12160-014-9685-9

Ströhle, A. (2008). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission*, *116*(6), 777. https://doi.org/10.1007/s00702-008-0092-x

Stubbs, B., Vancampfort, D., Rosenbaum, S., Firth, J., Cosco, T., Veronese, N., Salum, G. A., & Schuch, F. B. (2017). An examination of the anxiolytic effects of exercise for people with anxiety and stress-related disorders: A meta-analysis. *Psychiatry Research*, *249*(January), 102–108. https://doi.org/10.1016/j.psychres.2016.12.020

Sunesson, E., Haglund, E., Bremander, A., Jarbin, H., & Larsson, I. (2021). Adolescents' Experiences of Facilitators for and Barriers to Maintaining Exercise 12 Months after a Group-Based Intervention for Depression. *International Journal of Environmental Research and Public Health*, *18*(10), 5427. https://doi.org/10.3390/ijerph18105427

Swann, C., Rosenbaum, S., Lawrence, A., Vella, S. A., McEwan, D., & Ekkekakis, P. (2020). Updating goal-setting theory in physical activity promotion: a critical conceptual review. *Health Psychology Review*, *15*(1), 34–50. https://doi.org/10.1080/17437199.2019.1706616

Sylvester, B. D., Jackson, B., & Beauchamp, M. R. (2018). Chapter Five - The Effects of Variety and Novelty on Physical Activity and Healthy Nutritional Behaviors. In A. J. Elliot (Ed.), *Advances in Motivation Science* (Vol. 5, pp. 169–202). Elsevier. https://doi.org/https://doi.org/10.1016/bs.adms.2017.11.001

Thompson, D., Goebert, D., & Takeshita, J. (2010). A Program for Reducing Depressive Symptoms and Suicidal Ideation in Medical Students. *Academic Medicine*, *85*(10), 1635–1639. https://doi.org/10.1097/acm.0b013e3181f0b49c

Trivedi, M. H., Greer, T. L., Church, T. S., Carmody, T. J., Grannemann, B. D., Galper, D. I., Dunn, A. L., Earnest, C. P., Sunderajan, P., Henley, S. S., & Blair, S. N. (2011). Exercise as an Augmentation Treatment for Nonremitted Major

Depressive Disorder. *The Journal of Clinical Psychiatry*, *72*(05), 677–684. https://doi.org/10.4088/jcp.10m06743

US Department of Health and Human Services. (2018). *2018 Physical activity guidelines advisory committee scientific report*.

Wilson, P. M., Mack, D. E., & Grattan, K. P. (2008). Understanding motivation for exercise: A self-determination theory perspective. *Canadian Psychology/Psychologie Canadienne*, *49*(3), 250–256. https://doi.org/10.1037/a0012762

Wing, R. R., Phelan, S., & Tate, D. (2002). The role of adherence in mediating the relationship between depression and health outcomes. *Journal of Psychosomatic Research*, *53*(4), 877–881. https://doi.org/10.1016/s0022-3999(02)00315-x

Yazici, A. B., Gul, M., Yazici, E., & Gul, G. K. (2016). Tennis Enhances Well-being in University Students. *Mental Illness*, *8*(1), 6510. https://doi.org/10.4081/mi.2016.6510

Zhang, Z., Wang, T., Kuang, J., Herold, F., Ludyga, S., Li, J., Hall, D. L., Taylor, A., Healy, S., Yeung, A. S., Kramer, A. F., & Zou, L. (2022). The roles of exercise tolerance and resilience in the effect of physical activity on emotional states among college students. *International Journal of Clinical and Health Psychology*, *22*(3), 100312. https://doi.org/https://doi.org/10.1016/j.ijchp.2022.100312

Zuckerman, O., & Gal-Oz, A. (2014). Deconstructing gamification: evaluating the effectiveness of continuous measurement, virtual rewards, and social comparison for promoting physical activity. *Personal and Ubiquitous Computing*, *18*(7), 1705–1719. https://doi.org/10.1007/s00779-014-0783-2

## Chapter 2:

***The Stride program: Feasibility and preliminary efficacy of an exercise service for university students experiencing mental distress***

This chapter is based on the paper published in *Psychology of Sport and Exercise.*

Jeftic, I., Furzer, B., Dimmock, J. A., Wright, K., Budden, T., Boyd, C., Simpson, A., Rosenberg, M., Sabiston, C. M., deJonge, M., & Jackson, B. (2023). The Stride program: Feasibility and pre-to-post program change of an exercise service for university students experiencing mental distress. *Psychology of Sport and Exercise*, 69, 102507. https://doi.org/10.1016/J.PSYCHSPORT.2023.102507

## 2.0 Chapter Foreword

In Chapter 1, we reviewed evidence regarding the mental health of university students, and exercise as a support method for students experiencing mental illness. We outlined four key considerations grounded in relevant scientific literature to guide the development of on-campus exercise programs. We concluded the previous chapter by noting that further research is required to understand the feasibility of on-campus exercise programs for students experiencing mental illness. In the chapter that follows, we applied these four considerations to guide the development of the Stride program, and we present the results of a study assessing the feasibility and pre- to post-program change (in key health indicators) of the Stride program. We gratefully acknowledge that funding for the Stride program was provided by UWA Student Life.

**Figure 1**

*The Stride Program Logo, Developed by Alyssa Petrofes, 2019*

## 2.1 Abstract

Rates of mental illness are disproportionately high for young adult and higher education (e.g., university student) populations. As such, universities and tertiary institutions often devote significant efforts to services and programs that support and treat mental illness and/or mental distress. However, within that portfolio of treatment approaches, structured exercise has been relatively underutilised and greater research attention is needed to develop this evidence base. The Stride program is a structured 12-week exercise service for students experiencing mental distress. We aimed to explore the feasibility of the program and assess pre- and post-program change, through assessments of student health, lifestyle, and wellbeing outcomes. Drawing from feasibility and effectiveness-implementation hybrid design literatures, we conducted a non-randomised feasibility trial of the Stride program. Participants were recruited from the Stride program ($N$ = 114, $M_{age}$ = 24.21 years). Feasibility results indicated the program was perceived as acceptable and that participants reported positive perceptions of program components, personnel, and sessions. Participants' pre-to-post program change in depressive symptomatology, physical activity levels, mental health-related quality of life, and various behavioural outcomes were found to be desirable. Our results provide support for the feasibility of the Stride program, and more broadly for the delivery and potential effectiveness of structured exercise programs to support university students experiencing mental distress.

*Keywords:* depression; anxiety; physical activity; college; gym; mental health

## 2.2 Introduction

Mental illness is a broad term used to refer to illnesses that may affect a person's thinking, perception, mood, or behaviour. It has been reported that, across age groups, young adults (i.e., aged 18 to 25) often experience the highest rates of mental illness (McCance-Katz, 2019; McManus et al., 2016)—between 19.4 and 22.3% may experience anxiety disorders, between 8.3 and 12.4% may experience mood disorders, and between 7.1 and 18.4% may experience substance abuse disorders (Gustavson et al., 2018). The prevalence of mental illness among this population may be due, in part, to the transitions and 'life-changing' (see Luhmann et al., 2014) events that occur for many at this life stage and that present new stressors to young adults (Samouilhan & Seabi, 2010). These stressors can increase the risk of mental illness, and may include things such as developing financial independence, moving and living away from home, entering employment, and family or other relationship changes (Bulo & Sanchez, 2014). With particular relevance for our study, it is also recognised that young adults within post-secondary education institutions—including, for instance, colleges, universities, and technical institutions—may face additional stressors (e.g., self-expectations, academic, transitioning to university, for a comprehensive list see: Hurst et al., 2013) not encountered by their non-student counterparts. The combination of stressors faced by young adult students has links to the development of mental illness (Lu, 1994) or mental distress—more broadly defined than mental illness, where a person may experience mental illness symptoms without being ill; and, for post-secondary students, mental illness can detrimentally impact their academic engagement (Kessler et al., 1995), academic productivity (Wang et al., 2007), and social relationships (Kessler et al., 1998).

The mental health challenges faced by students within tertiary institutions are well acknowledged—colleges and universities typically provide a range of supports and

professional services designed to bolster students' mental health and treat or prevent mental distress (Browne et al., 2017). Support personnel or services often include on-campus medical professionals (e.g., general practitioners, mental health nurses, psychiatrists), psychologists, counsellors, and health promotion officers, teams, and programs. Several of these support services offer primary mental illness treatment options for students (i.e., pharmacotherapy or psychotherapy; American Psychological Association, 2015). However, researchers have reported that the capacity of these services is becoming increasingly stretched and that students may experience long waitlist times for treatment (Broglia et al., 2018). As such, there are several examples in the literature where tertiary institutions have offered further support to their students through additional programs or resources focused on treatment and prevention of mental illness or distress. Examples of interventions that have been successfully implemented in this respect include programs designed to improve student mental health literacy (Reavley et al., 2014), brief interventions for high-risk alcohol intake (Martens et al., 2007), and the use of mobile technology to improve mental health (Bendtsen et al., 2020). Despite this range of support personnel and initiatives, service utilisation is increasing and is beyond capacity in many instances. It is important, therefore, to continue to seek ways institutions may expand their portfolio of treatment strategies for mental distress (Oswalt et al., 2020).

Structured exercise programming is a well-established approach for supporting mental health and for complementing other mental illness treatment options. Exercise has been shown as beneficial to support young adults experiencing mental disorders (Pascoe et al., 2020)—structured exercise programming may play a role in the prevention and treatment of depression (Ravindran et al., 2016), anxiety (Stonerock et al., 2015), post-traumatic stress disorders (Hegberg et al., 2019), psychotic disorders (Mittal et al., 2017), and in reducing suicide attempts (Grasdalsmoen et al., 2020).

Additionally, university students who regularly exercise (relative to those who do not) may experience, among other desirable outcomes, improvements in general well-being (Wickham et al., 2020), sleep quality and quantity (Gerber et al., 2014), and academic performance (Keating et al., 2013), along with a reduction in perceived stress and burnout (Baghurst & Kelley, 2014).

Despite the potential for exercise to complement other therapeutic interventions for students with mental illness, the literature documenting programs of this nature within tertiary education settings is not well developed. Few studies exist that document the structure, feasibility, and/or effectiveness of exercise or physical activity programs designed to support student mental health (see Ashdown-Franks et al., 2022; Keeler et al., 2019; Muir et al., 2020). The programs described in the above studies all use exercise as a component within the treatment of mental distress for students; they differ, however in their program components and implementation. These differences include, for example, entry or referral requirements (e.g., self-referred or medical referral), program length, session structure (e.g., exercise and behavioural therapy or exercise only), session length, session quantity (e.g., 6, 8, or 12 sessions), exercise choice (e.g., chosen or prescribed exercise), and peer involvement (i.e., use of students to deliver sessions or exclusively through an exercise professional; for a more detailed overview, see Jeftic et al., 2023). Despite these differences in program delivery, the interventions reported in these studies have provided preliminary evidence for positive mental health outcomes experienced by participants (i.e., students experiencing mental distress). The authors of these studies did not, however, couch their work within contemporary guidelines for effectiveness-implementation based research or report on adequately powered randomised controlled trials (Curran et al., 2012; Schulz et al., 2010). As such, there remains scope to advance our understanding of (a) how best to structure and implement such programs, (b) the feasibility of such programs, and (c) the primary and

secondary outcomes that may be targeted in future trials of such programs, and (d) the magnitude of change on these outcomes that may be attributed to exercise program participation. With these considerations in mind, in this study we sought to present evidence regarding the feasibility (or implementation) and potential effectiveness (i.e., change over time on key outcomes) of an on-campus exercise program for university students experiencing mental distress or mental illness.

There are well-acknowledged recommendations designed to guide the conduct of feasibility studies focused on understanding clinical effectiveness and implementation strategies. Perhaps most notable for our investigation, Curran and colleagues (2012) provided a framework for identifying and designing 'effectiveness-implementation hybrid' studies. These authors outlined the ways through which investigators may frame feasibility efforts around a hybrid focus on both effectiveness (e.g., clinical outcomes) and implementation (e.g., delivery, acceptability, feasibility) considerations. Alongside Curran et al.'s model, there are also well-established guidelines for the conduct and reporting of feasibility and preliminary efficacy trials of health-related programs—allowing for accurate interpretation of the research and better trial replication (see Standards for Reporting Implementation Studies, Pinnock et al., 2017; CONsolidated Standards Of Reporting Trials—CONSORT—statement, Eldridge et al., 2016). By adhering to these recognised guidelines, it may be possible to improve the likelihood of successful future program implementation and scalability across tertiary institutions. At present though, there is little available evidence that draws from this methodological literature to document the effectiveness and implementation of exercise programming on tertiary campuses for student mental health. Accordingly, and in line with the recommended research stages involved in the development of complex interventions (Skivington et al., 2021), it is important to provide robust feasibility evidence for exercise programs of this nature. Work of this nature will not only help

expand the evidence base with a view to the wider implementation of such programs, but also promises to offer important guidance for future randomised controlled trials.

Our study was couched within the Stride program—a peer-mentor-led exercise service that opened at The University of Western Australia in May 2020. We developed Stride as an adjunct treatment option for students experiencing mental distress or illness. In the design of the exercise program, we drew from best-practice exercise prescription principles (e.g., Vella et al., 2023), and the existing literature described above (Eldridge et al., 2016; Pinnock et al., 2017). Stride is overseen by a Clinical Exercise Physiologist accredited by a relevant national accreditation body; entry within the program requires a referral from a support service or mental health professional, and students subsequently receive a free 12-week exercise program. Students referred to Stride complete a pre- and post-program mental and physical health assessment. Weekly exercise sessions are most commonly led by a postgraduate student in Clinical Exercise Physiology—in the most severe or high acuity cases, some students instead receive direct exercise mentoring from the coordinating Accredited Exercise Physiologist. The postgraduate students (or, in severe cases, the program coordinator) act as mentors within program and are referred to as such for the purposes of this study. The program was not designed as a primary treatment modality for mental illness but was and is intended as an adjunct support for students who are undertaking or waitlisted for other treatment, and to assist students with building positive physical activity and wellbeing strategies.

Our aim was to provide a comprehensive evaluation of the feasibility of the Stride program—and any pre-to-post program change participants experienced—using a framework based on a type 2 effectiveness-implementation hybrid study (see Curran et al., 2012). We developed two co-primary aims. First, we sought to assess elements of feasibility regarding the implementation of a novel on-campus exercise program to support students experiencing mental distress or illness. Second, we sought to analyse

pre-to-post program change with respect to relevant mental health, physical health, and various other program outcomes. Regarding feasibility assessment, we aimed to measure participant perceptions regarding key program elements (e.g., initial assessment, exercise sessions and information, mentor) as well as participant referral, drop-out, and retention indicators in line with recommendations on reporting feasibility trials (Eldridge et al., 2016). We assessed participants' pre-to-post-program changes in depressive symptomatology, physical activity levels, physical health, confidence perceptions, quality of life, social identity, and lifestyle behaviours (i.e., sleep, dietary intake) to provide program outcome insight that is aligned with the types of outcomes reported on in similar research (for example, deJonge et al., 2021).

## 2.3 Methods

We designed and conducted a non-randomised feasibility trial using considerations for a type 2 effectiveness-implementation hybrid study (Curran et al., 2012). A type 2 hybrid study provides insight into the effectiveness of a clinical intervention (i.e., the Stride program) and the feasibility of an implementation strategy (i.e., elements of program feasibility as reported above and below). For design and reporting purposes, we also adhered to the CONSORT guidelines extension for non-randomised pilot and feasibility trials (Eldridge et al., 2016). Feasibility trials are versions of a proposed main study, or large-scale program implementation, that allow for analysis of program and program component effectiveness. Feasibility trials such as the present study are recommended as a first step in understanding whether and how a program and its components promise to be effective (e.g., which appropriate procedures and tools) and can be implemented on a larger scale (i.e., using effect sizes found during feasibility testing) (Eccles et al., 2009). It should be noted that a priori power calculations are therefore often not completed for feasibility trials. However, informed by previous literature—an effect size of 0.58 for the effect of exercise on symptoms of

anxiety (Stubbs et al., 2017), and an effect size of 1.24 for the effect of exercise on depressive symptomatology (Kvam et al., 2016)—and a cautious approach, a priori analysis was completed to guide the sample size. As such, a priori analysis for differences between two dependent measures (effect size = 0.45; alpha = 0.05; power = 0.95) resulted in a sample size of 55.

### 2.3.1 Recruitment

Our feasibility trial was conducted using a single on-campus exercise program for students experiencing mental distress or illness—the Stride program at The University of Western Australia. Participants in the research study did not include all program participants due to the nature of the recruitment method (i.e., the voluntary nature of the research procedures). Recruitment into the research study occurred after initial screening by the program coordinator—this process allowed for the coordinator to assess participants' capacity to understand research requirements and to gauge whether participation in the research study would present any harm to a student's mental health. The program was promoted across campus through flyers, emails, and word-of-mouth among other on-campus support services (e.g., medical, counselling, psychological, psychiatric, and student support services) and the student cohort (e.g., posters). Promotion took place primarily through on-campus support services due to the referral-based nature of the program. Referrals could be provided by any student medical or support services available on the university campus, or a student's external healthcare provider. However, involvement in the research procedures (i.e., where students consented to the study separate from involvement in the program itself) was not publicly advertised in any of these materials. Inclusion criteria for the research procedures were that participants were aged 18 or older and had passed an initial mental health screening assessment—outlined below—by the program coordinator. No specific exclusion criteria were set regarding demographics, type of mental distress or illness, or

current types of treatment (e.g., pharmacotherapy or psychotherapy); however, the program coordinator did, at their discretion following an initial assessment, exclude participants on the basis of whether participation in the research component would adversely affect a participants mental health (e.g., the participant was experiencing severe mental illness and did not have the capacity to make an informed decision to participate in research).

### 2.3.2 Program Description

The Stride program was developed at the University of Western Australia (UWA) by a team of experienced researchers and professionals in the field of clinical exercise physiology. The program was developed throughout 2019 and the first half of 2020. In developing Stride on campus (with the aim of achieving effective integration with existing student support), we sought input from UWA Student Life (i.e., a campus student wellbeing and experience service); UWA Sport (i.e., the student sporting and recreation service); UWA Medical Services; and UWA Student Guild. Further, we sought input from university management to integrate institutional safety and risk management. Throughout this section, we describe the Stride program development, structure, and elements, according to the TIDieR guidelines (Hoffmann et al., 2014).

We developed Stride as a referral-only on-campus exercise-based student mental health support service. Referrals into the program could be sought or obtained from on-campus well-being support services (e.g., UWA Medical Centre, Counsellors, Psychologists, Student support officers, or Student faculties), or off-campus (e.g., a registered medical professional). In line with the aim of the program (to augment existing student support services in supporting the rising rates of student mental ill-being on university campuses), we confined our inclusion criteria to students experiencing mental health difficulties (e.g., depression, anxiety, substance use), who are actively help-seeking (i.e., engaged with other health services on campus). No

official or formal diagnosis for entry into the program was required—only a referral from the aforementioned support services. Students could be referred into the program for any mental health difficulties (e.g., mental illness or distress) they may be experiencing.

Over the course of 12 weeks, Stride offers students a minimum one exercise session per week (with the option of students participating in multiple sessions if feasible for themselves and their mentor). The program was structured to offer a minimum of one exercise session per week for 12-weeks to meet recommended dosage that will promote positive mental health outcomes (Biddle et al., 2019; Rethorst & Trivedi, 2013; Trivedi et al., 2011) and to not overburden students who are experiencing mental distress or illness. Stride participants were paired by the program coordinator (see below), an Accredited Exercise Physiologist (i.e., accredited by the relevant national body) tasked with overseeing the initial and final assessments in the program, with a mentor (see below), a Master of Clinical Exercise Physiology student at UWA. When the program coordinator decided on the most appropriate mentor, they first advised the student (mentee) to verify there was no pre-existing relationship with the intended mentor, or (if there was such a relationship) that the student was comfortable with the mentor knowing they were in the program (i.e., to protect the student's privacy from the mentor). If the student felt comfortable to progress with the pairing, the mentor was informed about the assigned student and was also then able to request a change if necessary (i.e., if there was a pre-existing relationship or other conflict). Throughout, the program coordinator ensured there was ample opportunity for either student or mentor to request a change if required. The mentors receive training in delivering exercise to clinical populations, including people experiencing mental health difficulties (e.g., mental disorders). The program coordinator and mentors are further described below, but their roles in brief included—for the program coordinator—management of

the program, liaising with program stakeholders and referrers, initial and final assessment of students, training of mentors, providing support to mentors, and—for the mentors—management and delivery of exercise sessions.

***Program Coordinator***

The Stride program coordinator was an Exercise Physiologist accredited by the relevant national body. Further, our coordinator is a former graduate of the Master of Clinical Exercise Physiology course, and as a result was well-positioned to provide oversight to the program mentors. The program coordinator had a primary role to train and oversee the program mentors, and complete student initial and final assessments. During the initial assessment the program coordinator completed an objective and a subjective assessment. The objective assessment is outlined in the main text of the manuscript; however, the subjective assessment involved a conversation with the student to understand their goals from the program, whether they were suited to partake in the program, the student's exercise preferences, and finally, whether the student had preferences for a mentor (e.g., age, gender identity, general and exercise interests) to ensure student comfort during exercise sessions. Notably, when student preferences could not be matched, students were offered the choice of entering the program with an available mentor or waiting for a mentor who matched their preferences more closely.

***Mentors and Additional Training***

Stride mentors were students of the Master of Clinical Exercise Physiology course at the University of Western Australia. As part of the accreditation process for Exercise Physiologists in Australia, these students require placement hours with Accredited Exercise Physiologists overseeing their work with clinical populations. As a result, Stride provides Master of Clinical Exercise Physiology students with an opportunity for work-integrated learning with a clinical population of people experiencing mental health difficulties. In select instances (i.e., when the program

coordinator perceived, because of the subjective assessment, that a Stride participant's mental illness manifested with severe symptoms), the program coordinator mentored students that might present excessive challenge for mentors. Generally, mentors were diverse with respect to age, ethnicity, nationality, domestic or international student status, part- or full-time study load, general interests, and exercise interests. The mentors were matched with a program participant according to the program coordinator's judgement. All mentors were required to complete a Stride training module before taking part in the Stride program delivery.

The training module that mentors were required to complete was initially presented as a series of online modules due to COVID-19 restrictions, and then as an interactive seminar hosted by the program coordinator. The training included general program information, rationale for the program and the structure of the program, the mentor's role in session delivery, and additional information (e.g., materials related to emergency services on-campus, supporting exercise adherence, and available exercise options) to support mentors. The general program information outlined the goals of the program, the program structure, a flowchart of program processes, and answers to frequently asked questions. The goals of the program were: (1) to provide a personalised, enjoyable exercise experience for students; (2) to support physical activity following Stride; (3) to support lasting mental health and wellbeing improvements; (4) to support the appropriate integration of exercise physiology training; and (5) to provide a replicable blueprint for universities. The program structure was displayed as a hierarchy outlining program developers, coordinators, mentors, and other support networks. Finally, we provided students with relevant statistics of student mental health at universities, notably to illustrate the rationale of the program and its importance.

The section related to the role of the mentor consisted of technical program-related information and covered required 'soft' skills. First, the technical information

outlined tasks required by mentors to complete. The tasks included that mentors revise the student's intake assessments, and subsequently to initiate contact with the student. mentors were instructed to contact the student through the student's preferred choice of communication, most often through text message, but other options included email or phone calls. During the first session with the student, the mentors were instructed to consult with the student to understand their exercise preferences and goals from the program. Following the first session, mentors were instructed to schedule weekly exercise sessions at a time (and location) suitable for both the student and mentor. Between exercise sessions, mentors were required to record the progress from the completed session, review the student's progression towards their program goals, plan the following sessions exercise content, and consult with the program coordinator if required. During the 6$^{th}$ week of the program, mentors began the transition process out of the program—intended to facilitate students' on-going engagement in physical activity and exercise post-program. This process was scheduled to last for 6 weeks, whereby mentors should aim to integrate exercise without the program sessions as part of the student's life. Finally, the mentors were trained to understand the risks associated with the exercise sessions and be aware of all program and university safety and emergency procedures.

To best implement the technical requirements, mentors were provided with brief 'soft' skill training in providing support and communication skills. These skills involved information on listening and communicating well, asking their student questions, and building rapport with the student; different avenues to help promote motivation and build student confidence; involving creativity during sessions (e.g., variety of exercise, use of music, group-session, green exercise, online tools or apps, etc.); supporting student adherence and engagement; and finally, providing support to other mentors in the program. Finally, the training provided mentors with a list of

program contacts, on-campus emergency contact information, and a non-exhaustive list of off-campus mental health emergency contacts. Following the completion of the program, the mentors were required to submit a written reflection of their experiences and learning from partaking in the program.

***Exercise Session Structure***

The exercise sessions were delivered on the main campus of The University of Western Australia. Exercise sessions were structured to be autonomy-supportive, with a high degree of student input and flexibility. The program coordinator and mentors collaborated with a student to develop a person-centred, individualised exercise program. Accordingly, each student was provided with on-going flexibility with regards to activity location, type, goals, and intensity to best support program engagement. For example, Stride participants were offered any type of exercise (e.g., individual or group sports, resistance training gym, swimming) that could be delivered on-campus (i.e., at the University of Western Australia); their choice of whether it was group-based (e.g., an exercise class), individual (i.e., one-on-one with their mentor), or with one of their friends; and, with each session intensity decided upon by the student. Each session lasted a minimum of 45 minutes unless the student's circumstances (e.g., mental health) impacted on their ability to complete the full session.

### 2.3.3 Procedure

Ethical approval was provided by The Human Research Ethics Committee at the first author's institution (RA/4/20/6055). Procedures for data collection were as follows. First, participants were referred into the program and were provided information about the program (i.e., program only, and not research activity surrounding the program) by the referrer. Second, program participants completed an intake assessment with the Stride program coordinator. The initial assessment included baseline measurements of mental health, physical health (e.g., physiological variables), and other program related

outcomes (e.g., leisure time physical activity, social identity, or sleep; for specific measurement tools, see Assessment of Pre-to-Post Program Change below). Physical health measures included weight, height, dual x-ray absorptiometry (body fat percentage and lean body mass). Physiological measures included oxygen uptake and power output, grip strength, resting heart rate, physical activity levels, and blood pressure. Mental health was assessed via a self-report inventory of depressive symptomatology. Other variables measured in the initial assessment included quality of life, leisure time physical-activity, self-efficacy, sleep quality and quantity, social identity, attachment to university, and dietary intake of sugary and fatty foods. Following the initial assessment, the program coordinator informed the research team as to the student's capacity to consent to and participate in the research components surrounding the program. If the coordinator deemed that the research activity posed no additional mental health risk, the participant was then provided with an invitation to participate in the research study being conducted around the Stride program.

Participants who expressed an interest in the research study met with the first author and were provided with written information about the research requirements and the opportunity to ask questions. Participants were informed that participation in the research was voluntary, that their decision would not impact their involvement in the Stride program in any way, and that they could withdraw from research without consequence (including for their involvement in the program) at any point. Participants were made aware that by providing consent to participate in the research they were also allowing the research team to access their intake and post-program assessment data. Research participants also completed a short baseline survey—in summary, reporting their age, sex, permanent residency status (i.e., domestic or international student), current university degree level, study load, year of study, residential status, relationship status, and questionnaires related to quality of life, self-efficacy, social identity, sleep,

and dietary intake. Shortly after completion of the baseline survey and initial assessment, participants were assigned a mentor for the program duration (students and mentors who had a pre-existing relationship were not matched to one another; for further information, see 2.3.2 Program Description). Mentors were exercise science postgraduate students—predominantly students enrolled in Master of Clinical Exercise Physiology—who were purposefully selected to provide support to the participant (in cases of severe mental illness, the program coordinator occupied this mentor role). Participants then completed their 12-week exercise program working in partnership with their mentor.

During their first exercise session, research participants completed a survey assessing their perceptions of their intake assessment. Additionally, throughout the 12-week exercise program, participants completed fortnightly surveys assessing exercise session perceptions. At the conclusion of the 12-week program, the program coordinator conducted a final assessment that was identical to the initial assessment, and the first author provided the end-of-program survey for research participants—this survey included assessments of the participants' program perceptions and their perception of their mentor, and identical-to-baseline questionnaires related to their quality of life, self-efficacy, social identity, sleep, and dietary intake. Participants who missed exercise sessions for a variety of unrecorded reasons were included in all data analyses. Participants who missed sessions were offered additional 'make-up' sessions to allow them to achieve a minimum of 12 sessions over a 12-week period; however, students were able to complete more than one session per week.

### 2.3.4 Assessment of Feasibility

Feasibility measurements are presented in itemised form in Table 3. Reliability analysis of constructed multiple item scales are presented in Supplementary Table 1.

***Program referral process assessment.***

To assess the program referral process, data were recorded regarding the qualification of who provided the referral (e.g., a medical practitioner, a psychologist, a mental health nurse), the location the referral was received from (e.g., the on-campus medical centre), and reason for referral (i.e., the students' mental distress or illness).

***Recruitment and drop-out rates.***

Recruitment rates were reported as participants who were referred into the program and subsequently engaged in the program. Drop-out rates (i.e., the proportion of students who started but did not complete the program) were also recorded.

***Intake assessment perceptions.***

During the first exercise session (i.e., following the initial assessment) participants completed a 4-item questionnaire assessing their perceptions regarding the initial assessment. Items included "The initial assessment was well organised" and "The initial assessment answered all my questions about Stride"; a full list of items is available in Table 3. All items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating more positive evaluations. All items were treated as separate continuous variables, and descriptively analysed.

***Exercise session information.***

During exercise sessions, participants reported on the location of their exercise-session (i.e., where on campus); the type of exercise completed (e.g., resistance, cardiovascular, etc.); whether the session was individual or part of a group; the total duration of an exercise session, scored in intervals of 16-30, 31-45, or 46< minutes; and their exercise participation intensity (on a scale of 1 to 10, where 10 is most intense). Also, mentors scored participants on their participation level of an exercise session (full, partial, or minimal participation). Items were descriptively analysed.

***Enjoyment of exercise sessions.***

During exercise sessions, participants completed a fortnightly 3-item questionnaire assessing their perceptions of enjoyment. An example item is "I am enjoying the exercise sessions very much"—a full list of items is available in Table 3. All items were scored on a 7-point Likert scale ranging from 1 (not true at all) to 7 (very true), with higher scores corresponding to more positive evaluations. The three items were treated as separate continuous variables, and descriptively analysed.

***Program perceptions.***

Within the end-of-program survey, participants completed a 5-item questionnaire assessing their perceptions regarding the program's overall usefulness, whether they felt the program had helped their wellbeing, academic performance, mental health, and their intention to recommend the program to other students. The development of this questionnaire was informed by previous feasibility work (see, for example, Budden et al., 2022) . All items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating more positive evaluations. Items were treated as singular continuous variables, and descriptively analysed.

***Perceptions of mentor.***

Within the end-of-program survey, participants completed a 13-item questionnaire regarding their experiences with their mentor. Mentors were the key program facilitators for participants, and several items were required to provide comprehensive assessment of participants' perceptions of their mentor. Example items included "My Stride mentor took into account my needs and preferences", "My Stride mentor provided an enjoyable exercise experience"; a full of items are available in Table 3. All items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores equivalent to more positive evaluations. The 13-items were treated as continuous separate variables and analysed

descriptively. Additionally, participants completed a modified version of the Single Item Social Identification measure (SISI; Postmes et al., 2013). In this study, the item was worded as, “I identify with my mentor in the Stride program”. Respondents indicated the extent of agreement with the statement on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The item was descriptively analysed as a singular continuous variable. Finally, participants reported the average frequency of communication with their mentor, and responses were <1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-7, >7 times per week. Communication with the mentor was descriptively analysed as a singular continuous variable.

### 2.3.5 Assessment of Pre-to-Post Program Change

The assessment of pre-to-post program change is provided in this section. By retrieving pre- and post-program data, collected within 14 days of the first exercise session and within 14 days of a participant completing the Stride program, we assessed changes accompanying program participation in mental health symptomatology using QIDS-SR-16 (Quick Inventory of Depressive Symptomatology – Self Report; Rush et al., 2003). Scoring, for analysis purposes, was completed according to Rush et al. (2003) guidelines. Participants also self-reported on several other measures pre- and post-program that were used for the purposes of drawing inferences about possible, although not conclusive, preliminary program effects—these variables were (a) leisure time physical activity (Godin, 2011), (b) quality of life (Gandek et al., 1998), (c) response efficacy—a student’s confidence about whether exercise would result in mental health improvement (3 item scale; Witte, 1996), (d) exercise self-efficacy—a student’s confidence in their capability to engage in exercise (Bandura, 2006), (e) lifestyle self-efficacy—a student’s confidence in their ability to change lifestyle behaviours impacting on their mental health (2 item scale), (f) barrier self-efficacy—a student’s confidence in their ability to overcome exercise barriers (Jackson &

Dimmock, 2012), (g) sleep quantity and sleep quality, (h) social identity (2-SISI; (Postmes et al., 2013), (i) attachment to university (school attachment, 3 items, Moody & Bearman, 1998; originally sourced from Bollen & Hoyle, 1990), and (j) dietary intake of sugary and fatty food, assessed using the Dietary Instrument for Nutrition Education (Roe et al., 1994). Additionally, anthropometric measurements including weight, body mass index (BMI), and body fat percentage and lean body mass using Dual Energy X-ray Absorptiometry (Haarbo et al., 1991) were collection, and physiological measurements including maximum grip strength (Fukumori et al., 2015), resting heart rate, blood pressure (calculated to mean arterial pressure; (DeMers & Wachs, 2022), and power output (W/kg) and oxygen uptake (VO2) assessed using the Aerobic Power Index (Furzer et al., 2012)—chosen due to the increased degree of fatigue that people with mental distress or illness may be experiencing (Harvey et al., 2009).

### 2.3.6 Data Analysis

Data analysis was completed using SPSS Statistics 27.0. Data were initially screened for missing values. Missing variables, subscales, or isolated items within a subscale due to participant failure to respond or missed session were not replaced; that participant was, however, excluded for analysis of that variable. Data analyses were conducted based on all available data. Participant demographics and responses to feasibility data (e.g., retention, program perceptions) were descriptive in nature. Internal consistency estimates for multi-item self-report measures (i.e., self-efficacy and attachment to university) were calculated using Cronbach's alpha. The magnitude of pre-to-post-program change in outcome variables is presented primarily in the form of Cohen's d effect sizes and is supplemented using inferential paired samples t-tests.

## 2.4 Results

### 2.4.1 Participant Characteristics

Demographic information is reported in more detail in Table 2. The average age of the 114 participants who completed the baseline survey was 24.21 years (*SD* = 6.33)—of those, 34 participants identified as male (29.8%), 79 identified as female (69.3%), and one participant identified as non-binary (0.9%). Most participants were domestic students (62.8%), studying at an undergraduate level (60.5%), full-time (87.7%), and reported single as their relationship status (66.4%). Most participants were in their first three years of any university degree (87.9%). Participants reported a wide range of living arrangements, with the majority living with family, friends, or their partner (60.2%). The majority of participants reported taking any form of medication (57%).

**Table 2**

*Descriptive Characteristics of Participants*

| Characteristic | n | Value |
|---|---|---|
| Age at initial assessment (years) | | |
| Mean (SD); Range (min, max) | 112 | 24.21 (6.33); 18, 57 |
| Sex (%) | | |
| Male | 34 | 29.8 |
| Female | 79 | 69.3 |
| Other | 1 | 0.9 |
| Student status (%) | | |
| Domestic | 71 | 62.8 |
| International | 42 | 37.2 |
| Degree level current students (%) | | |
| Undergraduate | 69 | 60.5 |
| Postgraduate | 45 | 39.5 |
| Study Load (%) | | |
| Full Time | 100 | 87.7 |
| Part Time | 14 | 12.3 |
| Year of study (%) | | |
| 1 | 29 | 27.1 |
| 2 | 34 | 31.8 |
| 3 | 31 | 29.0 |
| 4+ | 13 | 12.2 |
| Living Arrangement (%) | | |
| Alone | 19 | 16.8 |
| Family | 25 | 22.1 |

| | | |
|---|---|---|
| Living with partner | 8 | 7.1 |
| On-Campus | 26 | 23.0 |
| Share Housing | 35 | 31.0 |
| Relationship Status (%) | | |
| Single | 75 | 66.4 |
| In a relationship | 34 | 30 |
| Divorced | 1 | 0.9 |
| De-facto | 3 | 2.7 |
| Medication (%) | | |
| Yes | 65 | 57.0 |
| No | 49 | 43.0 |

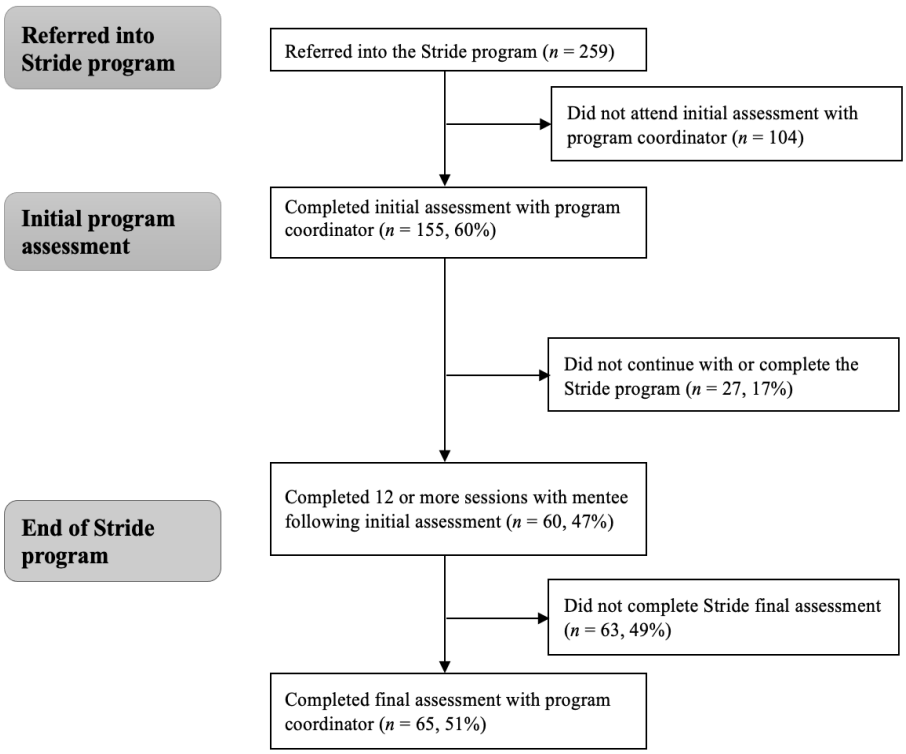
### 2.4.2 Feasibility

#### *Program Referral Process Assessment*

A total of 259 students (i.e., combined research participants and non-participants) were referred to the Stride program between 20th May 2020 and 8th December 2022 (representing the window of data collection for this study). The most common qualification of referral provider was a medical practitioner, and 67.6% of all

**Figure 2**

*Research participant flow diagram.*



referrals originated from the on-campus medical centre. The reasons for referral most frequently included anxiety disorders (53.9%), mood disorders (34.5%), attention deficit/hyperactivity disorder (17.8%), and high levels of stress (12.4%). In 59.5% of referral letters, only one referral reason was provided, with the remaining 40.5% of referrals specifying two or more reasons.

***Recruitment and Drop-out Rates***

From the 259 students referred to the program, 155 were schedules to attend an initial assessment with the program coordinator. Data were not collected from the 104 (non-attendee) students regarding their reason for not attending an initial assessment. Of the 155 students scheduled to attend an initial assessment, 27 either did not attend, or did not complete the assessment. The remaining 128 students completed the initial assessment and entered the Stride program—of which, 80 completed ten exercise sessions with their mentor, 60 completed twelve exercise sessions, and 37 students completed more than twelve exercise sessions. Additionally, of the 128 students that entered the Stride program following initial assessment, 65 students completed the final assessment (i.e., 63 did not attend). As such, the program completion rate was 47% (i.e., 60 of the 128 students that completed 12 or more sessions following an initial assessment). A flowchart depicting the program recruitment and drop-out rates is represented in Figure 2. The research component was optional for students and, of the 155 who attended the initial program assessment, 37 did not provide consent to participate in the research, four were excluded by the program coordinator due to mental illness acuity, and 114 provided consent for research and completed the baseline survey. Of the 114 participants who completed the baseline survey, 62 participants completed the end-of-program survey. As a result, the research completion rate was 54% (i.e., 62 of the 114 participants that initially provided consent). A flowchart representing research participation and completion rates is represented in Figure 2.

### *Intake Assessment Perceptions*

Participants' perceptions of the intake assessment (following their first Stride session) are reported in Table 3. On average, across the four intake assessment items, 94.2% of participants agreed or strongly agreed with the statements. On a response scale ranging from 1 to 5, the mean score of these four items ranged from 4.55 (*SD* = 0.64) to 4.74 (*SD* = 0.54). Broadly, it appeared that the elements of intake assessment were considered satisfactory.

**Table 3**

*Participants' Experiences In, and Perceptions of the Stride Program*

| Item | *N* | *Mean (SD)* | *Agree / Strongly Agree (%)* |
|---|---|---|---|
| *Initial Assessment* | | | |
| Was well organised | 62 | 4.60 (0.61) | 93.8 |
| Helped me understand what to expect from the Stride program | 62 | 4.55 (0.64) | 92.3 |
| Answered all my questions about Stride | 62 | 4.69 (0.56) | 95.3 |
| Was useful in introducing the Stride program | 62 | 4.74 (0.54) | 95.5 |
| *Program Experiences* | | | |
| There were enough 1 on 1 sessions with my mentor | 62 | 4.35 (0.87) | 88.3 |
| I enjoyed the 1 on 1 time with my mentor | 62 | 4.61 (0.71) | 95.2 |
| The 1 on 1 sessions with my mentor were well organised | 62 | 4.58 (0.71) | 95.2 |
| The Stride program helped my academic performance | 62 | 3.48 (0.88) | 48.4 |
| The Stride program helped improve my mental health | 62 | 4.06 (0.83) | 79.0 |
| The Stride program is a useful component of on-campus mental health treatment | 62 | 4.37 (0.81) | 85.5 |
| I would recommend the Stride program to other student | 62 | 4.48 (0.81) | 88.7 |
| The Stride sessions were good for my mood and general well-being | 62 | 4.40 (0.82) | 88.7 |
| *Mentor Perceptions* | | | |
| My Stride mentor arranged session times that suited me | 62 | 4.77 (0.46) | 98.4 |
| My Stride mentor was easily contactable | 62 | 4.77 (0.49) | 96.8 |
| My Stride mentor is someone I like | 62 | 4.74 (0.54) | 95.2 |
| My Stride mentor was caring | 62 | 4.73 (0.55) | 95.2 |
| My Stride mentor took into account my needs and preferences | 62 | 4.69 (0.59) | 93.5 |
| My Stride mentor provided a supportive environment | 62 | 4.76 (0.53) | 95.2 |
| My Stride mentor provided an enjoyable exercise experience | 62 | 4.76 (0.56) | 93.5 |
| My Stride mentor explored exercise options with me to find something I would enjoy | 60 | 4.72 (0.52) | 96.7 |
| My Stride mentor was knowledgeable about exercise | 62 | 4.81 (0.40) | 100 |
| My Stride mentor provided me with information about things that may influence my mental health (e.g., sleep, nutrition, relationships) | 62 | 4.19 (0.90) | 82.3 |
| My Stride mentor helped my motivation for exercise | 62 | 4.65 (0.60) | 93.5 |
| My Stride mentor explored exercise options for my transition out of Stride | 62 | 4.52 (0.81) | 87.1 |
| My Stride mentor helped support me to be active outside of the Stride sessions | 62 | 4.50 (0.88) | 91.9 |
| I identify with my mentor in the Stride program | 62 | 4.55 (1.59) | 56.5 |

| *Communication* | N | 1-2 (%) | 2-3 (%) | 3-4 (%) | 4-5 (%) | 5-6 (%) |
|---|---|---|---|---|---|---|
| On an average week, how many times a week were you in contact with your mentor? | 62 | 50.0 | 37.1 | 8.1 | 3.2 | 1.6 |

| *Exercise Session Perceptions* | *N* | *Mean (SD)* | *Scored 5 or higher /7 (%)* |
|---|---|---|---|
| I am enjoying the exercise sessions very much | 375 | 6.20 (0.90) | 96.5 |
| These exercise sessions are fun to do | 374 | 6.13 (0.90) | 95.2 |
| When I am doing these exercise sessions, I think about how much I enjoy them | 376 | 5.44 (1.27) | 50.7 |

*Note.* Initial Assessment, Program Experiences, and Mentor *Perception* items were scored 1-5, where higher scores denote more positive perceptions. Communication items were scored 1-6, where higher scores denote more frequent communication. Exercise Session Perception items were scored from 1 to 7, where higher scores denote more positive perceptions.

### *Exercise Sessions*

Exercise session data are reported in Table 4. Due to some exercise sessions utilising more than one location and/or more than one type of exercise, percentage totals for location and type of exercise may summate to over 100%. The majority of exercise sessions took place at the on-campus recreation facility (77.9%), with resistance training representing the most common type of exercise (74.3%). One-on-one exercise sessions (i.e., a student with only their mentor) accounted for 88.9% of reported exercise sessions, with 89.8% of sessions completed at 'full' participation level as reported by mentor. The duration of reported exercise sessions was most commonly 46 minutes or more (60.4%), followed by sessions lasting 31 to 45 minutes (34.1%). Additionally, using a scale ranging from 1 (*easiest*) to 10 (*hardest*), 71.4% of exercise sessions were rated between 6 to 8 for exercise intensity.

**Table 4**

*Descriptive Characteristics of Exercise Sessions*

| Characteristic | n | % |
|---|---|---|
| Location | | |
| Gym | 216 | 85.1 |
| Sporting Grounds* | 17 | 6.7 |
| Aquatic Centre | 12 | 4.7 |
| Outdoors | 9 | 3.6 |
| Online | 6 | 2.4 |
| Exercise Type | | |
| Resistance | 188 | 74.3 |
| Cardio | 59 | 23.3 |
| Mobility | 25 | 9.9 |
| Playing sport | 25 | 9.9 |
| Circuit | 14 | 5.5 |
| Fitness class | 7 | 2.8 |
| Individual or Group | | |
| Individual | 226 | 89.7 |
| Group session – additional Stride student | 14 | 5.6 |
| Group session – external | 6 | 2.4 |
| Group session – mixed stride & external | 6 | 2.4 |
| Participation level | | |
| Full | 228 | 89.8 |
| Partial | 8 | 3.1 |
| Minimal | 18 | 7.1 |

| | | |
|---|---|---|
| Duration of exercise session (min) | | |
| 16 – 30 | 14 | 5.5 |
| 31 – 45 | 87 | 34.1 |
| 46+ | 154 | 60.4 |
| Exercise intensity (1 to 10) | | |
| 2 | 5 | 2.0 |
| 3 | 6 | 2.4 |
| 4 | 13 | 5.1 |
| 5 | 27 | 10.6 |
| 6 | 60 | 23.5 |
| 7 | 69 | 27.1 |
| 8 | 53 | 20.8 |
| 9 | 18 | 7.1 |
| 10 | 4 | 1.6 |

*Note.* Participants reported location for 260 sessions. Participants reported on type of exercise for 318 sessions. Participants reported on individual or group exercise for 252 sessions. Participants reported on participation level for 254 sessions. Participants reported on duration of exercise for 255 sessions. Participants reported on exercise intensity for 255 sessions.

### *Enjoyment of Exercise Sessions*

Exercise sessions were generally perceived as fun (see Table 3; 95.2% scored between 5 and 7 on the 7-point response scale, with an average score of 6.13), and participants reported strong exercise session enjoyment (i.e., 96.5% scored between 5 and 7 on the 7-point scale, with an average score of 6.20). In response to the statement "*When I am doing these exercise sessions, I think about how much I enjoy them"*, 50.7% of participants reported positively (an average score of 5.44).

### *Program Perceptions*

Descriptive data for program experiences and perceptions of program components are also reported in Table 3. Participants' perceptions of their experience in the Stride program were generally positive, with mean response scores across items ranging from 3.48 to 4.61 (range 1 to 5). The following program experiences are presented as a percentage of participants who responded *"agree"* or *"strongly agree"* to each item on the survey. The majority of participants felt there were enough one-on-one sessions with their mentor (88.3%), enjoyed the one-on-one time with their mentor (95.2%), and reported the one-on-one sessions with their mentors were well organised

(95.2%). The majority of participants also reported that the Stride program helped improve their mental health (79.0%), was good for their mood and general wellbeing (88.7%), was a useful component of on-campus mental health treatment (85.5%), and that they would recommend the Stride program to other students experiencing mental health difficulties (88.7%). Interestingly, fewer than half of respondents (48.4%) felt the program helped improve academic performance (mean response score of 3.48 on the 1-to-5 scale).

***Perceptions of Mentor***

Data regarding mentor perceptions are reported in Table 3. Participants' perceptions of their mentor were largely positive, with mean scores ranging between 4.19 (*SD* = 0.90) and 4.81 (*SD* = 0.41) (on a 1-to-5 scale) for the 13 items. Below, participant perceptions are again reported as the percentage of participants who responded *"agree"* or *"strongly agree"* to each statement. The majority of participants perceived their mentor to be easily contactable (96.8%) and caring (95.2%), that they provided a supportive environment (95.2%), helped their motivation for exercise (93.5%), and explored exercise options that they would enjoy (96.7%). Additionally, 100% of participants responded *"agree"* or *"strongly agree"* that their mentor was knowledgeable about exercise. A smaller percentage of participants (56.5%) agreed or strongly agreed that they identified with their mentor (an average score of 4.55 on a 1-to-7 scale) on a single item measure of social identity. Finally, most participants reported communication with their mentor between 1-to-3 times each week (i.e., 87.1% of responses).

### 2.4.3 Preliminary Efficacy

Data for pre-to-post-program changes in mean scores, and associated standard deviations, paired samples t-tests, confidence intervals, statistical significance values, and Cohen's *d* effect sizes for each outcome variable are reported in Table 5; and, in

Supplementary Table 2 we present a Pearson correlations tables. On average, participants reported a 3.87-point decrease from pre-to-post-program in their Quick Inventory of Depressive Symptomatology scores, which represented a large effect ($d$ = -0.78) and clinical meaningful change (i.e., above the threshold of 3.75). Participants reported a 39.65% pre-to-post-program increase in their leisure-time physical activity (i.e., all physical activity inclusive of Stride sessions), equating to a medium-to-large effect ($d$ = 0.62). Change on quality-of-life subscales were variable—for the physical health subscale we observed negligible change (a 0.89% increase, $d$ = 0.06), and for mental health we observed a 32.47% pre-to-post-program increase, indicative of a large effect ($d$ = 1.04).

Participants reported a large positive pre-to-post-program change in their *exercise self-efficacy* ($d$ = 1.19), a small-to-medium-sized improvement in *lifestyle self-efficacy* ($d$ = 0.39), and a medium-sized improvement in *barrier self-efficacy* ($d$ = 0.53). We observed negligible change in *response efficacy* perceptions (i.e., their belief that exercise will improve mental health; $d$ = 0.08). Internal consistency estimates were calculated for all multi-item self-report variables with acceptable internal consistency ($\alpha > 0.6$) at baseline assessment, and at minimum, high internal consistency ($\alpha > 0.8$) at follow-up. A small pre-to-post-program increase was observed for hours asleep each night ($d$ = 0.16), and a medium-sized pre-to-post-program improvement was observed for the number of days participants felt they had a good sleep each week ($d$ = 0.45). Of the two social identity measures, we observed a 24.7% increase in students' identification with their course, reflecting a large effect size ($d$ = 0.89), and a 7.73% increase in students' perceptions of their identification with other students at the University, reflecting a small effect size ($d$ = 0.24). A pre-to-post-program increase of 8.05% was observed for participants' perceptions of their attachment to university ($d$ = 0.45). For dietary intake, there was a small-to-medium pre-to-post-program decrease in

fatty food scores ($d$ = -0.33), and a small pre-to-post-program decrease in sugary food scores ($d$ = -0.15). In terms of anthropometric measurements, we witnessed negligible or small-but-inconsistent changes. We observed an average pre-to-post-program decrease in weight of 0.7kg ($d$ = -0.04), an average decrease in BMI of 0.2 units ($d$ = -0.03), an average 0.2% decrease in body fat percentage ($d$ = -0.02), and an average increase in lean body mass of 0.5kg ($d$ = 0.04). For physiological measurements, we observed an average pre-to-post-program decrease in maximum grip strength of 1.16kg ($d$ = -0.10), a 0.32% pre-to-post-program increase in resting heart rate ($d$ = -0.02), a small-sized decrease in mean arterial pressure ($d$ = -0.28), and a small-sized decrease in power output ($d$ = -0.29).

**Table 5**

*Pre-to-post Program Changes on Outcome Variables*

| Variable | *M pre (SD)* | *M post (SD)* | *M diff* (SD) | % change | 95% Confidence Interval of the Difference Lower | Upper | *t* | *df* | *p* | ***d*** |
|---|---|---|---|---|---|---|---|---|---|---|
| *Mental Health and Wellbeing* | | | | | | | | | | |
| Quick Inventory of Depressive Symptomatology | 13.07 (4.96) | 9.20 (4.99) | -3.87 (5.09) | -29.61 | -5.17 | -2.57 | -5.99 | 60 | <.001 | **-0.78** |
| *Physical Activity* | | | | | | | | | | |
| Leisure-time PA | 26.25 (18.98) | 39.23 (22.99) | 12.98 (20.92) | 49.45 | 7.58 | 18.39 | 4.81 | 59 | <.001 | **0.62** |
| *Quality of Life* | | | | | | | | | | |
| Physical health (PCS; SF-12) | 53.99 (8.42) | 54.47 (7.07) | 0.20 (6.51) | 0.89 | -1.47 | 1.87 | 0.24 | 60 | .811 | **0.06** |
| Mental health (MCS; SF-12) | 28.35 (10.74) | 39.34 (10.43) | 11.00 (12.17) | 38.76 | 7.87 | 14.11 | 7.05 | 60 | <.001 | **1.04** |
| *Self-Efficacy* | | | | | | | | | | |
| Response-Efficacy | 4.29 (0.62) | 4.35 (0.86) | 0.06 (0.96) | 1.39 | -0.19 | 0.31 | 0.45 | 58 | .652 | **0.08** |
| Exercise Self-Efficacy | 2.89 (0.63) | 3.48 (0.76) | 0.59 (0.79) | 20.42 | 0.63 | 1.03 | 8.49 | 60 | <.001 | **1.19** |
| Lifestyle Self-Efficacy | 3.07 (0.79) | 3.39 (0.84) | 0.33 (0.93) | 10.42 | 0.09 | 0.57 | 2.75 | 60 | .008 | **0.39** |
| Barrier Self-Efficacy | 2.83 (0.75) | 3.25 (0.83) | 0.42 (0.80) | 14.84 | 0.21 | 0.63 | 3.97 | 57 | <.001 | **0.53** |
| *Social Identity* | | | | | | | | | | |
| Identify with students in course | 4.62 (1.62) | 5.92 (1.28) | 1.30 (1.71) | 28.14 | 0.86 | 1.73 | 5.93 | 60 | <.001 | **0.89** |
| Identify with students at UWA | 4.48 (1.44) | 4.84 (1.51) | 0.36 (1.21) | 8.03 | 0.04 | 0.68 | 2.28 | 57 | .026 | **0.24** |
| Attachment to university | 2.86 (0.46) | 3.10 (0.60) | 0.24 (0.45) | 8.39 | 0.13 | 0.36 | 4.19 | 58 | <.001 | **0.45** |
| *Sleep* | | | | | | | | | | |
| Daily sleep quantity (in hours) | 3.49 (0.74) | 3.61 (0.80) | 0.12 (0.69) | 3.44 | -0.06 | 0.29 | 1.31 | 60 | .196 | **0.16** |
| Weekly good sleep quality (in days) | 3.23 (1.96) | 4.07 (1.79) | 0.84 (1.79) | 26.00 | 0.38 | 1.30 | 3.65 | 60 | <.001 | **0.45** |
| *Dietary Intake* | | | | | | | | | | |
| Fatty food score | 19.26 (7.20) | 17.06 (6.29) | -2.21 (6.31) | -11.42 | -3.98 | -0.43 | -2.50 | 50 | .016 | **-0.33** |
| Sugary food score | 4.21 (1.33) | 4.02 (1.17) | -0.20 (1.39) | -4.51 | -0.57 | 0.17 | -1.06 | 50 | .296 | **-0.15** |
| *Anthropometric Measurements* | | | | | | | | | | |
| Weight (kg) | 72.99 (18.28) | 72.24 (18.30) | -0.73 (4.41) | -1.03 | -0.81 | 2.27 | 0.962 | 33 | .343 | **-0.04** |
| BMI | 25.31 (6.25) | 25.13 (5.72) | -0.19 (3.50) | -0.71 | -1.41 | 1.03 | -0.31 | 33 | .756 | **-0.03** |
| Body Fat % | 32.67 (8.93) | 32.47 (9.75) | -0.20 (3.31) | -0.61 | -1.38 | 0.97 | -0.36 | 32 | .725 | **-0.02** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lean Body Mass (kg) | 45.73 (11.60) | 46.24 (11.77) | 0.51 (1.50) | 1.11 | -0.03 | 1.04 | 1.94 | 32 | .061 | **0.04** |
| *Physiological Measurements* | | | | | | | | | | |
| Max Grip Strength (kg) | 36.21 (11.13) | 35.05 (10.99) | -1.16 (7.18) | -3.20 | -3.52 | 1.20 | -1.00 | 37 | .326 | **-0.10** |
| Resting Heart Rate | 78.42 (10.77) | 78.67 (13.53) | 0.24 (11.80) | 0.32 | -3.94 | 4.42 | 0.12 | 32 | .907 | **-0.02** |
| Mean Arterial Pressure (mmHg) | 93.33 (7.91) | 91.24 (6.73) | -2.10 (7.20) | -2.24 | -4.49 | 0.31 | -1.77 | 36 | .086 | **-0.28** |
| Power Output (watts/kg) | 2.77 (0.55) | 2.61 (0.55) | -0.16 (0.69) | -5.78 | -0.57 | 0.26 | -0.82 | 12 | .428 | **-0.29** |

*Note.* All values (except *p* values) rounded to 2 decimal points. Positive differences for leisure-time PA, mental health (MCS; SF-12), physical health (PCS; SF-12), self-efficacy scales, social identity and engagement scales, sleep, and lean body mass items all represent positive increases. Negative differences for quick inventory of depressive symptomatology (QIDS-SR), weight, BMI, body fat %, and mean blood pressure represents positive reductions in scores. Reductions in fatty food and sugary food scores represent positive reductions. A positive difference for resting heart rate represents negative outcomes. Negative differences in max grip strength and aerobic power index represent negative outcomes. 61 participants provided responses to both baselines and end-of-program surveys including dietary information. 51 participants provided responses to both baseline and end-of-program surveys that did not include dietary information (due to mental illness concern). 33 participants were measured at their initial and final assessment for their weight and BMI, and 32 completed a DEXA scan to provide us with body fat % and lean body mass. 38 participants completed the maximum grip strength test during their initial and final assessment. 33 participants completed heart rate measurement during their initial and final assessment. 37 participants completed a blood pressure test during their initial and final assessment. 13 participants completed an aerobic power test their initial and final assessment.

## 2.5 Discussion

Interventions to support university students experiencing mental distress or illness are critical from both a health promotion and an educational perspective. The scope of this problem is underscored by the high prevalence of university students experiencing mental illness (Sheldon et al., 2021), wait times university students may encounter when seeking help (Punton et al., 2022), and calls for universities to offer more options to support student mental distress or illness treatment (Baik et al., 2019). There appears to be growing emphasis on the role that exercise can play in the support of mental health. However, there are few published examples documenting the delivery and potential effectiveness of structured exercise interventions for students with mental distress or illnesses (e.g., deJonge et al., 2021), and in the instances where these studies have been reported, they have seldom been couched within recommended feasibility trial guidelines. We conducted a single-group, non-randomised feasibility trial of a structured exercise program for students experiencing mental distress or illness, adhering to CONSORT guidelines for feasibility trials (Eldridge, Chan, et al., 2016). We drew from principles within the hybrid effectiveness-implementation framework to structure our efforts (Curran et al., 2012b). Accordingly, the aim of our research was to assess the feasibility and preliminary efficacy of the Stride program.

In broad terms, we found support for both the feasibility and preliminary efficacy of the Stride program. With respect to the assessment of preliminary efficacy, our lack of control group and randomisation means that any outcome-related conclusions regarding mental health changes must be considered as having coincided with or accompanied by (rather than being *caused by*) exercise involvement. We are also mindful that the nature of the program—typically operating contemporaneously alongside other treatment strategies—means that we are unable to isolate exercise-specific versus other (e.g., pharmacological, counselling-based) effects. Nonetheless, we

found a large effect size for reductions in depressive symptomatology that aligned with involvement in Stride and that also align with literature documenting the effects of exercise on mental illnesses (e.g., Aylett et al., 2018; Firth et al., 2015; Hu et al., 2020). We also observed a large effect size showing increases in leisure time physical activity, improvements in the mental health component of quality-of-life, increases in exercise self-efficacy, and other positive outcomes including improvements in sleep quality and quantity and fatty and sugary food intake. Importantly, these secondary variables have also previously been shown to be related to varying degrees of improvement in mental illness (e.g., sleep: Scott et al., 2021; fatty and sugary food intake: Ventriglio et al., 2020). Taken together, therefore, we may tentatively conclude that involvement in this structured exercise program may hold potential for realising marked mental health improvements. An adequately powered randomised controlled trial is required to provide greater confidence as to the causal mechanisms and outcomes of such programs in the future—we hope this work will help to inform such trials.

We assessed varied components relating to the feasibility of the Stride program—scrutiny of almost all components indicated that the program was feasible, and perceptions of the program implied acceptability. These results support previous studies in which program acceptability has been assessed (e.g., deJonge et al., 2021; Muir et al., 2020), which is noteworthy even in the face of several differences in the nature and delivery of the programs in question. For example, deJonge and colleagues (2021) reported positively on the acceptability of an exercise program which differed in terms of length of program and duration of sessions (6 weekly 1-hour sessions), the design of sessions (i.e., 30-minute physical activity and 30-minutes of coaching), and degree of mentor training. The comparison between these two programs highlights that there may be multiple routes to developing feasible exercise programs for this population, and that tailoring by institution involving co-design principles (Steen et al.,

2011) may be an important consideration for scale-out efforts in this field (Aarons et al., 2017b).

Although our data indicated that the intervention overall was considered acceptable and feasible, a closer inspection of data relating to program experiences and components (e.g., assessments, mentors, session structure) provides important additional insight. The initial assessment was viewed in a strongly positive way by students and may have had a positive effect on the engagement rates of students (e.g., Bombard et al., 2018). Additionally, students reported largely positive program experiences, with beliefs that the program improved their general well-being, mood, and mental health—which in itself may improve mental health (Mann et al., 2004). Furthermore, students' perceptions of their mentor and the exercise sessions were overwhelmingly positive. The mentors in the program were peers (i.e., university students)—the use of peer support workers has shown positive mental health outcomes for people experiencing mental distress or illness (Stubbs et al., 2016), and although the Stride mentors were not peer support 'workers', researchers have also reported that informal peer support may have a positive effect on mental health (Lubman et al., 2017). The use of a peer may also, at least in part, underpin the positive experiences students reported about their exercise sessions, not least due to potential reductions in barriers to engagement (Martin Ginis et al., 2013). It is important to note, for balance, that students reported relatively neutral perceptions (to the single item) regarding whether the Stride program helped their academic performance. For students and institutions, this may be noteworthy due to the potential negative effects of mental distress or illness upon academic performance (Eisenberg et al., 2009); future studies may be warranted that examine this outcome in more detail (e.g., by using more sophisticated assessments).

In this study, we provided evidence that this exercise program was generally acceptable and may be associated with positive mental health outcomes for students experiencing mental distress or illness. We did not, however, obtain long-term follow-up data, and as such it is impossible to draw conclusions about relapse rates or any lasting changes to behaviour that accompanied involvement in the program. We encourage researchers seeking to test the effectiveness of such programs to integrate longer-term (e.g., 3-month, 6-month, 12-month) measurement points to advance our understanding further (Fitzpatrick et al., 2018). Additionally, the use of the QIDS-SR was an element of the Stride program that provided the program coordinator and mentors with substantial information on 9 domains of a students' mental health symptomatology. The 9 domains of the QIDS-SR (i.e., sleep, mood, appetite/weight change, concentration/decision making, self-outlook, suicidal ideation, involvement, energy level, and agitation/retardation) are often shared between different psychopathologies. For example, a person experiencing an anxiety disorder may have symptoms related to disturbances in sleep, mood, concentration, and energy levels, or a person experiencing psychotic disorders may present symptoms of negative self-outlook (American Psychiatric Association, 2022). However, a limitation of the QIDS-SR is that no reliability assessment is completed to identify and/or quantify severity of other psychopathologies. Nevertheless, in our study we supplemented the QIDS-SR with the mental health component of the Quality of Life Short-Form 12 questionnaire to better understand any preliminary effects the program may have on students' mental health in a general sense. We recommend researchers conducting future studies consider a measurement of mental illness that provides the exercise trainer with adequate information while having capacity to identify and quantify psychopathologies.

A feasibility trial is recommended prior to the scale-up, scale-out, or randomised controlled testing of an intervention in order to identify problems that may occur during

further delivery (Craig et al., 2008). Following feasibility testing, randomised controlled designs progress our understanding of causal mechanisms and outcomes associated with interventions. We encourage those designing randomised controlled trials for exercise interventions with student populations to consider the nature of their chosen comparison (or control) arms (for important considerations, see Freedland et al., 2019). In doing so, researchers may also seek to examine individual components or 'ingredients' with programs such as this (e.g., peer mentoring, exercise participation, routine) with the goal of determining their independent and combined effects. Such work may be pursued, for example, using a self-determination theory lens (Deci & Ryan, 2012) whereby the differential effects of certain motivationally-enriching elements (e.g., supporting autonomy or relatedness) are tested. And, although exercise has been shown to support different types of mental illnesses (Alexandratos et al., 2012), randomised controlled designs may assist in providing knowledge on the effects an exercise program on different psychopathologies for this cohort. We hope our findings not only underscore the value that exercise programs offer in the treatment of student mental illness, but also provide a platform for increased and more sophisticated research activity surrounding such programs.

## 2.6 References


Aarons, G. A., Sklar, M., Mustanski, B., Benbow, N., & Brown, C. H. (2017). "Scaling-out" evidence-based interventions to new populations or new health care delivery systems. *Implementation Science : IS*, *12*(1), 111. https://doi.org/10.1186/s13012-017-0640-6

Acevedo, E. O. (2012). The Oxford handbook of exercise psychology. In *Exercise psychology*. Oxford University Press.

Alimoradi, Z., Golboni, F., Griffiths, M. D., Broström, A., Lin, C.-Y., & Pakpour, A. H. (2020). Weight-related stigma and psychological distress: A systematic review and meta-analysis. *Clinical Nutrition*, *39*(7), 2001–2013. https://doi.org/10.1016/j.clnu.2019.10.016

Althoff, T., White, R. W., & Horvitz, E. (2016). Influence of Pokémon Go on Physical Activity: Study and Implications. *Journal of Medical Internet Research*, *18*(12), e315–e315. https://doi.org/10.2196/jmir.6759

American Psychological Association. (2019). *Clinical practice guideline for the treatment of depression across three age cohorts*. https://www.apa.org/depression-guideline

Andrews, G., & Slade, T. (2001). Interpreting scores on the Kessler Psychological Distress Scale (K10). *Australian and New Zealand Journal of Public Health*, *25*(6), 494–497. https://doi.org/10.1111/j.1467-842x.2001.tb00310.x

Aschbrenner, K. A., Naslund, J. A., Shevenell, M., Mueser, K. T., & Bartels, S. J. (2016). Feasibility of Behavioral Weight Loss Treatment Enhanced with Peer Support and Mobile Health Technology for Individuals with Serious Mental Illness. *The Psychiatric Quarterly*, *87*(3), 401–415. https://doi.org/10.1007/s11126-015-9395-x

Ashdown-Franks, G., deJonge, M., Arbour-Nicitopoulos, K. P., & Sabiston, C. M. (2022). Exploring the feasibility and acceptability of a physical activity programme for individuals with serious mental illness: A case study. *Qualitative Research in Sport, Exercise and Health*, 1–23. https://doi.org/10.1080/2159676X.2021.2019098

Ashdown-Franks, G., Pilieci, C., & Sabiston, C. M. (2021). *Chapter 33 - Physical activity and exercise in the pathophysiology and treatment of bipolar disorder* (J. Quevedo, A. F. Carvalho, & E. B. T.-N. of B. D. Vieta, Eds.; pp. 373–381). Academic Press. https://doi.org/https://doi.org/10.1016/B978-0-12-819182-8.00035-1

Auerbach, R. P., Alonso, J., Axinn, W. G., Cuijpers, P., Ebert, D. D., Green, J. G., Hwang, I., Kessler, R. C., Liu, H., Mortier, P., Nock, M. K., Pinder-Amaker, S., Sampson, N. A., Aguilar-Gaxiola, S., Al-Hamzawi, A., Andrade, L. H., Benjet, C., Caldas-de-Almeida, J. M., Demyttenaere, K., … Bruffaerts, R. (2016). Mental disorders among college students in the World Health Organization World Mental Health Surveys. *Psychological Medicine*, *46*(14), 2955–2970. https://doi.org/10.1017/S0033291716001665

Australian Bureau of Statistics. (2018). *National Health Survey First Results 2017-18*. National Health Survey 2017-18. https://www.abs.gov.au/statistics/health/health-conditions-and-risks/national-health-survey-first-results/latest-release

Aylett, E., Small, N., & Bower, P. (2018). Exercise in the treatment of clinical anxiety in general practice–a systematic review and meta-analysis. BMC Health Services Research, 18, 1–18.

Battaglia, C., di Cagno, A., Fiorilli, G., Giombini, A., Borrione, P., Baralla, F., Marchetti, M., & Pigozzi, F. (2014). Participation in a 9-month selected physical

exercise programme enhances psychological well-being in a prison population. *Criminal Behaviour and Mental Health*, *25*(5), 343–354. https://doi.org/10.1002/cbm.1922

Bech, P., Rasmussen, N.-A., Olsen, L. R., Noerholm, V., & Abildgaard, W. (2001). The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. *Journal of Affective Disorders*, *66*(2–3), 159–164.

Bélanger, M., Gallant, F., Doré, I., O'Loughlin, J. L., Sylvestre, M.-P., Abi Nader, P., Larouche, R., Gunnell, K., & Sabiston, C. M. (2019). Physical activity mediates the relationship between outdoor time and mental health. *Preventive Medicine Reports*, *16*, 101006. https://doi.org/https://doi.org/10.1016/j.pmedr.2019.101006

Bettis, A. H., Coiro, M. J., England, J., Murphy, L. K., Zelkowitz, R. L., Dejardins, L., Eskridge, R., Adery, L. H., Yarboi, J., Pardo, D., & Compas, B. E. (2017). Comparison of two approaches to prevention of mental health problems in college students: Enhancing coping and executive function skills. *Journal of American College Health*, *65*(5), 313–322. https://doi.org/10.1080/07448481.2017.1312411

Blanco, C., Okuda, M., Wright, C., Hasin, D. S., Grant, B. F., Liu, S.-M., & Olfson, M. (2008). Mental health of college students and their non-college-attending peers: results from the National Epidemiologic Study on Alcohol and Related Conditions. *Archives of General Psychiatry*, *65*(12), 1429–1437. https://doi.org/10.1001/archpsyc.65.12.1429

Blumenthal, J. A., Babyak, M. A., Doraiswamy, P. M., Watkins, L., Hoffman, B. M., Barbour, K. A., Herman, S., Craighead, W. E., Brosse, A. L., Waugh, R., Hinderliter, A., & Sherwood, A. (2007). Exercise and pharmacotherapy in the

treatment of major depressive disorder. *Psychosomatic Medicine*, *69*(7), 587–596. https://doi.org/10.1097/PSY.0b013e318148c19a

Bovaird, T. (2007). Beyond Engagement and Participation: User and Community Coproduction of Public Services. *Public Administration Review*, *67*(5), 846–860. https://doi.org/10.1111/j.1540-6210.2007.00773.x

Bovend'Eerdt, T. J. H., Botell, R. E., & Wade, D. T. (2009). Writing SMART rehabilitation goals and achieving goal attainment scaling: a practical guide. *Clinical Rehabilitation*, *23*(4), 352–361. https://doi.org/10.1177/0269215508101741

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, *10*(1), 1–10.

Boyd, H., McKernon, S., Mullin, B., & Old, A. (2012). Improving healthcare through the use of co-design. *NZ Med J*, *125*(1357), 76–87.

Brown, W., Bauman, A., Bull, F., & N., B. (2012). *Development of Evidence-based Physical Activity Recommendations for Adults (18-64 years)*.

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Nock, M. K., & Kessler, R. C. (2018). Mental health problems in college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders*, *225*, 97–103. https://doi.org/10.1016/j.jad.2017.07.044

Budden, T., Dimmock, J. A., Smith, B., Beauchamp, M., Rosenberg, M., & Jackson, B. (2020). Overweight and obese men's experiences in a sport-based weight loss intervention for men. *Psychology of Sport and Exercise*, *50*, 101750. https://doi.org/10.1016/j.psychsport.2020.101750

Carpiniello, B., Primavera, D., Pilu, A., Vaccargiu, N., & Pinna, F. (2013). Physical activity and mental disorders: A case–control study on attitudes, preferences and

perceived barriers in Italy. *Journal of Mental Health*, *22*(6), 492–500. https://doi.org/10.3109/09638237.2013.815330

Carr, J. J., Lalara, J., Lalara, G., Lalara, G., Daniels, B., Clough, A. R., Lowell, A., & Barker, R. N. (2021). Staying Strong Toolbox: Co-design of a physical activity and lifestyle program for Aboriginal families with Machado-Joseph disease in the Top End of Australia. *PLOS ONE*, *16*(2), e0244311-. https://doi.org/10.1371/journal.pone.0244311

Collins, S., & Long, A. (2003). Working with the psychological effects of trauma: consequences for mental health-care workers - a literature review. *Journal of Psychiatric and Mental Health Nursing*, *10*(4), 417–424. https://doi.org/10.1046/j.1365-2850.2003.00620.x

Crust, L. (2004). Carry-Over Effects of Music in an Isometric Muscular Endurance Task. *Perceptual and Motor Skills*, *98*(3), 985–991. https://doi.org/10.2466/pms.98.3.985-991

Cunningham, C. E., Zipursky, R. B., Christensen, B. K., Bieling, P. J., Madsen, V., Rimas, H., Mielko, S., Wilson, F., Furimsky, I., Jeffs, L., & Munn, C. (2017). Modeling the mental health service utilization decisions of university undergraduates: A discrete choice conjoint experiment. *Journal of American College Health*, *65*(6), 389–399. https://doi.org/10.1080/07448481.2017.1322090

Curran, G. M., Bauer, M., Mittman, B., Pyne, J. M., & Stetler, C. (2012). Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. *Medical Care*, *50*(3), 217.

Deci, E. L., & Ryan, R. M. (2012). *Self-determination theory.*

deJonge, M. L., Jain, S., Faulkner, G. E., & Sabiston, C. M. (2021). On campus physical activity programming for post-secondary student mental health: Examining effectiveness and acceptability. *Mental Health and Physical Activity*, *20*, 100391. https://doi.org/10.1016/j.mhpa.2021.100391

deJonge, M. L., Omran, J., Faulkner, G. E., & Sabiston, C. M. (2020). University students' and clinicians' beliefs and attitudes towards physical activity for mental health. *Mental Health and Physical Activity*, *18*, 100316.

Department for Education. (2020). *Higher Education Statistics: Student Data*. https://www.dese.gov.au/higher-education-statistics/student-data

Dimmock, J., Jackson, B., Podlog, L., & Magaraggia, C. (2013). The effect of variety expectations on interest, enjoyment, and locus of causality in exercise. *Motivation and Emotion*, *37*(1), 146–153.

Dunbar, M. S., Sontag-Padilla, L., Ramchand, R., Seelam, R., & Stein, B. D. (2017). Mental Health Service Utilization Among Lesbian, Gay, Bisexual, and Questioning or Queer College Students. *Journal of Adolescent Health*, *61*(3), 294–301. https://doi.org/10.1016/j.jadohealth.2017.03.008

Eccles, M. P., Armstrong, D., Baker, R., Cleary, K., Davies, H., Davies, S., Glasziou, P., Ilott, I., Kinmonth, A.-L., Leng, G., Logan, S., Marteau, T., Michie, S., Rogers, H., Rycroft-Malone, J., & Sibbald, B. (2009). An implementation research agenda. *Implementation Science : IS*, *4*, 18. https://doi.org/10.1186/1748-5908-4-18

Eisenberg, D., Lipson, S. K., Ceglarek, P., Kern, A., & Phillips, M. V. (2018). College Student Mental Health. In *Promoting Behavioral Health and Reducing Risk Among College Students* (pp. 75–86). Routledge. https://doi.org/10.4324/9781315175799-5

Ekkekakis, P. (2013). *Routledge Handbook of Physical Activity and Mental Health*. Taylor & Francis Group. http://ebookcentral.proquest.com/lib/uwa/detail.action?docID=1356328

Eldridge, S. M., Chan, C. L., Campbell, M. M. J., Bond, C. M., Hopewell, S., Thabane, L., Lancaster, G. A., O'Cathain, A., Altman, D., Bretz, F., Campbell, M. M. J., Cobo, E., Craig, P., Davidson, P., Groves, T., Gumedze, F., Hewison, J., Hirst, A., Hoddinott, P., … on behalf of the, P. consensus group. (2016). CONSORT 2010 statement: Extension to randomised pilot and feasibility trials. *Pilot and Feasibility Studies*, *2*(1), 1–32. https://doi.org/10.1186/s40814-016-0105-8

Eliakim, M., Meckel, Y., Nemet, D., & Eliakim, A. (2007). The effect of music during warm-up on consecutive anaerobic performance in elite adolescent volleyball players. *International Journal of Sports Medicine*, *28*(04), 321–325.

Eurostat. (2018). *Share of those aged between 15 to 64 with tertiary educational attainment in selected European countries in 2020*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Tertiary_education_statistics

Eyles, H., Jull, A., Dobson, R., Firestone, R., Whittaker, R., Te Morenga, L., Goodwin, D., & Mhurchu, C. N. (2016). Co-design of mHealth Delivered Interventions: A Systematic Review to Assess Key Methods and Processes. *Current Nutrition Reports*, *5*(3), 160–167. https://doi.org/10.1007/s13668-016-0165-7

Fanning, J., Mullen, S. P., & McAuley, E. (2012). Increasing physical activity with mobile devices: a meta-analysis. Journal of Medical Internet Research, 14(6), e161–e161. https://doi.org/10.2196/jmir.2171

Firth, J., Cotter, J., Elliott, R., French, P., & Yung, A. R. (2015). A systematic review and meta-analysis of exercise interventions in schizophrenia patients. *Psychological Medicine*, 45(7), 1343–1361.

Firth, J., Siddiqi, N., Koyanagi, A., Siskind, D., Rosenbaum, S., Galletly, C., Allan, S., Caneo, C., Carney, R., Carvalho, A. F., Chatterton, M. Lou, Correll, C. U., Curtis, J., Gaughran, F., Heald, A., Hoare, E., Jackson, S. E., Kisely, S., Lovell, K., … Stubbs, B. (2019). The Lancet Psychiatry Commission: a blueprint for protecting physical health in people with mental illness. *The Lancet. Psychiatry*, *6*(8), 675–712. https://doi.org/10.1016/S2215-0366(19)30132-4

Fitzgerald, M., & Ratcliffe, G. (2020). Serious Games, Gamification, and Serious Mental Illness: A Scoping Review. *Psychiatric Services*, *71*(2), 170–183. https://doi.org/10.1176/appi.ps.201800567

Frederiksen, K. P., Stavestrand, S. H., Venemyr, S. K., Sirevåg, K., & Hovland, A. (2021). Physical exercise as an add-on treatment to cognitive behavioural therapy for anxiety: a systematic review. *Behavioural and Cognitive Psychotherapy*, *49*(5), 626–640. https://doi.org/10.1017/S1352465821000126

Furzer, B., Rebar, A., Dimmock, J. A., More, A., Thornton, A. L., Wright, K., Colthart, A., & Jackson, B. (2021). Exercise is medicine… when you enjoy it: Exercise enjoyment, relapse prevention efficacy, and health outcomes for youth within a drug and alcohol treatment service. *Psychology of Sport and Exercise*, *52*, 101800. https://doi.org/10.1016/j.psychsport.2020.101800

Girdler, S. J., Confino, J. E., & Woesner, M. E. (2019). Exercise as a Treatment for Schizophrenia: A Review. *Psychopharmacology Bulletin*, *49*(1), 56–69.

Glasgow, R. E., Harden, S. M., Gaglio, B., Rabin, B., Smith, M. L., Porter, G. C., Ory, M. G., & Estabrooks, P. A. (2019). RE-AIM Planning and Evaluation Framework: Adapting to New Science and Practice With a 20-Year Review. *Frontiers in Public Health*, *7*, 64. https://doi.org/10.3389/fpubh.2019.00064

Glazzard, J., Rose, A., & Ogilvie, P. (2021). The impact of peer mentoring on students' physical activity and mental health. *Journal of Public Mental Health*, *20*(2), 122–131. https://doi.org/10.1108/jpmh-10-2018-0073

Goldman-Mellor, S. J., Caspi, A., Harrington, H., Hogan, S., Nada-Raja, S., Poulton, R., & Moffitt, T. E. (2014). Suicide attempt in young people: a signal for long-term health care and social needs. *JAMA Psychiatry*, *71*(2), 119–127. https://doi.org/10.1001/jamapsychiatry.2013.2803

Gollwitzer, P. M., Fujita, K., & Oettingen, G. (2004). *Planning and the implementation of goals*.

Grant, S., Mayo-Wilson, E., Montgomery, P., Macdonald, G., Michie, S., Hopewell, S., & Moher, D. (2018). CONSORT-SPI 2018 Explanation and Elaboration: guidance for reporting social and psychological intervention trials. *Trials*, *19*(1), 406. https://doi.org/10.1186/s13063-018-2735-z

Grasdalsmoen, M., Eriksen, H. R., Lønning, K. J., & Sivertsen, B. (2020). Physical exercise, mental health problems, and suicide attempts in university students. *BMC Psychiatry*, 20(1), 1–11. https://doi.org/10.1186/S12888-020-02583-3/TABLES/3

Hadlaczky, G., Hökby, S., Mkrtchian, A., Carli, V., & Wasserman, D. (2014). Mental Health First Aid is an effective public health intervention for improving knowledge, attitudes, and behaviour: A meta-analysis. *International Review of Psychiatry*, *26*(4), 467–475.

Hegberg, N. J., Hayes, J. P., & Hayes, S. M. (2019). Exercise Intervention in PTSD: A Narrative Review and Rationale for Implementation. *Frontiers in Psychiatry*, *10*, 133. https://doi.org/10.3389/fpsyt.2019.00133

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a

large non-clinical sample. *British Journal of Clinical Psychology*, *44*(2), 227–239. https://doi.org/10.1348/014466505x29657

Hetrick, S. E., Robinson, J., Burge, E., Blandon, R., Mobilio, B., Rice, S. M., Simmons, M. B., Alvarez-Jimenez, M., Goodrich, S., & Davey, C. G. (2018). Youth Codesign of a Mobile Phone App to Facilitate Self-Monitoring and Management of Mood Symptoms in Young People With Major Depression, Suicidal Ideation, and Self-Harm. *JMIR Mental Health*, *5*(1), e9–e9. https://doi.org/10.2196/mental.9041

Hussar, B., Zhang, J., Hein, S., Wang, K., Roberts, A., Cui, J., Smith, M., Bullock Mann, F., Barmer, A., & Dilig, R. (2020). *The condition of education 2020*.

Hutchinson, J. C., Jones, L., Vitti, S. N., Moore, A., Dalton, P. C., & O'Neil, B. J. (2018). The influence of self-selected music on affect-regulated exercise intensity and remembered pleasure during treadmill running. *Sport, Exercise, and Performance Psychology*, *7*(1), 80–92. https://doi.org/10.1037/spy0000115

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R. S., Abebe, Z., Abera, S. F., Abil, O. Z., Abraha, H. N., Abu-Raddad, L. J., Abu-Rmeileh, N. M. E. E., Accrombessi, M. M. K., … Murray, C. J. L. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 Diseases and Injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, *392*(10159), 1789–1858. https://doi.org/10.1016/S0140-6736(18)32279-7

Jaworska, N., De Somma, E., Fonseka, B., Heck, E., & MacQueen, G. M. (2016). Mental health services for students at postsecondary institutions: A national survey. *The Canadian Journal of Psychiatry*, *61*(12), 766–775.

Jayakody, K., Gunadasa, S., & Hosker, C. (2013). Exercise for anxiety disorders: systematic review. *British Journal of Sports Medicine*, *48*(3), 187–196. https://doi.org/10.1136/bjsports-2012-091287

Jeftic, I., Furzer, B. J., Dimmock, J. A., Wright, K., Boyd, C., Budden, T., Rosenberg, M., Kramer, B., Buist, B., Fitzpatrick, I., Sabiston, C., deJonge, M., & Jackson, B. (2023). Structured exercise programs for higher education students experiencing mental health challenges: background, significance, and implementation. *Frontiers in Public Health*, *11*. https://www.frontiersin.org/articles/10.3389/fpubh.2023.1104918

Jones, M., Bright, P., Hansen, L., Ihnatsenka, O., & Carek, P. J. (2019). Promoting Physical Activity in a Primary Care Practice: Overcoming the Barriers. *American Journal of Lifestyle Medicine*, *15*(2), 158–164. https://doi.org/10.1177/1559827619867693

Karageorghis, C. I., & Priest, D.-L. (2012). Music in the exercise domain: a review and synthesis (Part I). *International Review of Sport and Exercise Psychology*, *5*(1), 44–66. https://doi.org/10.1080/1750984X.2011.631026

Keeler, L. A., Skidmore, B., Leenstra, T., MacDonald, J. R., & Stewart, D. (2019). Treating University Students' Depression using Physical Activity with Peers: Two Field-Based Quasi-Experiments Grounded in the Self-Determination Theory. *Journal of College Student Psychotherapy*, *35*(3), 205–223. https://doi.org/10.1080/87568225.2019.1660293

Keen, A. W. (2005). Using music as a therapy tool to motivate troubled adolescents. *Social Work in Health Care*, *39*(3–4), 361–373.

Kerr, D. C. R., & Capaldi, D. M. (2011). Young men's intimate partner violence and relationship functioning: long-term outcomes associated with suicide attempt

and aggression in adolescence. *Psychological Medicine*, *41*(4), 759–769. https://doi.org/10.1017/S0033291710001182

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606–613.

Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A. (2016). Exercise as a treatment for depression: A meta-analysis. *Journal of Affective Disorders*, *202*, 67–86. https://doi.org/10.1016/j.jad.2016.03.063

Lahart, I., Darcy, P., Gidlow, C., & Calogiuri, G. (2019). The Effects of Green Exercise on Physical and Mental Wellbeing: A Systematic Review. *International Journal of Environmental Research and Public Health*, *16*(8), 1352. https://doi.org/10.3390/ijerph16081352

Landes, S. J., McBain, S. A., & Curran, G. M. (2020). Reprint of: An introduction to effectiveness-implementation hybrid designs. *Psychiatry Research*, *283*, 112630. https://doi.org/10.1016/j.psychres.2019.112630

Larkin, M., Boden, Z. V. R., & Newton, E. (2015). On the brink of genuinely collaborative care: experience-based co-design in mental health. *Qualitative Health Research*, *25*(11), 1463–1476.

Lederman, O., Grainger, K., Stanton, R., Douglas, A., Gould, K., Perram, A., Baldeo, R., Fokas, T., Nauman, F., & Semaan, A. (2016). Consensus statement on the role of Accredited Exercise Physiologists within the treatment of mental disorders: a guide for mental health professionals. *Australasian Psychiatry*, *24*(4), 347–351.

Lederman, O., Ward, P. B., Rosenbaum, S., Maloney, C., Watkins, A., Teasdale, S., Morell, R., & Curtis, J. (2020). Stepping up early treatment for help-seeking

youth with at-risk mental states: Feasibility and acceptability of a real-world exercise program. *Early Intervention in Psychiatry*, *14*(4), 450–462.

Leenstra, T., Keeler, L., Arthur-Cameselle, J., & Russell, K. (2019). The peer mentor experience in a physical activity intervention for mental health. *Mentoring & Tutoring: Partnership in Learning*, *27*(1), 68–87. https://doi.org/10.1080/13611267.2019.1583410

Lim, H., Heckman, S. J., Letkiewicz, J. C., & Montalto, C. P. (2014). Financial Stress, Self-Efficacy, and Financial Help-Seeking Behavior of College Students. *Financial Counseling and Planning*, *25*(2), 148.

Mandolesi, L., Polverino, A., Montuori, S., Foti, F., Ferraioli, G., Sorrentino, P., & Sorrentino, G. (2018). Effects of Physical Exercise on Cognitive Functioning and Wellbeing: Biological and Psychological Benefits. *Frontiers in Psychology*, *9*(509). https://doi.org/10.3389/fpsyg.2018.00509

Martin Ginis, K. A., Nigg, C. R., & Smith, A. L. (2013). Peer-delivered physical activity interventions: an overlooked opportunity for physical activity promotion. *Translational Behavioral Medicine*, *3*(4), 434–443. https://doi.org/10.1007/s13142-013-0215-2

Matthews, E. W., Cowman, M., Brannigan, M., Rosenbaum, S., Sloan, D., Ward, P. B., & Denieffe, S. (2022). Implementing experience-based co-design to develop a physical activity programme in recovery-focused outpatient mental health services. *International Journal of Therapy and Rehabilitation*, *29*(4), 1–16. https://doi.org/10.12968/ijtr.2021.0101

McCance-Katz, E. F. (2019). *The national survey on drug use and health: 2017*. Substance Abuse and Mental Health Services Administration.

McCown, W., Keiser, R., Mulhearn, S., & Williamson, D. (1997). The role of personality and gender in preference for exaggerated bass in music. *Personality*

*and Individual Differences*, *23*(4), 543–547. https://doi.org/10.1016/s0191-8869(97)00085-8

McEwan, D., Harden, S. M., Zumbo, B. D., Sylvester, B. D., Kaulius, M., Ruissen, G. R., Dowd, A. J., & Beauchamp, M. R. (2015). The effectiveness of multi-component goal setting interventions for changing physical activity behaviour: a systematic review and meta-analysis. *Health Psychology Review*, *10*(1), 67–88. https://doi.org/10.1080/17437199.2015.1104258

McMahen, C., Wright, K., Stanton, R., Lederman, O., Rosenbaum, S., McKeon, G., & Furzer, B. (2022). Outcome assessments used in studies examining the effect of prescribed exercise interventions for people living with severe mental illness, a scoping review. *Mental Health and Physical Activity*, *22*, 100438. https://doi.org/https://doi.org/10.1016/j.mhpa.2021.100438

McManus, S., Bebbington, P., Jenkins, R., & Brugha, T. (2016). *Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014*.

Mead, S., Hilton, D., & Curtis, L. (2001). Peer support: A theoretical perspective. *Psychiatric Rehabilitation Journal*, *25*(2), 134–141. https://doi.org/10.1037/h0095032

Memon, A. R., Gupta, C. C., Crowther, M. E., Ferguson, S. A., Tuckwell, G. A., & Vincent, G. E. (2021). Sleep and physical activity in university students: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *58*, 101482. https://doi.org/10.1016/j.smrv.2021.101482

Mental Health Commission of Canada. (2013). *Making the Case for Investing in Mental Health in Canada*. https://mentalhealthcommission.ca/resource/making-the-case-for-investing-in-mental-health-in-canada/

MEXT. (2018). *Overview of the Ministry of Education, Culture, Sports, Science and Technology*.

Michie, S., Wood, C. E., Johnston, M., Abraham, C., Francis, J., & Hardeman, W. (2015). Behaviour change techniques: the development and evaluation of a taxonomic method for reporting and describing behaviour change interventions (a suite of five studies involving consensus methods, randomised controlled trials and analysis of qualitative da. *Health Technology Assessment*, *19*(99). http://openaccess.city.ac.uk/id/eprint/13435/

Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. (2017). Exercise and mental health. *Maturitas*, *106*(August), 48–56. https://doi.org/10.1016/j.maturitas.2017.09.003

Milne, L., Keating, S., & Gabb, R. (2007). Student peer mentoring at Victoria University. *Victoria University*.

Mittal, V. A., Vargas, T., Osborne, K. J., Dean, D., Gupta, T., Ristanovic, I., Hooker, C. I., & Shankman, S. A. (2017). Exercise Treatments for Psychosis: A Review. *Current Treatment Options in Psychiatry*, *4*(2), 152–166. https://doi.org/10.1007/s40501-017-0112-2

Moore, G. F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., Moore, L., O'Cathain, A., Tinati, T., Wight, D., & Baird, J. (2015). Process evaluation of complex interventions: Medical Research Council guidance. *BMJ (Clinical Research Ed.)*, *350*, h1258–h1258. https://doi.org/10.1136/bmj.h1258

More, A., Jackson, B., Dimmock, J. A., Thornton, A. L., Colthart, A., & Furzer, B. J. (2017). Exercise in the Treatment of Youth Substance Use Disorders: Review and Recommendations. *Frontiers in Psychology*, *8*, 1839. https://doi.org/10.3389/fpsyg.2017.01839

More, A., Jackson, B., Dimmock, J. A., Thornton, A. L., Colthart, A., & Furzer, B. J. (2018). "It's like a counselling session … but you don't need to say anything:" Exercise program outcomes for youth within a drug and alcohol treatment

service. *Psychology of Sport and Exercise*, *39*, 1–9. https://doi.org/https://doi.org/10.1016/j.psychsport.2018.07.002

Morgan, A., Parker, A. G., Alvarez-Jimenez, M., & Jorm, A. (2013). Exercise and Mental Health: An Exercise and Sports Science Australia Commissioned Review. *Journal of Exercise Physiology Online*, *16*, 64–73.

Muir, I. L., Munroe-Chandler, K. J., Loughead, T. M., Sutherland, C. A., & Hawksley, K. G. (2020). The UWorkItOut UWin Program: Improving University Students' Psychological Distress through Physical Activity. *International Journal of Kinesiology and Sports Science*, *8*(3), 36. https://doi.org/10.7575/aiac.ijkss.v.8n.3p.36

Mulvale, G., Moll, S., Miatello, A., Murray-Leung, L., Rogerson, K., & Sassi, R. B. (2019). Co-designing Services for Youth With Mental Health Issues: Novel Elicitation Approaches. *International Journal of Qualitative Methods*, *18*, 160940691881624. https://doi.org/10.1177/1609406918816244

Murri, M. B., Ekkekakis, P., Magagnoli, M., Zampogna, D., Cattedra, S., Capobianco, L., Serafini, G., Calcagno, P., Zanetidou, S., & Amore, M. (2019). Physical exercise in major depression: Reducing the mortality gap while improving clinical outcomes. *Frontiers in Psychiatry*, *9*, 762. https://doi.org/10.3389/fpsyt.2018.00762

Nguyen-Michel, S. T., Unger, J. B., Hamilton, J., & Spruijt-Metz, D. (2006). Associations between physical activity and perceived stress/hassles in college students. *Stress and Health*, *22*(3), 179–188. https://doi.org/10.1002/smi.1094

Nobles, J., Thomas, C., Banks Gross, Z., Hamilton, M., Trinder-Widdess, Z., Speed, C., Gibson, A., Davies, R., Farr, M., Jago, R., Foster, C., & Redwood, S. (2020). "Let's Talk about Physical Activity": Understanding the Preferences of Under-Served Communities when Messaging Physical Activity Guidelines to the

Public. *International Journal of Environmental Research and Public Health*, *17*(8), 2782. https://doi.org/10.3390/ijerph17082782

Ntoumanis, N., Carr, R. M., Hall, L. H., Gucciardi, D. F., Thøgersen-Ntoumani, C., Kwasnicka, D., Prestwich, A., & Quested, E. (2018). Dyadic interventions to promote physical activity and reduce sedentary behaviour: systematic review and meta-analysis. *Health Psychology Review*, *13*(1), 91–109. https://doi.org/10.1080/17437199.2018.1532312

O'connor, P. J., Herring, M. P., & Caravalho, A. (2010). Mental Health Benefits of Strength Training in Adults. *American Journal of Lifestyle Medicine*, *4*(5), 377–396. https://doi.org/10.1177/1559827610368771

Oei, T. P. S., & Notowidjojo, F. (1990). Depression and Loneliness in Overseas Students. *International Journal of Social Psychiatry*, *36*(2), 121–130. https://doi.org/10.1177/002076409003600205

O'Reilly, M., Wiltshire, G., Kiyimba, N., & Harrington, D. (2023). "Is Everybody Comfortable?"#xd; Thinking Through Co-design Approaches to Better Support Girls' Physical Activity in Schools. *Qualitative Research in Sport, Exercise and Health*, *15*(2), 248–263. https://doi.org/10.1080/2159676X.2022.2083663

Orygen The National Centre of Excellence in Youth Mental Health. (2017). Under the radar. The mental health of Australian university students. In *Orygen, The National Centre of Excellence in Youth Mental Health*.

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, *18*(2).

Powell, B. J., Waltz, T. J., Chinman, M. J., Damschroder, L. J., Smith, J. L., Matthieu, M. M., Proctor, E. K., & Kirchner, J. E. (2015). A refined compilation of implementation strategies: results from the Expert Recommendations for

Implementing Change (ERIC) project. *Implementation Science : IS*, *10*, 21. https://doi.org/10.1186/s13012-015-0209-1

Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, *15*(5), 319–337. https://doi.org/10.1080/09603120500155963

Pritchard, M. E., & Wilson, G. S. (Gregory S. (2003). Using Emotional and Social Factors to Predict Student Success. *Journal of College Student Development*, *44*(1), 18–28. https://doi.org/10.1353/csd.2003.0008

Ravindran, A. v, Balneaves, L. G., Faulkner, G., Ortiz, A., McIntosh, D., Morehouse, R. L., Ravindran, L., Yatham, L. N., Kennedy, S. H., & Lam, R. W. (2016). Canadian Network for Mood and Anxiety Treatments (CANMAT) 2016 clinical guidelines for the management of adults with major depressive disorder: section 5. Complementary and alternative medicine treatments. *The Canadian Journal of Psychiatry*, *61*(9), 576–587.

Reddan, G. (2016). The Role of Work-Integrated Learning in Developing Students' Perceived Work Self-Efficacy. *Asia-Pacific Journal of Cooperative Education*, *17*(4), 423–436.

Rethorst, C. D., & Trivedi, M. H. (2013). Evidence-Based Recommendations for the Prescription of Exercise for Major Depressive Disorder. *Journal of Psychiatric Practice*, *19*(3), 204–212. https://doi.org/10.1097/01.pra.0000430504.16952.3e

Roth, G. (2019). Beyond the Quantity of Motivation: Quality of Motivation in Self-Determination Theory. In *Social Psychology in Action* (pp. 39–49). Springer International Publishing. https://doi.org/10.1007/978-3-030-13788-5_3

Rush, A. J., Gullion, C. M., Basco, M. R., Jarrett, R. B., & Trivedi, M. H. (1996). The inventory of depressive symptomatology (IDS): psychometric properties. *Psychological Medicine*, *26*(3), 477–486.

Salzer, M. S. (2012). A Comparative Study of Campus Experiences of College Students With Mental Illnesses Versus a General College Sample. *Journal of American College Health*, *60*(1), 1–7. https://doi.org/10.1080/07448481.2011.552537

Sancassiani, F., Machado, S., & Preti, A. (2018). Physical Activity, Exercise and Sport Programs as Effective Therapeutic Tools in Psychosocial Rehabilitation. *Clinical Practice and Epidemiology in Mental Health : CP & EMH*, *14*, 6–10. https://doi.org/10.2174/1745017901814010006

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. *BMJ*, *340*(7748), c332. https://doi.org/10.1136/bmj.c332

Scott, K. M., Lim, C., Al-Hamzawi, A., Alonso, J., Bruffaerts, R., Caldas-de-Almeida, J. M., Florescu, S., de Girolamo, G., Hu, C., de Jonge, P., Kawakami, N., Medina-Mora, M. E., Moskalewicz, J., Navarro-Mateu, F., O'Neill, S., Piazza, M., Posada-Villa, J., Torres, Y., & Kessler, R. C. (2016). Association of Mental Disorders With Subsequent Chronic Physical Conditions: World Mental Health Surveys From 17 Countries. *JAMA Psychiatry*, *73*(2), 150–158. https://doi.org/10.1001/jamapsychiatry.2015.2688

Shannonhouse, L., Lin, Y.-W. D., Shaw, K., Wanna, R., & Porter, M. (2017). Suicide intervention training for college staff: Program evaluation and intervention skill measurement. *Journal of American College Health*, *65*(7), 450–456. https://doi.org/10.1080/07448481.2017.1341893

Shaykevich, A., Grove, J. R., Jackson, B., Landers, G. J., & Dimmock, J. (2015). Auditory Feedback Improves Heart Rate Moderation during Moderate-Intensity Exercise. *Medicine & Science in Sports & Exercise*, *47*(5), 1046–1051. https://doi.org/10.1249/mss.0000000000000490

Smith, B., & Wightman, L. (2019). Promoting physical activity to disabled people: messengers, messages, guidelines and communication formats. *Disability and Rehabilitation*, *43*(24), 3427–3431. https://doi.org/10.1080/09638288.2019.1679896

Smith, J. D., Berkel, C., Rudo-Stern, J., Montaño, Z., St George, S. M., Prado, G., Mauricio, A. M., Chiapa, A., Bruening, M. M., & Dishion, T. J. (2018). The Family Check-Up 4 Health (FCU4Health): Applying Implementation Science Frameworks to the Process of Adapting an Evidence-Based Parenting Program for Prevention of Pediatric Obesity and Excess Weight Gain in Primary Care. *Frontiers in Public Health*, *6*, 293. https://doi.org/10.3389/fpubh.2018.00293

Smith, P., & Merwin, R. (2021). The Role of Exercise in Management of Mental Health Disorders: An Integrative Review. *Annual Review of Medicine*, *72*(1), 45–62. https://doi.org/10.1146/annurev-med-060619-022943

Sniehotta, F. F., Schwarzer, R., Scholz, U., & Schüz, B. (2005). Action planning and coping planning for long-term lifestyle change: theory and assessment. *European Journal of Social Psychology*, *35*(4), 565–576. https://doi.org/10.1002/ejsp.258

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097.

Stanton, R., Rosenbaum, S., Kalucy, M., Reaburn, P., & Happell, B. (2015). A call to action: exercise as treatment for patients with mental illness. *Australian Journal of Primary Health*, *21*(2), 120. https://doi.org/10.1071/py14054

Steen, M., Manschot, M., & Koning, N. (2011). Benefits of Co-design in Service Design Projects. *International Journal of Design*, *5*.

Stone, A. A., & Shiffman, S. (1994). Ecological Momentary Assessment (Ema) in Behavioral Medicine. *Annals of Behavioral Medicine*, *16*(3), 199–202. https://doi.org/10.1093/abm/16.3.199

Stonerock, G. L., Hoffman, B. M., Smith, P. J., & Blumenthal, J. A. (2015). Exercise as Treatment for Anxiety: Systematic Review and Analysis. *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, *49*(4), 542–556. https://doi.org/10.1007/s12160-014-9685-9

Ströhle, A. (2008). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission*, *116*(6), 777. https://doi.org/10.1007/s00702-008-0092-x

Stubbs, B., Vancampfort, D., Rosenbaum, S., Firth, J., Cosco, T., Veronese, N., Salum, G. A., & Schuch, F. B. (2017). An examination of the anxiolytic effects of exercise for people with anxiety and stress-related disorders: A meta-analysis. *Psychiatry Research*, *249*(January), 102–108. https://doi.org/10.1016/j.psychres.2016.12.020

Sunesson, E., Haglund, E., Bremander, A., Jarbin, H., & Larsson, I. (2021). Adolescents' Experiences of Facilitators for and Barriers to Maintaining Exercise 12 Months after a Group-Based Intervention for Depression. *International Journal of Environmental Research and Public Health*, *18*(10), 5427. https://doi.org/10.3390/ijerph18105427

Swann, C., Rosenbaum, S., Lawrence, A., Vella, S. A., McEwan, D., & Ekkekakis, P. (2020). Updating goal-setting theory in physical activity promotion: a critical conceptual review. *Health Psychology Review*, *15*(1), 34–50. https://doi.org/10.1080/17437199.2019.1706616

Sylvester, B. D., Jackson, B., & Beauchamp, M. R. (2018). Chapter Five - The Effects of Variety and Novelty on Physical Activity and Healthy Nutritional Behaviors.

In A. J. Elliot (Ed.), *Advances in Motivation Science* (Vol. 5, pp. 169–202). Elsevier. https://doi.org/https://doi.org/10.1016/bs.adms.2017.11.001

Thompson, D., Goebert, D., & Takeshita, J. (2010). A Program for Reducing Depressive Symptoms and Suicidal Ideation in Medical Students. *Academic Medicine*, *85*(10), 1635–1639. https://doi.org/10.1097/acm.0b013e3181f0b49c

Trivedi, M. H., Greer, T. L., Church, T. S., Carmody, T. J., Grannemann, B. D., Galper, D. I., Dunn, A. L., Earnest, C. P., Sunderajan, P., Henley, S. S., & Blair, S. N. (2011). Exercise as an Augmentation Treatment for Nonremitted Major Depressive Disorder. *The Journal of Clinical Psychiatry*, *72*(05), 677–684. https://doi.org/10.4088/jcp.10m06743

US Department of Health and Human Services. (2018). *2018 Physical activity guidelines advisory committee scientific report*.

Wilson, P. M., Mack, D. E., & Grattan, K. P. (2008). Understanding motivation for exercise: A self-determination theory perspective. *Canadian Psychology/Psychologie Canadienne*, *49*(3), 250–256. https://doi.org/10.1037/a0012762

Wing, R. R., Phelan, S., & Tate, D. (2002). The role of adherence in mediating the relationship between depression and health outcomes. *Journal of Psychosomatic Research*, *53*(4), 877–881. https://doi.org/10.1016/s0022-3999(02)00315-x

Yazici, A. B., Gul, M., Yazici, E., & Gul, G. K. (2016). Tennis Enhances Well-being in University Students. *Mental Illness*, *8*(1), 6510. https://doi.org/10.4081/mi.2016.6510

Zhang, Z., Wang, T., Kuang, J., Herold, F., Ludyga, S., Li, J., Hall, D. L., Taylor, A., Healy, S., Yeung, A. S., Kramer, A. F., & Zou, L. (2022). The roles of exercise tolerance and resilience in the effect of physical activity on emotional states among college students. *International Journal of Clinical and Health*

*Psychology*, *22*(3), 100312. https://doi.org/https://doi.org/10.1016/j.ijchp.2022.100312

Zuckerman, O., & Gal-Oz, A. (2014). Deconstructing gamification: evaluating the effectiveness of continuous measurement, virtual rewards, and social comparison for promoting physical activity. *Personal and Ubiquitous Computing*, *18*(7), 1705–1719. https://doi.org/10.1007/s00779-014-0783-2

## 2.7 Supplementary Materials

**Supplementary Table 1**

*Reliability Analysis of Constructed Multiple Item Scales*

| Questionnaire | Items | Cronbach's alpha - pre (n of respondents) | Cronbach's alpha - post (n of respondents) |
|---|---|---|---|
| Response Efficacy | 3 | .843 (111) | .937 (61) |
| Exercise Self-Efficacy | 6 | .852 (112) | .864 (62) |
| Lifestyle Self-Efficacy | 2 | .625 (112) | .820 (62) |
| Barrier Self-efficacy | 5 | .878 (110) | .907 (61) |
| Attachment to university | 3 | .627 (111) | .826 (62) |

**Supplementary Table 2**

*Pearson Correlations Coefficients of All Pre-to-post Program Change Measures*

| Pre \ Post | Alpha (baseline, follow-up) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Quick Inventory of Depressive Symptomatology | N/A | - | -0.232 | -0.023 | -.439** | -0.203 | -.360** | -0.172 | -.413** | -0.079 | 0.201 | -.316* | -0.222 | -.320* | -0.076 | 0.215 | -0.099 | -0.027 | 0.290 | -0.310 | -0.141 | -0.199 | .387* | -0.147 |
| 2. Leisure-time PA | N/A | -0.118 | - | 0.180 | 0.152 | 0.090 | 0.229 | 0.111 | 0.107 | 0.117 | 0.212 | 0.232 | 0.181 | 0.180 | -0.170 | -0.092 | 0.039 | 0.084 | -.387* | 0.268 | 0.230 | 0.021 | -0.154 | 0.234 |
| 3. QoL Physical Health | N/A | 0.101 | .329* | - | -0.060 | 0.068 | .313* | 0.209 | .262* | -0.080 | -0.049 | 0.213 | 0.228 | 0.067 | 0.071 | -0.074 | -0.175 | -0.319 | -.406* | 0.108 | 0.152 | 0.172 | 0.077 | 0.277 |
| 4. QoL Mental Health | N/A | -.330* | .255* | -.325* | - | 0.110 | 0.092 | 0.103 | 0.101 | 0.133 | 0.175 | 0.244 | 0.018 | 0.238 | -0.082 | 0.123 | 0.183 | 0.094 | -0.084 | 0.254 | 0.078 | 0.041 | -0.323 | 0.257 |
| 5. Response-Efficacy | (.843, .937) | -0.227 | -0.017 | 0.014 | 0.161 | - | .278* | 0.149 | 0.163 | -0.063 | 0.227 | 0.076 | 0.024 | 0.059 | -0.027 | -0.074 | -0.013 | 0.164 | -0.144 | 0.136 | 0.073 | -0.200 | -0.041 | 0.220 |
| 6. Exercise Self-Efficacy | (.852, .864) | -0.075 | .315* | 0.045 | 0.152 | 0.178 | - | .346** | .266* | 0.232 | .331** | 0.210 | -0.019 | 0.049 | -0.109 | -0.102 | 0.066 | -0.003 | -0.238 | 0.248 | 0.056 | 0.238 | 0.028 | -0.184 |
| 7. Lifestyle Self-Efficacy | (.625, .820) | -0.024 | -0.030 | -0.142 | 0.149 | -0.044 | .289* | - | .265* | 0.153 | 0.215 | 0.152 | -0.077 | 0.026 | -0.170 | -0.166 | -0.037 | -0.062 | -0.221 | 0.124 | 0.003 | 0.304 | -0.036 | -0.365 |
| 8. Barrier Self-Efficacy | (.878, .907) | 0.020 | 0.045 | -0.238 | .257* | 0.011 | .403** | .391** | - | -0.083 | 0.207 | 0.208 | -0.066 | 0.039 | -0.108 | -0.216 | -0.119 | -0.171 | -.330* | 0.098 | 0.194 | 0.294 | -0.240 | -0.118 |
| 9. Identify with students in course | N/A | -0.173 | 0.161 | 0.218 | 0.144 | .266* | .445** | .488** | .373** | - | .606** | .427** | 0.051 | 0.123 | -0.118 | -0.119 | 0.019 | -0.030 | -0.112 | 0.101 | -0.062 | -0.012 | -0.085 | -0.328 |
| 10. Identify with students at UWA | N/A | -.288* | 0.229 | 0.043 | 0.212 | 0.221 | .466** | .477** | .356** | .310* | - | .531** | -0.013 | .263* | -0.063 | 0.059 | 0.082 | 0.082 | 0.085 | 0.042 | -0.190 | 0.157 | -0.222 | -0.071 |
| 11. Attachment to university | (.627, .826) | -.277* | 0.235 | 0.005 | 0.197 | 0.196 | .388** | .358** | .501** | 0.173 | .515** | - | 0.003 | .358** | -0.127 | -0.235 | -0.078 | -0.090 | -0.134 | 0.055 | -0.033 | 0.313 | -.407** | 0.367 |

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12. Sleep quantity | N/A | -0.213 | 0.112 | -0.015 | 0.145 | 0.107 | .263* | 0.151 | 0.199 | -0.044 | 0.163 | 0.115 | - | 0.251 | 0.052 | -0.142 | -0.291 | -.321* | -0.195 | -0.148 | 0.074 | 0.107 | -0.161 | -0.332 |
| 13. Sleep Quality | N/A | -.368** | 0.254 | 0.053 | .311* | 0.172 | .374** | 0.237 | .423** | 0.041 | .291* | .455** | 0.239 | - | - | -0.159 | -0.118 | 0.140 | 0.061 | -0.126 | 0.267 | 0.036 | -0.095 | -.354* | 0.031 |
| 14. Fatty food score | N/A | 0.060 | 0.140 | -0.005 | -0.117 | -0.050 | -0.056 | 0.022 | -0.220 | -0.082 | -0.072 | -0.093 | -0.078 | -.331* | - | -0.024 | 0.284 | 0.142 | -0.260 | .427* | 0.181 | 0.187 | 0.077 | .702* |
| 15. Sugary food score | N/A | -0.061 | 0.040 | -0.198 | 0.039 | 0.119 | 0.149 | 0.204 | -.309* | 0.077 | -0.005 | -0.155 | 0.093 | -0.083 | 0.036 | - | 0.007 | 0.014 | 0.026 | 0.032 | 0.258 | 0.020 | -0.110 | 0.414 |
| 16. Weight | N/A | 0.154 | 0.120 | -0.140 | -0.019 | 0.018 | -0.113 | -0.009 | 0.001 | 0.031 | -0.060 | 0.029 | -0.196 | -0.132 | 0.239 | -0.015 | - | .812** | 0.318 | .802** | .444** | -0.096 | .388* | 0.069 |
| 17. Body Mass Index | N/A | 0.163 | 0.123 | -0.166 | -0.021 | 0.020 | -0.089 | 0.024 | -0.036 | 0.117 | 0.088 | 0.066 | -0.242 | -0.174 | 0.097 | 0.041 | .851** | - | .571** | .508** | 0.162 | -0.178 | .417* | -0.256 |
| 18. Body Fat % | N/A | 0.086 | -0.131 | -0.294 | 0.034 | 0.219 | 0.083 | -0.020 | 0.064 | 0.007 | 0.087 | 0.006 | -0.039 | -0.132 | 0.040 | -0.148 | 0.309 | .621** | - | - | - | -0.038 | 0.211 | -.711** |
| 19. Lean Body Mass | N/A | 0.069 | 0.193 | 0.061 | 0.042 | 0.102 | -0.044 | 0.009 | 0.038 | 0.019 | 0.187 | 0.012 | 0.147 | 0.003 | 0.232 | 0.150 | .764** | .466** | -0.280 | - | .694** | 0.046 | 0.184 | 0.433 |
| 20. Max Grip Strength | N/A | -0.022 | 0.197 | 0.152 | 0.037 | 0.178 | 0.059 | 0.104 | 0.081 | 0.019 | -0.142 | 0.051 | 0.143 | 0.176 | 0.207 | -0.282 | .483** | 0.219 | -0.276 | .746** | - | 0.081 | 0.271 | 0.142 |
| 21. Resting Heart Rate | N/A | -0.080 | 0.001 | -0.069 | 0.093 | -0.032 | 0.060 | -0.122 | 0.087 | -0.257 | -0.011 | -0.020 | 0.014 | -0.077 | 0.121 | 0.137 | 0.071 | 0.041 | -0.181 | 0.122 | 0.023 | - | 0.120 | -0.149 |
| 22. Mean Arterial Pressure | N/A | .318* | -0.099 | -0.005 | -0.153 | -0.193 | -0.237 | -0.194 | -0.274 | 0.201 | -0.184 | -0.257 | 0.016 | -0.165 | 0.051 | 0.083 | .516** | .393* | -0.234 | .384* | 0.191 | -0.051 | - | -0.322 |
| 23. Aerobic Power Index | N/A | 0.221 | 0.060 | -0.144 | 0.049 | 0.393 | 0.039 | 0.290 | 0.088 | 0.349 | -0.045 | -0.001 | 0.132 | -0.020 | 0.272 | -0.303 | 0.009 | 0.132 | -0.314 | 0.263 | 0.232 | -0.116 | -0.433 | - |

## Chapter 3:

***Exercise enjoyment, depressive symptoms, and health outcomes for university students in a mental health service: An intensive repeated measures study***

This chapter is based on the paper submitted to the *Journal of Science and Medicine in Sport.*

Jeftic, I., Rebar, A., Furzer, B. J., Dimmock, J. A., Budden, T., Simpson, A., Wright, K., Boyd, C., Rosenberg, M., Sabiston, C. M., deJonge, M., & Jackson, B. (*in review*). *Exercise enjoyment, depressive symptoms, and health outcomes for university students in a mental health service: An intensive repeated measures study.* Manuscript submitted for publication.

## 3.0 Chapter Foreword

In the following chapter, we present the results of an intensive repeated measures study. The study builds on the previous chapter by providing more detailed insight into change over time in participants' depressive symptomatology during the program, and exploring associations at both between- and within-person levels between participants' exercise enjoyment, exercise intensity, session duration, and depressive symptomatology, perceived physical health, and self-esteem.

## 3.1 Abstract

Structured exercise programs for university students experiencing mental distress are underutilised, with limited research evidence regarding the links between exercise experiences and health indicators in these contexts. We sought to examine the between- and within-person associations between exercise enjoyment, depressive symptomatology, self-esteem, and perceptions of physical health for participants in a 12-week, on-campus, referral-based exercise program. Using an intensive repeated measures design, fortnightly over a 12-week period, participants self-reported perceptions of exercise enjoyment, depressive symptomatology, self-esteem, and physical health. Of a total 93 participants, of which 83% ($n$ = 77) completed at least 2 assessments, 60% ($n$ = 55) completed 4 or more assessments, and 40% ($n$ = 37) completed 5 or 6 assessments. Multilevel modelling was used to test associations between variables at both between- and within-person levels. Depressive symptomatology decreased, while self-esteem and perceived physical health increased over time in the program. Students who, on average, reported relatively higher levels of exercise enjoyment had lower depressive symptomatology, higher self-esteem, and higher perceived physical health (i.e., between-person associations). At times when students reported high levels of exercise enjoyment relative to their own average, this coincided with lower depressive symptomatology, higher self-esteem, and higher perceived physical health (i.e., within-person associations). Enjoyment within a university on-campus exercise program were associated with improvements in mental and perceived physical health. Importantly, from a within-person perspective, greater-than-typical exercise enjoyment for a given person corresponded with lower depressive symptomatology scores. These findings emphasise the value in incorporating program design elements that can support participants' exercise enjoyment.

*Keywords:* anxiety, stress, student health, mental disorders, affect

## 3.2 Introduction

A significant area of concern for higher education institutions is the prevalence of student mental distress and illness. Around the world, university students experience mental distress or illness—most commonly depression, anxiety, substance use disorders—at higher rates than other populations (e.g., Australia: Browne et al., 2017; Canada: Linden et al., 2021; and, China: Zeng et al., 2019); and, of significant alarm, university students are at heightened risk of suicidal ideation and suicide attempts (Eskin et al., 2016). There are a range of factors that have been shown to be associated with increased risk of students experiencing mental distress or illness, including (a) students experiencing high levels of academic stress, (b) financial insecurities and anxieties, (c) alcohol dependency, (d) a student's mental health history, (e) the ethnicity of a student, and (f) a student's sexual orientation (Said et al., 2013).

To support students who are experiencing mental distress or illness, higher education institutions often provide mental health supports including medical practitioners (e.g., mental health nurses, doctors, or psychiatrists), counselling and psychological personnel, and wellbeing support services (e.g., peer support services, see: Suresh et al., 2021). However, students seeking to access these services are regularly presented with lengthy wait times (Edbrooke-Childs & Deighton, 2020), and approaches to supporting students are often focused on 'treating' their mental illness (e.g., through pharmacotherapy or psychotherapy), with less attention paid to adjunctive supports to assist students in developing lifelong wellbeing behaviours. Furthermore, services available on-campus are often based on 'traditional' mental health treatment models, with few services developed purposely for a university population through student consultation (e.g., through a co-design process). As such, there have been appeals for further innovation in providing mental health services on-campus, with suggestions for institutions to adopt a stepped-care approach (i.e., expanding the range

of services available to students to help meet mental health needs for low-to-high intensity psychological intervention) towards mental health services, tailored for university students (Duffy et al., 2019).

One approach that can support young adults experiencing mental illness is the provision of exercise as a low-intensity psychological intervention. Low-intensity psychological interventions typically target students experiencing mild/moderate mental health concerns and often focus on fostering skills for self-care and self-management. Evidence in support of exercise as a treatment for people experiencing mental illness is plentiful, with strong correlations found specifically for university students; for example, physical activity and participation in leisure pursuits positively correlate with higher psychological wellbeing profiles (Brown et al., 2022). Relatively few publications exist, however, outlining the feasibility and efficacy of exercise programs as an on-campus mental health service option for students (e.g., deJonge et al., 2021; Jeftic et al., 2023a; Keeler et al., 2019; Muir et al., 2020). Generally, in the limited available literature, there is evidence that exercise programs are both feasible and efficacious for supporting students experiencing mental illness/distress. For example, deJonge et al. (2021) reported large pre-to-post program effect sizes for reductions in anxiety, depressive, and distress symptoms; Muir et al. (2020) provided similar evidence for reductions in students' psychological distress following their 6-week exercise program; and Jeftic et al. (2023a) outlined that an on-campus exercise program showed feasibility and positive post-program changes in assisting students experiencing mental distress. All of these programs were structured as complementary (i.e., running alongside) to existing services—inherently promoting recovery models that are based on behaviour change to improve lifelong wellbeing (i.e., promoting physical activity). However, further understanding is required as to the elements or experiences of these

kinds of exercise programs that may correspond with key indicators of students' mental health and wellbeing.

A better understanding of structural elements and student experiences in these exercise programs—and the health-related correlates of those elements or experiences—is important for the development of programs tailored for this population. Examples in this respect include exercise session characteristics (e.g., intensity, duration) and experiences (e.g., enjoyment) that may be associated with health outcomes. Regarding exercise experiences, Teixeira et al. (2012) suggested that an exercise session perceived as fun and enjoyable can lead to more adaptive outcomes as well as greater ongoing engagement, and Murri et al. (2019) proposed that affect- (i.e., enjoyment-) based exercise prescription may have particularly positive outcomes for people experiencing mental illness. With respect to exercise intensity (e.g., low, moderate, or vigorous activity), exercise that is perceived to be of low-to-moderate intensity may be more appropriate for people experiencing mental health challenges (Fraser et al., 2015); and, recommendations for exercise sessions duration (i.e., the length of one single bout of exercise) are highly variable with evidence to suggest positive effects for mental health stemming from significantly lower durations of exercise than general population physical activity guidelines (Mammen & Faulkner, 2013). Although there are broad considerations as to whether exercise experiences and characteristics are associated with more positive health outcomes, presently there is no evidence to determine whether exercise session enjoyment, intensity, or duration are related to health outcomes for a student population exercising to improve mental distress or illness. Therefore, broadly, we aimed to examine associations between these exercise experiences or characteristics and students' perceptions of their mental and physical health during participation in an exercise-as-treatment-for-mental-distress program.

Our study was designed to provide insight into the relationships between exercise session experiences (i.e., enjoyment) or characteristics (i.e., exercise session intensity, session duration) and important health indicators (i.e., mental health symptomatology, self-esteem, perceptions of physical health). These health indicators were selected either as direct markers of mental health, and/or because there is evidence that these factors may protect university students' mental health and general wellbeing (Trainor et al., 2010; Tyson et al., 2010). To derive comprehensive insight into the relations between these variables, it is valuable to model between-person as well as within-person associations. Between-person associations reveal whether those who, on average, report high exercise enjoyment relative to the rest of the sample also report, on average, lower mental health symptomatology scores. Meanwhile, within-person associations reflect the 'coupling' between these variables over-time and within people—for example, at times when a person scored particularly highly on exercise enjoyment relative to their average for that variable, did they also score highly relative to their own average on perceived physical health?

We recruited a sample of university student participants who were taking part in a referral-based, on-campus mental health exercise program, and used intensive repeated assessments to obtain repeated measures of key study variables (Stone & Shiffman, 1994). This study design involves repeated measurements of behaviour and experience in an effort to further our understanding of levels and change in experiences and behaviours over time. Importantly, intensive repeated measure designs also provide an opportunity to test associations between exercise and health variables at both the between- and within-person levels. For between-person associations, we sought to examine whether participants' average levels of exercise enjoyment, exercise intensity, and exercise duration were associated with their average levels of mental health symptomatology, self-esteem, and perceived physical health. We also sought to test

how fluctuations in levels of exercise enjoyment, exercise intensity, and exercise duration—relative to an individual's average over the study—accompanied fluctuations in mental health symptomatology, self-esteem, and perceived physical health. We hypothesised first that we would observe negative between- and within-person relationships for exercise enjoyment with respect to depressive symptomatology, and positive between- and within-person relationships between exercise enjoyment with respect to self-esteem, and perceived physical health. Secondly, we set out to explore any relationships between exercise intensity, and duration, and depressive symptomatology, self-esteem, and perceived physical health.

## 3.3 Methods

### 3.3.1 Participants and Procedure

Participants were recruited from the Stride program—an exercise program for students experiencing mental distress or illness at the University of Western Australia (for a detailed program description, refer to Jeftic et al., 2023a). Briefly, the exercise program involved (1) an initial and final program assessment conducted by the program coordinator—an exercise physiologist accredited by the relevant Australian accreditation board (i.e., Exercise and Sport Science Australia)—and (2) one weekly exercise session (at minimum) for a 12-week period, administered by an exercise mentor (i.e., a current Master of Clinical Exercise Physiology student). During the initial program assessment, participants provided informed consent; all procedures were approved by the human research ethics committee (RA/4/20/6055) at the lead author's institution. All participants were made aware that their research participation was entirely separate from their decision to be involved in the program, and that their research involvement would not impact or influence their program eligibility or experience. Participants who provided consent completed a short baseline demographic survey (e.g., sex, age, and student status: domestic or international) during the initial

program assessment. The exercise sessions were (a) tailored specifically during the initial program assessment for each participant (i.e., based on their goals, desired intensity, and schedule) with a range of activities (e.g., resistance training, social sport, aerobic training, etc.), (b) delivered face-to-face and completed with their exercise mentor, and (c) at the University of Western Australia on-campus sport and recreation, or exercise and performance centre facilities. At the end of selected exercise sessions, participants were provided a fortnightly (i.e., exercise weeks 1, 3, 5, 7, 9, and 11, where the initial program assessment was in week 0, and final program assessment in week 13) post-session survey about their exercise session experiences and characteristics. A description of participants and number of completed measurements is presented at the beginning of the Results section (see: 3.4 Results).

### 3.3.2 Measures

The fortnightly post-session survey consisted of five sections, and in all but the depressive symptoms sections, participants were instructed to answer based on how they felt at that moment in time. In the depressive symptoms section, participants were a00sked to respond how they felt over the previous seven days. The depressive symptoms section was based on the Quick Inventory of Depressive Symptomatology (QIDS; Rush et al., 2003)—13 items were used to measure participants' mental health scores. All depressive symptoms items were scored on a 4-point response scale, where 0 indicated no negative symptom was being experienced, and 3 indicated the most severe symptoms were being experienced. Participants were asked to "please select one response to each item that best describes you for the last seven days". Examples of items included "falling asleep", "sleep during the night", "concentration/decision making", and "energy level". Depressive symptoms were calculated as the average of the 13 items, with higher scores indicating more depressive symptoms. For this study, the interitem reliability was $\alpha = 0.88$ (Guttman reliability indicator = 0.89).

Exercise enjoyment perceptions were measured using three items from the intrinsic motivation inventory (IMI) interest-enjoyment subscale (Ryan, 1982). Participants were instructed to "Please answer the following questions in terms of how you feel right now about the exercise sessions you are taking part in". The three items used were "I am enjoying the exercise sessions very much", "These exercise sessions are fun to do", and "When I am doing these exercise sessions, I think about how much I enjoy them". All items were scored on a 7-item response scale (1 = "not true at all", 7 = "very true"), in line with IMI scoring procedures. Exercise enjoyment was calculated as the average of the three items, with higher scores indicating enjoying exercise more. For this study, the interitem reliability was $\alpha = 0.83$ (Guttman reliability indicator = 0.79).

All of the remaining variables of interest (i.e., exercise characteristics, self-esteem, and perceptions of physical health) were assessed using single item measures to ensure concision, reduction in participant burden, and selected on the basis of their suitability and evidence of validity (DeSalvo et al., 2006; Foster et al., 2001; Robins et al., 2001). Additionally, single item measures can be sensitive to change across time and between groups (Stone & Shiffman, 1994). Exercise characteristics included two variables: (1) exercise intensity, measured using session rating of perceived exertion (RPE; Foster et al., 2001); and, (2) exercise duration measured in minutes of activity using a 5-point scale (i.e., 1 = "<5 minutes", 2 = "6-15 minutes", 3 = "16-30 minutes", 4 = "31-45 minutes", and 5 = "46+ minutes"). Self-esteem was measured in line with recommendations for single item assessment provided by Robins et al. (2001), whereby participants were asked to rate their self-esteem by answering "Right now, I have high self-esteem" on a 5-point response scale (1 = "not very true of me", 5 = "very true of me"). For the assessment of perceptions of physical health, participants were asked to respond to "right now, in general, would you say your physical health is…", using a response scale anchored at 1 ("poor"), 2 ("fair"), 3 ("good"), 4 ("very good"), and 5

("excellent"); these procedures were used due to their suitability and evidence as per DeSalvo and colleagues (DeSalvo et al., 2006).

### 3.3.3 Data Management and Analyses

Intraclass correlations (ICC) were estimated to establish whether there was significant nesting of variability within-person over the (up to) 6 assessments, with the values interpretable as the amount of between vs within-person variability (+ error) as a proportion (Wolak et al., 2012). Linear mixed effect models were calculated to test relationships of exercise perceptions and characteristics (i.e., exercise enjoyment, exercise session intensity and duration) with mental health symptoms and health outcomes or indicators using lme4 package of R (Bates et al., 2015). Intercepts were set to vary between individuals. To test both between- and within-person associations, the predictor variables were parsed into intraindividual means (average of scores across all assessments for each individual) and residuals (assessment score – intraindividual mean for that individual) (Stone & Shiffman, 1994). All analyses were conducted in R version 4.2.3 with assumption testing resulting in no unmet assumptions (R Core Team, 2023).

## 3.4 Results

There were 93 program participants (age: $M = 22.97$, $SD = 3.82$, *range* = 18 to 39, $n = 91$; two participants did not provide their age) who consented to participate in the study. Of the 93 participants, there were 64 females and 29 males, of which 32 were international students and 60 domestic students (one student did not respond). Of the 6 possible assessments, most (83%, $n = 77$) participants completed at least 2 assessments; 60% of the sample completed 4 or more ($n = 55$), and 40% of the sample ($n = 37$) completed 5 or 6 assessments. This resulted in a complete dataset of 350 observations from 93 participants.

Descriptive statistics are presented in Table 6 for the study variables. The ICCs showed that about half of the variability was due to between-person differences,

suggesting the importance of considering both between-person and within-person levels of the associations. The duration of exercise sessions was least stable (i.e., had the most variance) with only 30% of the variability resulting from between-person differences.

**Table 6**

Descriptive Statistics of Change Over Time of Exercise Enjoyment, Relapse Prevention Efficacy, Self-esteem, and Perceived Physical Health

| Variable | Timepoint *M (SD)* | | | | | |
|---|---|---|---|---|---|---|
| | Timepoint 1 ($n$ = 83) | Timepoint 2 ($n$ = 71) | Timepoint 3 ($n$ = 80) | Timepoint 4 ($n$ = 52) | Timepoint 5 ($n$ = 37) | Timepoint 6 ($n$ = 42) |
| Exercise enjoyment | 5.67 (0.97) | 5.92 (0.87) | 5.97 (0.93) | 6.07 (0.84) | 6.02 (1.01) | 6.17 (0.70) |
| Depressive symptoms | 1.24 (0.57) | 1.14 (0.61) | 0.99 (0.52) | 0.90 (0.61) | 0.98 (0.59) | 0.98 (0.53) |
| Self-esteem | 3.04 (1.02) | 3.32 (0.91) | 3.33 (1.04) | 3.58 (0.94) | 3.27 (0.93) | 3.69 (1.02) |
| Perceived physical health | 2.34 (0.98) | 2.56 (0.86) | 2.84 (0.98) | 3.10 (1.01) | 3.00 (0.91) | 3.19 (1.09) |
| Session intensity | 6.35 (1.98) | 6.87 (1.78) | 7.22 (1.30) | 7.27 (1.14) | 7.14 (1.44) | 6.69 (1.69) |
| Session duration | 4.57 (61) | 4.61 (0.60) | 4.61 (0.55) | 4.48 (0.58) | 4.46 (0.61) | 4.52 (0.80) |

The change over time for participants' exercise enjoyment, depressive symptoms, self-esteem, perceived physical health, session intensity, and session duration is displayed in Table 7. Timepoint 1 (i.e., week 1) had the most participants record a response ($n$ = 83), which was relatively steady until Timepoint 3 (i.e., week 5; $n$ = 80), following which there was a decrease in responses until Timepoint 6 (i.e., week 11; $n$ = 42) (note that testing for statistically significant change in models was not completed).

The findings of the model testing associations of exercise enjoyment, session intensity, and duration with depressive symptoms, self-esteem and perceived physical health are shown in Table 8. With respect to between-person analyses, we observed effects such that when individuals reported enjoying exercise or completing more intense exercise on average, they reported lower scores on their depressive symptoms, and higher scores for their self-esteem and perceived physical health. Additionally, at a between-person level, participants who on average completed exercise sessions of a longer duration also experienced relatively higher depressive symptoms. Finally, participants of female sex reported scoring higher on depressive symptomatology, compared to male sex. With respect to within-person relationships, we observed that at times when participants scored highly on exercise enjoyment (relative to their own average), they also scored lower (than was typical for them) on depressive symptoms, and higher on self-esteem and perceptions of their physical health. The within-person relationships between exercise intensity, and exercise duration, and depressive symptomatology, self-esteem, and perceived physical health were not statistically significant.

**Table 7**

*Descriptive Statistics and Intraclass Correlations of Exercise Enjoyment, Relapse Prevention Efficacy, Self-Esteem, and Perceived Physical Health*

| Variable | Intraclass Correlations | Descriptive Statistics | |
|---|---|---|---|
| | ICC (95% CI) | *M (SD)*[a] | *Range* |
| Exercise enjoyment | 0.50 (0.40, 0.61) | 5.95 (0.89) | 2 to 7 |
| Depressive symptoms | 0.59 (0.49, 0.68) | 1.06 (0.58) | 0 to 2.85 |
| Self esteem | 0.55 (0.45, 0.65) | 3.33 (0.99) | 1 to 5 |
| Subjective physical health | 0.49 (0.38, 0.59) | 2.76 (0.99) | 1 to 5 |
| Session intensity | 0.53 (0.43, 0.63) | 6.90 (1.61) | 2 to 10 |
| Session duration | 0.30 (0.19, 0.42) | 4.56 (0.59) | 3 to 5 |

*Note.* Relapse prevention efficacy model: N = 325 occasions, 64 individuals; Self-esteem model: N = 311 occasions, 64 individuals; Perceived physical health model: N = 321 occasions, 64 individuals.

[a]Descriptive statistics calculated for person-level averages across occasions.

**Table 8**

*Results of Model Testing Between- and Within-Person Associations of Exercise Enjoyment, Session Intensity, and Duration on Depressive Symptomatology, Self-Esteem, and Perceived Physical Health Controlling for Sex and Age*

| Variable | Depressive Symptomatology | Self-Esteem | Perceived Physical Health |
|---|---|---|---|
| | 95% Confidence Intervals (statistically significant, p <0.05, results are bolded) | | |
| Intercept | -0.35 to 2.42 | -0.32 to 4.09 | -1.62 to 2.79 |
| Enjoyment (Between-Person) | **-0.30 to -0.05** | **0.24 to 0.63** | **0.19 to 0.58** |
| Enjoyment (Within-Person) | **-0.24 to -0.09** | **0.21 to 0.46** | **0.25 to 0.52** |
| Session Intensity (Between) | **-0.14 to -0.00** | **0.01 to 0.22** | **0.01 to 0.23** |
| Session Intensity (Within) | -0.06 to 0.02 | -0.05 to 0.09 | -0.09 to 0.06 |
| Duration (Between) | **0.03 to 0.48** | -0.65 to 0.07 | -0.52 to 0.19 |
| Duration (Within) | -0.12 to 0.07 | -0.16 to 0.15 | -0.16 to 0.18 |
| Sex | **0.06 to 0.50** | -0.61 to 0.07 | -0.64 to 0.04 |
| Age | -0.02 to 0.02 | -0.04 to 0.03 | -0.02 to 0.05 |

*Note.* Depressive symptomatology model: N = 333 occasions, 76 individuals; Self-Esteem model: N = 333 occasions, 76 individuals; Perceived Physical Health model: N = 333 occasions, 76 individuals

## 3.5 Discussion

The mental health challenges experienced by university students can significantly and negatively affect their wellbeing, career potential, and university experience. To provide support beyond the traditional services that exist on many campuses, some tertiary institutions have implemented structured exercise programs as a form of complementary mental illness or distress treatment. These services appear to be used sporadically by institutions to date, however, and as such it is important to better understand elements underlying these programs that may support more positive outcomes for participants. Our aim in this study was to identify associations between participants' exercise enjoyment, exercise session/program characteristics, and important health outcomes (i.e., depressive symptomatology, self-esteem, and self-perceptions of physical health). Analyses revealed evidence of associations at both the between- and within-person level; in both instances, exercise enjoyment was associated with more adaptive responses on all health outcomes. At only a between-person level, exercise session intensity was negatively associated with depressive symptomatology, and positively associated with self-esteem and perceived physical health (no within-person level associations were found); and, at only a between-person level exercise session duration was positively associated with depressive symptomatology (no within-person level associations were found).

Our findings complement existing evidence that exercise aligns with beneficial mental health outcomes for participants experiencing mental illness or distress; and more importantly, they inform us that participants' enjoyment of exercise and their exercise session intensity and duration (i.e., session dosage) may be key in optimising program design. There are two notable practical considerations stemming from this study. First, the findings add support for the integration of structured exercise programs to support university students experiencing mental illness (see Jeftic et al., 2023a;

deJonge et al., 2021; Keeler et al., 2019; Muir et al., 2020). The amount of structured exercise programs on-campus may be slowly increasing; however, uptake is limited and our findings, in addition to the growing body of literature supporting structured exercise programs, may further emphasise the need for such intervention efforts.

Second, these findings offer two program design elements (i.e., exercise enjoyment and session intensity and duration) for how structured exercise programs on-campus may be optimised. Regarding exercise enjoyment, the prescription of exercise to support mental health outcomes could be supplemented by the development—alongside consumers—of clinical environments that promote ongoing exercise enjoyment. We encourage exercise and service providers to consult the exercise psychology literature for techniques to improve exercise enjoyment (see, for example, Jeftic et al., 2023b). A prominent example is Self-Determination Theory (Deci & Ryan, 2012) which posits that more autonomous motives (e.g., enjoyment) can result when an individual's psychological needs are supported during exercise (Ntoumanis et al., 2017). To put this in perspective, Ntoumanis et al. (2021) outlined interventions informed by Self Determination Theory can positively influence physical and psychological health outcomes. As such, programs should integrate need-support training (e.g., outlining avenues to support participants' autonomy, competency, and relatedness) for service providers, as this may promote enjoyment of exercise. In addition, exercise enjoyment may be improved through a diversity of sessions, whereby exercise providers might utilise variety of activity, provide music and music choice to clients, offer sessions that are in nature or near bodies of water, and gamify exercise (i.e., create exercise games with goals, accomplishments, and points).

The second of the two program design elements these findings provide practical considerations for is session intensity and duration. Regarding exercise session intensity, our findings suggest when participants perceive exercise as moderate to

vigorous (i.e., scoring between 6 and 8 on the RPE), there are more positive health outcomes, compared to less intense activity. Accordingly, exercise program should therefore structure sessions moderate intensity level, if safe for the individual (Chan et al., 2018); alongside such structure, clinicians should seek on-going feedback during each session as to whether the participant perceives the exercise to be adequately intense (i.e., increase or decrease intensity based on present participant circumstances). The findings regarding exercise session duration suggest that participants who complete less exercise, in comparison to more exercise, experienced more positive health outcomes than those significantly longer. Although this is contrary to our expectations, it aligns with previous suggestions that exercise duration beyond 30-45 minutes may not lead to further improvements in mood or mental health (Chan et al., 2018).

Our findings also contribute novel insight to the research literature regarding the potential benefits of structured exercise programs for students experiencing mental illness or distress. There are already documented associations for various populations between positive affective responses following exercise (i.e., enjoyment) and self-esteem, self-perceptions of physical health, and exercise intensity (for example see: Furzer et al., 2021; Teixeira et al., 2021). However, in the context of university students experiencing mental illness or distress, this is the first study to demonstrate associations—and to do so at both the between- and within-person levels—between exercise experiences (i.e., enjoyment) and health outcomes, most notably depressive symptomatology. In addition, this study also demonstrates associations, at the between-person level, between exercise intensity and session duration, and all health outcomes. An area where these findings can be of particular interest is to aide in the development of mechanistic pathways related to the effects that exercise may have for people experiencing mental illness; and, within these pathways, the consideration of exercise

enjoyment, session intensity, or session duration as moderators is limited (Vella et al., 2023).

The strengths of this study include the provision of an exercise program to a vulnerable population experiencing mental illness, the use of repeated assessments providing an ability to account for change over time, and between- and within-person changes. These strengths should, however, be balanced against noteworthy limitations. It is prudent to reaffirm that the exercise program provided to students was contemporaneous with other mental illness treatment they may have been receiving (e.g., pharmacotherapy and/or psychotherapy), and, that the effects of the other treatments may have contributed to changes in health outcomes. However, the observed within- and between-person associations provide considerable confidence that exercise enjoyment is an important correlate of key health outcomes. In addition, it is important to note that our research outcomes were self-reported. Ecological momentary assessments are often constrained by the need for brevity in assessment procedures; however, in the future, assessments could be supplemented by objective markers (e.g., heart rate monitors to assess session intensity; physical health markers). Finally, it is important to acknowledge that due to the observational nature of our design, we cannot offer conclusions about the causal nature of relationships examined. In the future, researchers should test the causal nature of these relationships using controlled designs.

## 3.6 Conclusion

There is growing support for the implementation of exercise programs to support university students experiencing mental illness or distress; however, the use of such programs is still relatively limited. We found that exercise enjoyment may be of particular importance in shaping positive experiences and health outcomes in these settings. Practically, we propose that when exercise is perceived to be enjoyable, this may be an important strategy to assist health status among students experiencing mental

illness or distress; and, that sessions should be of moderate intensity, lasting up to 45 minutes in length. Conceptually, the relationships between variables identified in our research make an important contribution to the literature, and future studies may advance these findings.

## 3.7 References


Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Brown, D. M. Y., Faulkner, G. E. J., & Kwan, M. Y. W. (2022). Healthier movement behavior profiles are associated with higher psychological wellbeing among emerging adults attending post-secondary education. *Journal of Affective Disorders*, *319*, 511–517. https://doi.org/10.1016/J.JAD.2022.09.111

Browne, V., Munro, J., & Cass, J. (2017). Under the radar: The mental health of Australian university students. *JANZSSA-Journal of the Australian and New Zealand Student Services Association*, *25*(2).

Chan, J. S. Y., Liu, G., Liang, D., Deng, K., Wu, J., & Yan, J. H. (2018). Special Issue – Therapeutic Benefits of Physical Activity for Mood: A Systematic Review on the Effects of Exercise Intensity, Duration, and Modality. *Https://Doi.Org/10.1080/00223980.2018.1470487*, *153*(1), 102–125. https://doi.org/10.1080/00223980.2018.1470487

Deci, E. L., & Ryan, R. M. (2012). *Self-determination theory.*

deJonge, M. L., Jain, S., Faulkner, G. E., & Sabiston, C. M. (2021). On campus physical activity programming for post-secondary student mental health: Examining effectiveness and acceptability. *Mental Health and Physical Activity*, *20*, 100391. https://doi.org/10.1016/j.mhpa.2021.100391

DeSalvo, K. B., Fisher, W. P., Tran, K., Bloser, N., Merrill, W., & Peabody, J. (2006). Assessing Measurement Properties of Two Single-item General Health Measures. *Quality of Life Research*, *15*(2), 191–201. https://doi.org/10.1007/s11136-005-0887-2

Duffy, A., Saunders, K. E. A., Malhi, G. S., Patten, S., Cipriani, A., McNevin, S. H., MacDonald, E., & Geddes, J. (2019). Mental health care for university students: a way forward? *The Lancet Psychiatry*, *6*(11), 885–887. https://doi.org/10.1016/S2215-0366(19)30275-5

Edbrooke-Childs, J., & Deighton, J. (2020). Problem severity and waiting times for young people accessing mental health services. *BJPsych Open*, *6*(6), e118. https://doi.org/DOI: 10.1192/bjo.2020.103

Eskin, M., Sun, J.-M., Abuidhail, J., Yoshimasu, K., Kujan, O., Janghorbani, M., Flood, C., Carta, M. G., Tran, U. S., Mechri, A., Hamdan, M., Poyrazli, S., Aidoudi, K., Bakhshi, S., Harlak, H., Moro, M. F., Nawafleh, H., Phillips, L., Shaheen, A., … Voracek, M. (2016). Suicidal Behavior and Psychological Distress in University Students: A 12-nation Study. *Archives of Suicide Research*, *20*(3), 369–388. https://doi.org/10.1080/13811118.2015.1054055

Foster, C., Florhaug, J. A., Franklin, J., Gottschall, L., Hrovatin, L. A., Parker, S., Doleshal, P., & Dodge, C. (2001). A New Approach to Monitoring Exercise Training. *The Journal of Strength & Conditioning Research*, *15*(1). https://journals.lww.com/nsca-jscr/Fulltext/2001/02000/A_New_Approach_to_Monitoring_Exercise_Training.19.aspx

Fraser, S. J., Chapman, J. J., Brown, W. J., Whiteford, H. A., & Burton, N. W. (2015). Physical activity attitudes and preferences among inpatient adults with mental illness. *International Journal of Mental Health Nursing*, *24*(5), 413–420. https://doi.org/https://doi.org/10.1111/inm.12158

Furzer, B., Rebar, A., Dimmock, J. A., More, A., Thornton, A. L., Wright, K., Colthart, A., & Jackson, B. (2021). Exercise is medicine… when you enjoy it: Exercise enjoyment, relapse prevention efficacy, and health outcomes for youth within a

drug and alcohol treatment service. *Psychology of Sport and Exercise*, *52*, 101800. https://doi.org/10.1016/J.PSYCHSPORT.2020.101800

Jeftic, I., Furzer, B., Dimmock, J. A., Wright, K., Budden, T., Boyd, C., Simpson, A., Rosenberg, M., Sabiston, C. M., deJonge, M., & Jackson, B. (2023a). The stride program: Feasibility and pre-to-post program change of an exercise service for university students experiencing mental distress. *Psychology of Sport and Exercise*, 102507. https://doi.org/10.1016/J.PSYCHSPORT.2023.102507

Jeftic, I., Furzer, B. J., Dimmock, J. A., Wright, K., Boyd, C., Budden, T., Rosenberg, M., Kramer, B., Buist, B., Fitzpatrick, I., Sabiston, C., deJonge, M., & Jackson, B. (2023b). Structured exercise programs for higher education students experiencing mental health challenges: background, significance, and implementation. *Frontiers in Public Health*, *11*. https://www.frontiersin.org/articles/10.3389/fpubh.2023.1104918

Keeler, L. A., Skidmore, B., Leenstra, T., MacDonald, J. R., & Stewart, D. (2019). Treating University Students' Depression using Physical Activity with Peers: Two Field-Based Quasi-Experiments Grounded in the Self-Determination Theory. *Journal of College Student Psychotherapy*, *35*(3), 205–223. https://doi.org/10.1080/87568225.2019.1660293

Linden, B., Boyes, R., & Stuart, H. (2021). Cross-sectional trend analysis of the NCHA II survey data on Canadian post-secondary student mental health and wellbeing from 2013 to 2019. *BMC Public Health*, *21*(1), 590. https://doi.org/10.1186/s12889-021-10622-1

Mammen, G., & Faulkner, G. (2013). Physical Activity and the Prevention of Depression: A Systematic Review of Prospective Studies. *American Journal of Preventive Medicine*, *45*(5), 649–657. https://doi.org/https://doi.org/10.1016/j.amepre.2013.08.001

Muir, I. L., Munroe-Chandler, K. J., Loughead, T. M., Sutherland, C. A., & Hawksley, K. G. (2020). The UWorkItOut UWin Program: Improving University Students' Psychological Distress through Physical Activity. *International Journal of Kinesiology and Sports Science*, *8*(3), 36. https://doi.org/10.7575/aiac.ijkss.v.8n.3p.36

Murri, M. B., Ekkekakis, P., Magagnoli, M., Zampogna, D., Cattedra, S., Capobianco, L., Serafini, G., Calcagno, P., Zanetidou, S., & Amore, M. (2019). Physical Exercise in Major Depression: Reducing the Mortality Gap While Improving Clinical Outcomes. *Frontiers in Psychiatry*, *9*. https://www.frontiersin.org/articles/10.3389/fpsyt.2018.00762

Ntoumanis, N., Quested, E., Reeve, J., & Cheon, S. H. (2017). Need-supportive communication. In *Persuasion and Communication in Sport, Exercise, and Physical Activity* (pp. 155–169). Routledge. https://doi.org/10.4324/9781315624365-10

R Core Team. (2023). R: A language and environment for statistical computing. R Foundation for Statistical Computing. https://www.R-project.org/

Robins, R. W., Hendin, H. M., & Trzesniewski, K. H. (2001). Measuring Global Self-Esteem: Construct Validation of a Single-Item Measure and the Rosenberg Self-Esteem Scale. *Personality and Social Psychology Bulletin*, *27*(2), 151–161. https://doi.org/10.1177/0146167201272002

Rush, A. J., Trivedi, M. H., Ibrahim, H. M., Carmody, T. J., Arnow, B., Klein, D. N., Markowitz, J. C., Ninan, P. T., Kornstein, S., & Manber, R. (2003). The 16-Item Quick Inventory of Depressive Symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR): a psychometric evaluation in patients with chronic major depression. *Biological Psychiatry*, *54*(5), 573–583.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, *43*(3), 450.

Said, D., Kypri, K., & Bowman, J. (2013). Risk factors for mental disorder among university students in Australia: findings from a web-based cross-sectional survey. *Social Psychiatry and Psychiatric Epidemiology*, *48*(6), 935–944. https://doi.org/10.1007/s00127-012-0574-x

Stone, A. A., & Shiffman, S. (1994). Ecological Momentary Assessment (Ema) in Behavioral Medicine. *Annals of Behavioral Medicine*, *16*(3), 199–202. https://doi.org/10.1093/abm/16.3.199

Suresh, R., Karkossa, Z., Richard, J., & Karia, M. (2021). Program evaluation of a student-led peer support service at a Canadian university. *International Journal of Mental Health Systems*, *15*(1), 54. https://doi.org/10.1186/s13033-021-00479-7

Teixeira, D. S., Rodrigues, F., Machado, S., Cid, L., & Monteiro, D. (2021). Did You Enjoy It? The Role of Intensity-Trait Preference/Tolerance in Basic Psychological Needs and Exercise Enjoyment. *Frontiers in Psychology*, *12*, 682480. https://doi.org/10.3389/FPSYG.2021.682480/BIBTEX

Teixeira, P. J., Carraça, E. V, Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 78. https://doi.org/10.1186/1479-5868-9-78

Trainor, S., Delfabbro, P., Anderson, S., & Winefield, A. (2010). Leisure activities and adolescent psychological well-being. *Journal of Adolescence*, *33*(1), 173–186. https://doi.org/https://doi.org/10.1016/j.adolescence.2009.03.013

Tyson, P., Wilson, K., Crone, D., Brailsford, R., & Laws, K. (2010). Physical activity and mental health in a student population. *Journal of Mental Health*, *19*(6), 492–499. https://doi.org/10.3109/09638230902968308

Vella, S. A., Aidman, E., Teychenne, M., Smith, J. J., Swann, C., Rosenbaum, S., White, R. L., & Lubans, D. R. (2023). Optimising the effects of physical activity on mental health and wellbeing: a joint consensus statement from sports medicine Australia and the Australian Psychological Society. *Journal of Science and Medicine in Sport*. https://doi.org/10.1016/J.JSAMS.2023.01.001

Wolak, M. E., Fairbairn, D. J., & Paulsen, Y. R. (2012). Guidelines for estimating repeatability. *Methods in Ecology and Evolution*, *3*(1), 129–137. https://doi.org/https://doi.org/10.1111/j.2041-210X.2011.00125.x

Zeng, W., Chen, R., Wang, X., Zhang, Q., & Deng, W. (2019). Prevalence of mental health problems among medical students in China: A meta-analysis. *Medicine*, *98*(18).

# Chapter 4:

## *Structured exercise programs to support student mental health: Understanding in-program experiences and post-program exercise maintenance*

## 4.0 Chapter Foreword

In Chapters 2 and 3, we used quantitative methods to assess program feasibility, pre- to post-program changes on key health variables, and various between- and within-person associations. These methods did not, however, provide in-depth evidence relating to participants' program experiences, or allow us to better understand why participants continued (or not) with exercise following program completion. In the following Chapter, we present the results of our qualitative investigation into *participants' experiences and perceptions within the Stride program*, and their *post-program transition experiences*.

## 4.1 Abstract

Tertiary students experience high rates of mental health challenges. Although tertiary institutions often provide students access to support services, experts have flagged the need to improve services available for students. An approach is to provide structured exercise programs designed to support students experiencing mental health challenges. Ours aims were to understand participants' experiences during a structured exercise program for mental health challenges, and factors influencing post-program exercise maintenance. We recruited 31 participants ($M_{age}$ = 23.35, *SD* = 5.01; *Range* = 18-39; 22 female, 9 male) who had completed the Stride program (a structured exercise program at an Australian university). Semi-structured interviews were analysed using reflexive thematic analysis. We organised our findings under two higher-order categories: (1) experiences and perceptions within the program, and (2) post-program transition experiences. Under experiences and perceptions within the program, we identified three themes, reflecting *program design elements, people in the program*, and the *perceived effects of exercise*. Under post-program transition experiences, we identified three themes affecting exercise maintenance: *accessibility*, *improvements in self-efficacy*, and *social exercise*. Participants outlined program recommendations including on-going communication pre-program, and a facilitated introduction to their exercise mentor. Future exercise programs supporting student mental health may improve in-program experiences by aligning program design with contemporary exercise psychology recommendations (e.g., providing variety, accountability, or needs-supportive delivery). Programs ought to support post-program maintenance by facilitating students' positive self-efficacy beliefs during program participation, and by assisting students to integrate in 'social' deliveries of exercise.

*Keywords*: mental illness, psychological distress, physical activity, implementation science, college

## 4.2 Introduction

Young adults commonly experience a range of mental disorders, including depressive, anxiety, affective, behavioural, and substance disorders (Gustavson et al., 2018). A large proportion of young adults are enrolled in tertiary education (Marginson, 2016), and in these settings individuals may also experience additional stressors related to academic studies, transitioning to university, or future career concerns (Hurst et al., 2013)—with some evidence that tertiary students may experience elevated risks of mental illness (Browne et al., 2017), and that transitioning can significantly impact physical activity levels (Kwan et al., 2020). Experiencing a mental illness or mental distress (i.e., significant psychological hardship but not a mental illness) may lead to negative outcomes for young adults students including romantic relationship difficulties (Ritter et al., 2023), impaired physical wellbeing (McCloughen et al., 2012), curtailed employment possibilities (Waghorn & Lloyd, 2005), and may also impair academic performance and tertiary education experiences (Bruffaerts et al., 2018). As such, continued efforts are required to improve mental health and to strengthen mental illness (or distress) support services for those studying in tertiary education (e.g., university, college, technical school) settings.

Tertiary education institutions play an important role in preventing and treating mental illness and distress in student cohorts, and are increasingly adopting mental health frameworks to guide their efforts (e.g., ACCESS Open Minds, Vallianatos et al., 2019; Healthy Universities, Holt & Powell, 2017). To assist students, institutions often provide on-campus mental health support programs and personnel—including counselling, medical facilities, psychologists, and/or wellbeing services (Francis & Horn, 2017). Some institutions also offer alternative and/or complementary mental health support interventions (e.g., peer mentoring programs, Milne et al., 2007; alcohol interventions, Martens et al., 2007; or exercise prescription, deJonge et al., 2021), and

may also offer students interventions to improve overall wellbeing (e.g., mindfulness-based interventions, Galante et al., 2018; academic support, Zilvinskis et al., 2023; or online wellbeing promotion interventions, Stallman & Kavanagh, 2018). Nevertheless, experts have flagged the need for tertiary institutions to continue to improve the efficiency of existing services and increase their treatment and support avenues for students experiencing mental illness and distress (Oswalt et al., 2020).

The use of structured exercise programs is one method that is a viable treatment and lifestyle support option for people experiencing mental illness—at present, though, programs of this nature are underutilised in tertiary education settings. As such, there have been appeals for more widespread delivery of exercise programs as a treatment option in these settings (Stanton et al., 2015). Exercise can have significant positive effects for people experiencing various mental disorders (e.g., depressive disorders, Bailey et al., 2018; anxiety disorders, Carter et al., 2021; and substance-related disorders, More et al., 2017). Additionally, exercise may support young adults experiencing high levels of mental distress (Herbert et al., 2020), and help students build resilience (Ho et al., 2015). Despite the various benefits exercise can have for people experiencing mental illness or distress, on-campus exercise programs have been infrequently documented in the scientific literature to date, and to our knowledge, are not commonplace within the mental health service delivery portfolio across tertiary institutions.

The relatively limited use of on-campus exercise programs has been recognised as an important gap in the support services provided to students experiencing mental illness or distress (Peterson et al., 2022). There is research evidence indicating that on-campus exercise programs would be well received by students and staff (e.g., deJonge et al., 2020). In their study, deJonge et al. (2020) interviewed students and staff regarding their attitudes towards the integration of an exercise program to support students

experiencing mental distress—the authors reported that students and staff had positive attitudes toward the integration of exercise programs on-campus. Nonetheless, despite evidence to support exercise as a treatment for mental illness, and favourable attitudes toward such programs, only a handful of published studies exist regarding the feasibility and/or efficacy of exercise programs aimed at supporting students experiencing mental illness or distress.

Existing on-campus exercise programs supporting students with mental illness or distress include the MoveU.HappyU. program (deJonge et al., 2021); the Western Wellcat program (Keeler et al., 2019); and the UWorkItOut UWin program (Muir et al., 2020). In their study, deJonge et al. (2021) examined the feasibility and acceptability of the MoveU.HappyU. program—a 6-week, one-on-one physical activity program for students seeking mental health support—and reported that the program led to significant reductions in anxiety symptoms, depression symptoms, and psychological distress, whilst also being perceived as acceptable by participants. Regarding the Western Wellcat program, an 8–10-week peer-led exercise intervention, Keeler et al. (2019) noted the program was highly feasible for universities to integrate due to the high program completion rates by students and low program cost, and reported preliminary support for depression and distress outcomes following program completion. Similarly, Muir et al. (2020) found the UWorkItOut UWin program—a 6-week exercise training and counselling intervention for students with psychological distress—had positive effects in reducing university students' psychological distress. Bringing together this foundational work, and drawing from principles in related fields including exercise prescription, behaviour change, and implementation science, Jeftic et al. (2023) also recently presented key considerations for the design, delivery, and evaluation of exercise programs to support university students experiencing mental illness or distress.

The scientific literature regarding the implementation of on-campus exercise programs for mental illness or distress is not extensive but is generally positive. Our understanding of students' experiences within these programs, though, is not well developed and requires further investigation. Better understanding students' experiences within exercise programs of this nature may improve our knowledge of (a) how to best structure exercise programs to overcome specific challenges students may encounter, (b) what features of exercise programs work—and do not work—for a student population, (c) how to best integrate exercise programs alongside existing mental health support services on-campus, and (d) whether, and how, these programs support—or fail to support—promotion of lasting physical activity behaviour change (i.e., how best do these programs foster longer-term engagement in exercise post-program, and what factors support or limit this objective?). Additionally, in a broad sense, the insight provided by students with experience participating in a mental health-focused exercise program can be vital to better assisting a population experiencing substantial challenges (Larsson et al., 2018).

Guided by these considerations, in this study we sought to better understand students' experiences within structured, on-campus exercise programs designed to support treatment for mental illness or distress. We purposefully sought information-rich paricipants in the form of university students who were experiencing mental illness or distress and who had completed an exemplar exercise program—the Stride program at the University of Western Australia (Jeftic et al., 2023). Stride is an on-campus exercise program designed to support university students experiencing mental illness or distress. Students a referred into Stride by a health professional (on- or off-campus) and are provided with 12 weeks of tailored exercise led by a trained peer mentor. Mentors in the program are postgraduate students who are currently completing a specialised degree in exercise science. Collecting data from information-rich participants (i.e., those

who had completed an exemplar program) ensured that our sample comprised individuals (a) with experience of mental illness or distress during their university studies, (b) who could provide in-depth descriptions of their experiences during and following exercise program completion, and (c) were able to provide recommendations for further program development based on their experiences. Therefore, using the Stride program as contextual exemplar, our aims were (1) to understand students' *experiences in structured, on-campus exercise programs* designed to support mental health treatment, and (2) to understand program-related and other elements that influenced students' *post-program exercise participation*.

## 4.3 Methods

### 4.3.1 Philosophical Perspective

In this study, we adopted an interpretivist philosophical position (Lincoln et al., 2011). Two assumptions underpin interpretivism: 1) subjective epistemology—the idea that knowledge is constructed, and 2) a relativist ontology—that, with regards to social situations, there is no single or separate objective reality under study (Smith & Sparkes, 2020). Interpretivism rests on the notion that (social) reality is perceived differently by individuals, implying multiple potential, and explorable, realities, constructed through human interaction. A person's 'lived experienced' is of utmost importance to understand when assuming an interpretivist perspective; and individual meaning is derived and expressed by individual's use of language, leading to shared understanding. Accordingly, to align with an interpretivist perspective, we aimed to address our research questions through a qualitative method—semi-structured interviews followed by reflexive thematic analyses.

Importantly, to adhere to an interpretivist perspective, we should acknowledge the philosophical notions underpinning reflexive thematic analyses—though without here going into detail regarding specific data analysis procedures (see 4.3.5 Data

Analysis). A reflexive approach to data analyses is intended to provide further insight as to *how* the data were co-created, to help rationalise that qualitative research, in this context, is not designed to reach complete objectivity (Sparkes & Smith, 2013). To partake in reflexivity involves meaningful self-interpretation of influences between researchers and participants that led to research findings (Finlay & Gough, 2008). To provide such context, this research was situated in a 'Western', English-speaking perspective, with Stride operating in an Australian state capital city. All members of the research team have completed a university degree and have worked alongside university students (e.g., in an academic role), and as such are familiar with the demands placed on university students that can lead to mental health challenges.

For the first author, a reflexive approach was integral during the 18-month collection period, due to the on-going long-term changes that evolve our experiences and interactions with others. For example, the first author (IJ, who led data collection and interviews) is (a) not Australian-born, (b) a Caucasian male, (c) a person with lived experience of mental illness, (d) physically active, (e) a University student of similar age to the participants (in his late 20's) at the time of data collection, and (f) involved in the delivery of mental health support on-campus. For the first author, being male and physically active, in a program where a majority of people are female or physically inactive, may have restricted how comfortable certain participants felt. In addition, having lived experience with mental illness enabled certain avenues of questioning and empathy. A second researcher (JG) was involved in some interviews—this person was male, not Australian-born, an international student, and similarly aged to participants (i.e., in his mid 20's). Due to students being of domestic or international status, at times language used by participants was questioned by the interviewer—even though no language barrier was present—to provide increased accuracy as to intended meaning, rather than assuming language use or interpretation was identical.

### 4.3.2 Program Description

Stride is a 12-week, referral-based exercise program for students experiencing mental illness or distress. Program development was informed by existing programs in similar tertiary education settings (e.g., deJonge et al., 2021; Keeler et al., 2019; Muir et al., 2020). Stride involves an intake assessment by a program coordinator, a 12-week exercise program led by a peer mentor (i.e., a postgraduate student in the field of sport, exercise, and health science), and a final assessment by the same program coordinator. Exercise goals and session plans and content are developed in collaboration between student and mentor. As a result, each exercise program is individualised and developed with ongoing input from the student experiencing mental illness or distress. Stride also involves a dedicated transition objective (and associated scheduling toward the later stages of the program) for students, when the mentor's goal is to explicitly support their student mentee's capacity and motivation to engage in self-managed (i.e., not program-scheduled) exercise outside of and following the completion of the program.

### 4.3.3 Sampling Procedure & Participants

Ethical approval for this study was granted by the Human Research Ethics Committee at the first author's institution (RA/4/20/6055). Participants were students experiencing mental illness or mental distress who had completed Stride. There were no specific inclusion criteria, aside from participation in, and completion of, Stride. Participants for the present study were excluded if their mental health severity was high, and involvement in an interview had the potential to cause further mental distress. Following the final assessment by the program coordinator, all eligible participants were invited, by the first author or the Stride program coordinator, to participate in an interview. Interviews were conducted in-person at the University of Western Australia ($n$ = 19), online through Microsoft Teams or Zoom ($n$ = 10), or over the phone ($n$ = 2). The majority of interviews ($n$ = 27) were between one participant and one interviewer

(IJ, or JG), and some interviews ($n$ = 4) were between one participant and two interviewers (IJ and JG). At the completion of data collection, we had recruited 31 university students—the final participant sample included 9 males and 22 females ($M_{age}$ = 23.35, $SD$ = 5.01; *Range* = 18-39). Participants were of either domestic ($n$ = 24) or international ($n$ = 7) student-status (no further cultural information was collected). Participants were interviewed, on average, 4.9 weeks following their completion of the program (*Range* = 2 days to 9.7 weeks); and interview length was, on average, 36 minutes with a range of 18 to 72 minutes. To address the dual aims of our research (i.e., to understand in program experiences as well as post-program exercise maintainence experiences), we directed questions appropriately based on the amount of time elapsed between end-of-program and interview. To ensure there was a sufficient number of participants who experienced an adequate tranisition time—and therefore were able provide detailed 'post-program' experiences—we deliberately conducted a number of interviews ($n$ = 18) following a 4-week period after program completion. All students provided their consent for research during the beginning of the interview.

### 4.3.4 Data Collection

We used a semi-structured interview guide that was developed by several co-authors (IJ, TB, BJ, JD, and BF) with prior experience in developing interview guides and conducting semi-structured interviews. There were no *a priori* theoretical or analytical frameworks used to inform interview guide development. Our interview guide consisted of open-ended questions exploring five topics designed to explore and understand (a) what has supported participants with previous mental health challenges (e.g., "In your experience, what has worked well for you with the treatment of mental health problems, and why?"), (b) participant perceptions of the referral process (e.g., "Why did you decide to join the Stride program?", "Were there any aspects that were particularly appealing/not appealing?"), (c) participant program experiences (e.g., "Can

you describe your overall experience with Stride?"), (d) participant experiences with various program elements (e.g., "Can you describe your initial assessment experience", "Can you describe your overall experience with your mentor?", "Can you tell me about your experience with the transition period?"), and (e) participant experiences of transitioning to on-going physical activity following program completion (e.g., "How have you found maintaining exercise since taking part in the program?"). A semi-structured interview guide has partial structure which allows researchers flexibility to pursue interesting and tangential lines of inquiry during interviews. Over the 18-month period of data collection, co-authors held meetings to discuss whether there was sufficient data saturation. Data saturation is reached when interviews have become repetitive and are progressively unlikely to generate novel research related information; this concept can help guide the number of interviews to be completed. However, data saturation has complicated notions (e.g., if data are co-created between researchers and the researched, *can* saturation ever be reached?) when used within a reflexive thematic analysis framework (Low, 2019). Therefore, in our research we used data saturation considerations *only* for pragmatic purposes, rather than a conclusive point when we believed that no new information could *ever* be generated. Toward the end of the 18-month data collection period, it became evident that participant responses were increasingly repetitive and data collected ceased at this time.

### 4.3.5 Data Analysis

The first author led data analysis. Every interview was audio-recorded, with the recordings transcribed initially by Otter.ai online transcription software (Otter.ai, 2023) and then reviewed for accuracy by the first author. Throughout data analysis, *a posteriori* reflexive thematic analysis process was implemented (Braun et al., 2016). The thematic analysis process initiated during the revision of transcriptions in NVivo (QSR International Pty Ltd, 2020), where the first author started familiarisation of

interview transcripts and began development of an initial coding guide. Codes (i.e., a word or phrase describing analogous experiences) were initially formed by grouping units of text with similar meaning. Following the familiarisation stage, the coding guide was applied throughout the entire dataset, and preliminary themes were ascertained. The preliminary set of themes was generated by categorising codes into one or many themes where the responses shared semantic *or* latent (i.e., the implicit intention of what was explicitly stated) meaning. This first set of themes was then critically discussed, refined, and re-ordered with co-authors in a series of 'critical friends' meetings (Smith & Sparkes, 2020). Following each meeting, the first author would re-develop the themes (e.g., provide renewed order, definitions, structure, and potentially remove themes), with the final intention to develop a set of themes representative of the guiding research questions. The process of critical friend meetings and theme re-development was repeated until two distinct higher-order categories were identified. The final data analysis step was development of the manuscript in a narrative style—in contrast to presenting results as 'singular' themes—as themes are often interconnected and can be better explained when staged as a story (Braun & Clarke, 2019).

### 4.4 Results

We organised our findings under two higher-order categories: (1) *Experiences and Perceptions within the Program*, referring to different elements of the program that influenced program outcomes, and (2) *Post-Program Transition Experiences*, encompassing factors affecting exercise maintenance following program completion. The choice of separating into two higher-order categories was guided by interview data neatly separating into sections pertaining to during the program, and post-program. Recommendations for programs of this nature were provided throughout—these recommendations were directed toward the same issues that were discussed within the higher-order categories above. As a result, we present these recommendations where

relevant within appropriate themes. We provide quotations exemplifying themes with pseudonyms and participant numbers below.

### 4.4.1 Experiences and Perceptions within the Program

Participants described three aspects integral to and that broadly characterised their experiences within the program. We present these aspects within three themes: (1) *program design elements*, (2) *people in the program*, and (3) *perceived effects of exercise*. It is important to note that we consider these themes to be interrelated—for example, *people in the program* act as deliverers of many *program design elements*. We present these themes in turn below, but do not seek to artificially 'amplify' distinctions between these themes so as to give the impression of isolated themes. Further examples of meaning units (beyond those presented in text) are available in Table 9.

#### *Program Design Elements*

Participants described various program design elements that supported their initial and ongoing program engagement. The program design elements in these results include the referral, the initial consultation, the variety of exercise options, providing students with choice of preferred options,  accountability inherent to program participation, and the non-judgmental nature of the program. Participation in the program required a referral, which was followed by an initial consultation with the program coordinator. Sage (P14) received a referral from their doctor because, due to their mental health, "it was really hard to join sports and then I kind of lost that motivation [to exercise]". Contrasted with this, Sage experienced "a very smooth transition into the Stride program" because, during the initial consultation, everything was "explained to me very well… I understood what the program was about, its importance and significance." Although Kerry (P18) described the initial consultation as "good because I was very shy" and the coordinator made them feel comfortable, Kerry "didn't expect a bit of gap between the [initial assessment] and the first Stride [exercise]

session", recommending for programs to provide ongoing updates regarding program timing. For Sasha (P13), a referral from their psychologist was of paramount importance for program engagement:

> I had briefly heard about [the program] beforehand… but God no, I was not appealed to it. As a person that has never really been to the gym, I get panic attacks from like, looking at the gym. So how could that help my mental health? I just did not believe that at all… and I just needed a psychologist, like, why even exercise to try to make you feel a bit more calm and relaxed? I've got anxiety problems.

Participants described how variety of exercise options, choice of preferred options, accountability, and the non-judgmental nature of the program supported their program engagement. The variety of exercise options presented, and the capacity to choose preferred options, was important for many participants. As one participant noted, "…it's good to have different kind of sports or activities that one person can go through and give them a little bit of idea what they can try" (Quinn, P9). Finley (P11) also affirmed, "just trying different exercises" supported their on-going engagement, "because at the gym, I got pretty good at the exercises I was doing… and I got a bit bored." Variety was also integral for Riley (P23) as they explained:

> I think just, like, trying a range of things. And [the program coordinator] was like well, what do you want to try? And I wasn't really sure. […] we came up with a couple of ideas like yoga and boxing and trying things that I guess could be stress relieving; but, like slow stuff like yoga […] I could see what I did and didn't enjoy.

Another positive program element participants described was their perception of *accountability*. One participant, Blake (P12), explained, "the most useful thing was just having someone there to keep me accountable", with another participant, Remy (P16)

sharing they "didn't want to let [mentor] down… [they] just kept me accountable. And that's mostly how [they] motivated me." However, some participants described that their ongoing engagement in the program was, in addition to perceptions of accountability, attributed to the flexible, *non-judgmental nature of the program*, as Hayden (P24) felt "there was much flexibility [for session times] and [my mentor] would keep me accountable"; and, for Parker (P4), flexibility was essential to their program engagement:

> It's very mental health orientated, if you don't want to show up, that's fine [...] You're not going to be judged for any excuses. You're not going to be made to feel bad, it just felt like a very judgment free and accepting zone. So that was I think, the best part about it.

Participants perceived the referral process and feeling comfortable during the initial consideration as important for initial program engagement. Regarding on-going engagement, participants expressed program design that provided flexibility, variety, autonomy, and accountability assisted their maintanence continued attendance.

***People in the Program***

We recognise that people in the program are responsible for delivering many of the program design elements described above (e.g., *people* provided variety, flexibility, and/or perceptions of accountability). To that extent, it is difficult to 'separate' program design and 'people' elements. However, in this theme, we present experiences that explicitly referred to (or were directly 'pointed at') specific people in the program and the characteristics of those people—specifically, a *supportive program coordinator* pand the *exercise mentor's role both as an exercise professional* and as a *confidant or friend*. The *program coordinator* was, generally, the first and last point-of-contact for participants in the program. For Ashley (P15), they felt "initially… very nervous" about program involvement; however, during the initial session, the *program coordinator* was

"supportive and made me feel comfortable". Ashley (P15) continued, "I wasn't really comfortable in sharing" details about their mental health "but [the program coordinator] did say some stuff that made me relate to them a bit more. And I opened up and felt way better [about the program] after the conversation." Cameron (17) had a similar experience, sharing that the *program coordinator* "made me feel comfortable, welcome, and they explained everything quite thoroughly. I left with no questions and no doubts about it as well."

Following their initial consultation, participants were paired with an exercise mentor. Participants broadly perceived their mentor as someone who was *knowledgable in the provision and prescription of exercise*, and for Finley (P11) "it was good to try new things around someone who knew how to do them properly and show me. Otherwise, I just never would have tried them." The importance of perceiving the mentor as knowledgable was also conveyed by Remy (P16):

> I probably wouldn't be doing half of the things that I do now at the gym, especially around all the free weights workouts. … I found it really, like, really good that I had learned all those exercises with [my mentor] at the gym. And now I am more comfortable to just 'sit' in the free weights area.

Participants' mentors were also often considered their peers—both were university students and often were similar in age and had shared interests. This 'peer' notion aided in the *formation of friendships between participant and mentor*, and, for some, resulted in more positive program experiences. An example was described by Blake (P12), who stated, "it was really cool to get paired up with a Masters student… because it felt like someone that you could become friends with… rather than a teacher." For Gerry (P21), becoming "good friends with [mentor] was really helpful" as they felt "very nervous" starting the program. Ashley (P15) "really valued have [sic] that friendship with the mentor… it just made it more than just exercise… made it more

motivating". Sage (P14) attributed their program enjoyment to the fun *friendship with their mentor*, as they explained:

> [My mentor] was, like, the best ever. We would always like crack jokes. And it was so much fun every session, I looked forward to it. I had such a high coming out of every single session. Like, we like built a relationship throughout the whole 12-week program. And we had these jokes that we would you know, carry on with each other. And it was just so much fun spending time with her.

The professional and interpersonal efforts of the program coordinator and mentors to provide a knowledgable, supportive, and caring environment for participants were described as significant factors that assisted participants with program engagement. In addition, participants described the peer aspect of mentors as assisting the formation of friendships, supporting on-going engagement and in-program experiences, and important to the improvements in their mental health.

**Table 9**

*Additional Meaning Units and Examples for Higher-Order Category "Experiences and Perceptions within the Program"*

| Theme | Topic | Meaning Unit |
|---|---|---|
| Program engagement | Referral process | So, I contacted [the program coordinator] and I was like, hey, I'm interested, can you give me some more information? They provided a lot more information. And then I went to my psychologist, and I was like, hey, this is the Stride program, can you recommend me for it? And she was like, yep. Great. And then it was just, it was easy. (Sage P14) |
| | Variety | I think most of it was he got me doing different exercises that I hadn't done before. So, starting out with gym, I had no idea how to do the machine. I just didn't really have like the coordination or the balance or the strength to do them properly. But it just sort of gave me the right tips and pointed me in the right direction, and then kept working on them over the year, and eventually got better at them, which is really good. (Finley, P11) |
| | Accountability | Yeah, Friday morning, Sunday mornings. I just liked having it organised for me, and me not having to. With the gym you can decide a day and a time whereas everything was like set, this is the time that I've got to go and [my mentor's] gonna be there. So, like, it was that accountability.(Finley, P11)<br>And I didn't want to let [my mentor] down in a sense. They just kind of kept me accountable. And that's mostly how they motivated me. (Remy, P16) |
| | Flexibility | With, Stride, for example, if you have to reschedule, you feel like it's okay. Because you're really close [with your mentor]. Then you feel better about yourself. Because I think if I had felt bad, I think it can lead to disengagement. (Noah, P20) |
| People in program | Coordinator | It was really easy to chat with [the program coordinator], who's really nice. In terms of how to go into a bit of detail, but mental health and everything like that. But you know, it wasn't too confronting or anything like that. (Parker, P4)<br>He was really caring and asked questions about how I'm dealing and stuff, but just general questions as well. (Jessie, P5) |
| | Mentor – expert | I felt like I didn't know, how to do it properly, like increase the weight and like, sets and rest. Even if I would have figured out on my own, I guess it made me feel more confident that I actually had someone show me what I'm doing, that I wasn't doing stuff wrong. (Frankie, P6) |
| | Mentor – friend | I mean, it's, it's unnerving at the start, of course, but coupled with the mentor and then becoming familiar with them, and the more kind of experience we had, each week, that kind of relationship grew, and it wasn't long before we could we clicked almost instantly, actually, which helped a lot. (Drew, P3)<br>She was really lovely. And it was also nice to just have someone while you know, exercising between reps or laps and just have someone to chat to about whatever's going on in their life. So, I found it easy to talk to her. And, you know, I enjoyed chatting to her, and I look forward to seeing her and stuff like that. So that really did help. (Blake, P12) |

| | | |
|---|---|---|
| Perceived effects of exercise | Immediate mood post-session | (Did Stride help your mental health?): 100%. Like, especially in comparison to the other days of the week, because I would, I only did stride once a week, because my schedules kind of hectic, so it was hard to squeeze in more sessions. But on that the day that I did have stride in the morning, it was different to every other day, like, it's hard to explain. But having done something like, every morning, I would wake up for Stride and I'd be like, 'oh, I don't want to go like I'm too tired. I want to sleep in especially towards the winter months, when I was cold, I don't want to get out of bed.' But then after getting up and going and having so much fun and feeling like you know, I just did an hour of exercise and everything like that. I felt that sense of accomplishment, like I just did something big. (Sage, P14) |
| | Short term effects following a session | I like slept well and wasn't stressing about anything. And we went quite hard. And we actually had like, because we did something. So, we had a race at the very end. And I was exhausted afterwards. But it was really good. And I came home like, absolutely exhausted, but mentally better sort of thing. (Jessie, P5)<br>I think it's helped me a lot. Because as a PhD students, there's so much pressure, I'm going to work every day. I have an anxiety disorder, and I'm so nervous for like the easiest thing. For example, five minutes late to a meeting, I will get really frustrated. Or, getting so much comments on my writing makes me frustrated. Even if the comments is the easiest thing I didn't write, like I forgot a 'or' or 'the', you know, it's not really severe problems, but it gives me really high anxiety. I think the Stride program helped me to have time specifically for myself and not thinking about other stuff. And it also helps me to sleep better because I'm exhausted. I also have a feeling that I'm getting old, but I'm not doing any sports, I'm not taking care of my health. But I was like, oh, I need to take care of myself. (Quinn, P9) |
| | Scepticism on on-going effects | On that day, definitely be better. Do it a bit more long term and more often. And that would improve overall. (Sasha, P13)<br>I think maybe to the end of the day as like a consistent thing. But sometimes some weeks would probably be longer. (Kerry, P18) |

### *Perceived Effects of Exercise*

Participants described their experiences of program-related effects on their mental health. The perceived effects of exercise were commonly described with reference to the *short term effects* experienced during and directly after, or on the same day as an exercise session. For example, Phoenix (P10) described sessions as "boosting your emotional energy" and helping to "steer away from your problems" which helped them engage further with exercise sessions. Similarly, Quinn (P9) explained they enjoyed attending sessions as they "helped me to have time specifically for myself and not thinking about other stuff." Participants experienced positive effects throughout the day following an exercise session, with Sage (P14) feeling "fresh and ready to go… I felt really good." Participants also referenced enjoying the feeling of being "physically exhausted at the end of the day… rather than just mentally exhausted" (Blake, P12). Similarly, Riley (P23) described their experience following a session as:

> I think it was the fact that I was able to tire my body, it was able to get physically tired as much as I was mentally tired. Like, I kind of balanced myself out on this. And then I could actually relax. It was sort of like that all this pent-up energy went away. And I was able to relax for the rest of the day. And then the flow on effect has been just a little bit less stressed. But definitely for the rest of the day after my Stride session, I felt fantastic.

Participants were less forthcoming regarding ongoing (*longer-term*) mental health effects experienced throughout program (i.e., the days following a Stride session). For instance, Logan (P2) suggested that the program "made a bit of a difference, like during the day, but then afterwards throughout the whole week, not so much […] a reason to exercise every day"; and, Finley (P11) explained the program itself may not be solely responsible for improvements in their mental health throughout the program, saying, "I don't know if it's all Stride… it definitely played a part.

Because, I've been doing other things throughout the year, like seeing therapists, and my psychiatrist."

The beneficial effects on mental health, attributed to the program, were important for some participants' program experiences and engagement. The positive effects participants experienced, or observed, following a session (e.g., feeling really good) appeared to reinforce their involvement in the program, and—more generally—their thoughts about exercise as an avenue to support their mental health.

### 4.4.2 Post-Program Transition Experiences

An objective of the Stride program was to support participants' transition to self-managed exercise upon program completion. Accordingly, our second aim in this study is to understand the factors influencing participants' post-program exercise participation. We identified three themes: (1) *accessibility*, (2) *improvements in self-efficacy*, and (3) *social exercise*. It is important to note that although our focus here was on *post*-program exercise maintenance, these themes refer to in-program factors where those elements were described as influencing participants' transition success (e.g., when something that was or was not present *during* the program had an influence on exercise involvement *after* the program). Further examples of meaning units are available in Table 10.

#### *Accessibility*

Participants primarily described *cost*, and *time* as factors that impeded their post-program exercise maintenance. Many participants described on-going exercise to have "a bit of a financial barrier" (Noah, P20); while, Jessie (P5) shared they were "provided a bunch of swim cards" because they "like swimming" and were *unable to pay for a membership*, but that they "haven't used them yet", and on reflection had wished "that I was provided with a home program". Finley (P11) outlined that "the price [of gym memberships] was one of the put offs" for something "that I wasn't going to use often"

and although “my mentor provided a 12 week program”, Finley hasn’t “gone [to the gym] for a while now as I had to take some time off with exams.” Another example of *time-constraints* was provided by Marley (P29), who described “two weeks of exams” as enough to “break that routine [of exercise].”

In contrast to the barriers that continued to exist following program completion (i.e., *cost* and *time* barriers), some participants overcame pre-existing barriers due to their experiences during the program, leading to maintained exercise post-program. Specifically, some participants described their pre-program perceptions of gyms as ‘male-centric’ and intimidating; however, their experiences in the program had helped them to overcome those initial concerns. Parker (P4; female) described the gym to be “very intimidating, it’s a very male area”, but Parker “still go[es] in even though there’s only a couple of girls”, sharing that they “definitely wouldn’t have [gone to the gym] without that push from Stride”, and recommending for others to “start in a more private location, then move to the bigger [gyms].” Gerry (P21; female) accounted a similar experience from initially (i.e., pre-program) perceiving the gym to be male-centric, to a successful exercise transition post-program:

> Being mostly men in the gym that are huge, with like six plates on each side [of the barbell]. And I put like a five kilo plate on each side. But they’ve got like 100 on each side. Okay, that’s a lot… like, I don’t want to be in your way. I felt like if they’re doing their thing, I don’t want to get in their way if they can do more than me. But then now, I can do what I want. Everyone’s just doing what they want in the gym, nobody cares.

The cost and time associated with exercise were identified as significant barriers for participants pre- and post-program, indicating an area of focus for future programs. A number of participants experienced a ‘male-centric’ gym environment as a barrier pre-program, and described in-program experiences building their confidence to access

a gym; with a recommendation for programs to start such participants exercising in a private location, and then expanding to more public-spaces.

**Table 10**

*Additional Meaning Units and Examples for Higher-Order Category "Post-program Transition Experiences"*

| Theme | Topic | Meaning Unit |
|---|---|---|
| Accessibility | Cost | It was difficult finding people to go with because a lot of my friends either didn't want to pay, or they didn't have the time and our schedules didn't match up. So, I have never found anyone to kind of do that with. (Noah, P20) |
| | Male-Centric | She just showed me workouts that I wanted to do. And she kind of like introduced me to the free weights area, and introduced me to some areas that are predominantly, in the gym, filled with men, so it's like it can be intimidating. (Remy, P16) |
| | University Exams | So, I just, like go to the gym and attend a class. Yeah, Stride definitely made me learn how to like to prioritise. Because now it's a busy period at university with assignments and a more stressful period of time of the semester. And having to like pick this is what I should do. Like, maybe I should just go for exercise. It does make me think that that's an option for me to do and go into it. (Ashley, P15) |
| | | I think I had my OSKI exams on the 19th and then my written exams on the 23rd. So early in the week, probably a few days before the Oski exam. was the last time I went and did proper gym exercises. But I'm going to be getting back into the gym this week. (Finley, P11) |
| Improved Self-Efficacy | Lived Experience | So, as I kind of touched on before, I had played tennis before, like a few years ago. And so, I kind of had a little bit of background experience in it. And I really enjoyed the sport. So, I decided I decided to kind of pick it up again. And I'm really happy that I did, because as I also mentioned, I've continued it even beyond the Stride program. So, I'm happy that I got back into a sport that I really enjoy, and that I'm able to sustain. (Sage, P14) |
| | | I think some of it has come from like actually, sort of getting into that routine came from the Stride program. And also, because last year was pretty stagnant. And like, if I when I was trying, like if I tried to do something like go for a bike ride or whatever, I was getting very exhausted very quickly. (Kerry, P18) |
| | | Now I have like a confidence to actually go and register myself in the gym. And, you know, but I haven't gone yet with all the craziness. Because I had to submit two chapters. (Sam, P21) |
| Social Exercise | Loss of a social element | I have the confidence to walk in there. And I might not be able to go by myself. Like, I still haven't been back, because I haven't found a partner yet. But I'm not as terrified going to the gym and the first step. Probably the biggest condition I had, which was having the membership at the gym and having somebody to come with me, so maybe I should have probably brought a friend or buddy on our last couple of sessions. (Sasha, P13) |
| | | I enjoy the exercise still, but it was more like I was more relaxed and confident, and I went with someone. And so, I think going with someone actually helped more than, but I enjoy I also enjoyed Zumba. But it was better going with someone. I'd rather go with someone, and after [Stride] I haven't gone back yet (Sam, P21) |

| | |
|---|---|
| Exercising socially | It's like a nightclub, but you're on a bike. I was told 'come with your cousin' who's two years older than me, and we'll do it together. I got given three free passes and I didn't know that I really enjoyed this. So then on every weekend, I'd go with them (Gerry, P21)<br>I think Stride allowed me to realise how important it is to have that extra person there to help boost your morale and confidence. The people at the gym that I go to, they understand that (the workout)'s really difficult, and they also try to support you and get you through it as well. That's where that negative feeling was pretty much blast out of the water, and it didn't matter. This was the place to be, and this is where I can get stuff done. (Jackie, P26)<br>I'm going to try to start doing the body fit program again, because it's on over the holidays. Because I do go to the gym with a few friends. So, they, I mean, all of us kind of keep each other accountable. Which is nice. (Finley, P11) |

### *Improvements in Self-Efficacy*

Participants described how the program—and the knowledge gained through the program—improved their exercise self-efficacy (i.e., a belief in one's capacity to successfully engage in exercise), and that this had been maintained following program completion. Hayden (P24) described their exercise experiences and learnings as a key element of their on-going exercise following the program:

> I think probably the main thing is just like learning that like it's okay to do what you want, what I want. I don't have to do like my boyfriend always says 'you should do strength training like that's like the only thing you should be doing'. Like, it's okay to do other exercise and it's okay to do whatever you feel happy with.

Jackie (P26) explained how their improved belief in the effects exercise has on mental health has assisted them in maintaining exercise post-program:

> Going through Stride, the experience I had, it has kind of, highlighted how strong the benefits are. And it's really become quite salient, because I think I'm very aware of the benefits physical activity has on mental health. Yeah, it's unbelievable, picking up that realisation. Before, I saw all these papers with analyses, saying that exercise is good. Okay, it's good, but then when I experienced it, my lived experiences, it really put it in a spotlight and highlighted the benefits of exercise.

Another participant, Noah (P20), highlighted their belief in their ability to exercise increased—as a result of fitness improvement—resulted in ongoing exercise following program complete:

> Seeing the progress that you made was one of the motivations that kept me exercising after Stride. I feel like the increase in fitness though, makes it easier. So then it's just easier to think 'Okay, like I've reached this level. Now I can do a

bit more work. Yeah, get a bit further, get stronger.' So I feel like that's motivating.

Improvements in self-efficacy through positive experiences, physiological feedback (i.e., feeling progress), and social persuasion (e.g., positive feedback) were important for participants to continue exercising following program completion.

***Social Exercise***

Participants' post-program exercise transition attempts were, at times, interconnected with the presence of a social element (e.g., a friend, an exercise class, or a sport team) to exercise, or play, with or alongside. Several participants who felt they did not successfully transition to ongoing exercise post-program attributed their inactivity to the abscene of an exercise partner. For instance, Jackie (P26) did not "want to exercise alone because I'm not really great at it… I don't know how to continue with exercise because I haven't found someone to partner up with." Riley (P23), who was not active at the time of interview, recommended facilitation between "another mentor and mentee pair… so that way they would have someone to exercise with afterwards" because they were "intimidated to go [exercise] somewhere alone"; however, Riley (P23) is attempting to resolve this by "planning on going with [his] sister… to bungee exercise". As Ashley (P15) experienced, the relationship with their mentor was critical during the program, and the removal of this relationship hampered their self-managed exercise efforts:

> Having that kind of relationship [with the mentor] made it more than just exercise. It was good that it spurred me on to do more, but also having people and friends to do it with makes it more motivating, in some sense. Now, outside of the Stride program, I have to admit that by myself I am not very consistent with the exercise program that my mentor left me with.

In contrast, participants who perceived they had transitioned successfully to post-program exercise often reported integrating a social element in their activities. Parker (P4) described, “since the Stride program has ended, [my friend] and I have been going to the gym…we’ve got, like, weekly gym dates.” Similarility, Dylan (P25) “meets a couple of friends from school… for squash once a week, sometimes every two weeks, just to have some fun and keep each other accountable and active.” Sage (P14), whose confidence was absent pre-program, experienced improvement in social confidence following the program, and attributed this to post-program exercise maintenance:

> [Post-program] was different, because I guess I got used to playing with [my mentor]. And then now I was joining a group session. It wasn’t just like a one-on-one kind of thing anymore. [My mentor] helped build up my confidence in the sport, and then just in interacting with new people, because I didn’t know [my mentor] before I played tennis with them, so it was kind of easier to transition into meeting new people and playing a sport with them [...] They really helped helped me get that confidence to kind of go out there and try something new.

Participants described the loss of social support directly related to exercise as a reason for not maintaining exercise participation post-program, with recommendations for future programs to implement post-program group sessions restricted to program participants.

## 4.5 Discussion

Our aims in this study were to understand students’ experiences during an on-campus exercise program designed to support mental health treatment, and identify factors affecting post-program exercise participation. Our results provide insight into the underpinning issue—that further understanding of *these programs* for *this*

*population* is needed to improve program structure and address the specific challenges these students encounter. Accordingly, in this discussion we aim to present overarching consderations that we consider the most notable findings. We separate the discussion into: (1) self-efficacy, where we outline the importance of improving the self-efficacy of students experiencing mental illness; (2) social support, providing a discussion on the importance of social support for in-program engagement and post-program exercise adherence; and, (3) limitations and future directions.

### 4.5.1 Self-Efficacy

Self-efficacy refers to the belief an individual has in their ability to complete tasks necessary to achieve specific outcomes (Bandura, 1978). General self-efficacy is particularly important for university students and is associated with adaptation to university and capacity to manage the stressors experienced during tertiary studies (Morton et al., 2014). From a mental health perspective, university students who are experiencing psychological distress report lower levels of academic self-efficacy (i.e., belief in one's ability to achieve academic success) relative to students not experiencing psychological distress (Vieira et al., 2019). Self-efficacy theory and research has shown that improvements in specific domains of self-efficacy (e.g., exercise self-efficacy) may generalise, or translate, to concomitant improvements in other domains of self-efficacy, such as academic self-efficacy, or general self-efficacy. In the exercise context, for example, there is evidence of these generality effects between the domains of exercise self-efficacy and academic self-efficacy (see Jackson & Dimmock, 2012). Students in our study indicated that various program elements (e.g., experiencing exercise, supportive environment, improvements in knowledge) led to improvements in their beliefs of being able to successfully engage in exercise (i.e., exercise self-efficacy). As such, it is possible that these improvements in exercise self-efficacy may accompany further program engagement, more successful integration of exercise following program

completion, and support more positive mental health outcomes. Furthermore, improvements in exercise self-efficacy through programs of this nature may—through efficacy generality processes—lead to improvements in academic self-efficacy and general self-efficacy, both of which are particularly important for students experiencing mental distress and are associated with more positive mental wellbeing outcomes (Cobo-Rendón et al., 2020).

Our results suggest that participants experienced improvements in exercise self-efficacy for various reasons, including reduced perceived barriers, improvements in exercise-related knowledge, and increased exercise involvement. First, to support in- and post-program exercise engagement, program designers may provide students with a variety of exercise (Vella et al., 2023) or social sporting options (Wiedenman et al., 2023); and, may assist students experiencing mental illness to find exercise that they perceive as enjoyable to improve exercise motivation (Firth et al., 2016). Second, program designers should aim to help students overcome exercise barriers by understanding that such barriers may be related to (or influenced by) the mental health challenges that the student is experiencing (e.g., fatigue associated with depression; deJonge et al., 2020). In our study, for example, some female students described that their mental illness exacerbated already existing barriers such as perceiving gyms as "male-centric"—in line with already documented barriers for women (Turnock, 2021). During the program, these students participated in private exercise sessions (i.e., in isolation) before engaging in public gym spaces; and, through such actions, students indicated their confidence and beliefs about being able to engage in exercise improved (i.e., exercise self-efficacy). These actions (i.e., building exercise confidence in judgment-free locations) *may* lead to more successful transitioning attempts post-program (Middelkamp et al., 2017).

### 4.5.2 Social Support

Our results also emphasise the importance of social perceptions for this population within programs of this nature—within-program factors such as social connection and social support, as well as the social support that continued, or was lost, following completion of the program (e.g., from friends). Consistent with previous research, social support is a broad concept, generally defined as reciprocal relationships that provide supportive resources and/or a distraction from stressors (Williams et al., 2004). Social support is a valuable tool that exercise program designers can incorporate to promote in-program engagement and post-program adherence (Beauchamp, 2019)—importantly for this population, it has been shown that social support during exercise for mental health treatment can further promote engagement and adherence (Wheeler et al., 2018). We identified that the relationships formed between students and their mentor were integral to program engagement and positive experiences. The quality of some student-mentor relationships was attributed to perceptions among students that their mentor was not only an exercise professional in training, but also shared salient identity characteristics (i.e., was a student *peer*, and by extension, similar to them). Students felt more comfortable sharing concerns with their mentor due to the relationship formed, and for some students, informal 'chats' may have augmented their mental health treatment outcomes. As such, we recommend the design of future programs incorporates a (trained and sensitive) peer support aspect to promote positive exercise experiences.

The impact of social support was not limited to students' engagement and experiences during the program, but also appeared to be a significant component of students' perceived exercise maintenance success following program completion. As mentioned previously, social support can be an important tool for exercise engagement and adherence (Wheeler et al., 2018); however, in the context of students experiencing mental illness, there are few practical approaches—from the perspective of program

design—to help develop on-going social support following program completion. In our study, students who perceived themselves to have transitioned successfully post-program (i.e., were exercising regularly) often indicated that they were experiencing social support to exercise in various ways (e.g., exercising with friends or playing social sport). As such, we suggest that programs are explicitly designed to provide structure and opportunities for students to invite friends to exercise with them alongside their mentor *during* the later phase of the program (e.g., a dedicated *transition* phase)—such approaches may be particularly valuable due to the strong associations between *loneliness* and mental distress or illness for university students (McIntyre et al., 2018). Integration of a student's existing support network (e.g., friends or family) during a structured exercise program—perhaps by attending exercise sessions with the student—may improve the likelihood of exercise maintanence post-program by promoting continuation of social supports formed during exercise. However, this is not a universal solution—many students may lack an available support network near or on-campus (e.g., rural, interstate, or international students). In such circumstances, it may be beneficial for program staff to help students—at an appropriate point in the program and following consultation—integrate into college recreational sporting options, rather than exercise in isolation (for example, see: Abdeahad & Mock, 2023).

### 4.5.3 Limitations and Future Directions

Below, we briefly discuss notable limitations of our study. Directly related to our specific study aims, it is important to consider the demographic proportions of study participants relative to the broader population that completed the Stride program. In terms of proportions, the percentage of males and females in our study accurately represented the wider program as a whole, and is roughly equivalent to the prevalence of mental health concerns among male and female students (Browne et al., 2017). Interstate, international, and post-graduate students were, however, underrepresented in

our study when compared to broader program participation statistics. We were guided by pragmatic principles around data saturation in our work, but in the future, researchers may want to focus efforts on better understanding program experiences within these and other groups (e.g., male vs female, undergraduate vs postgraduate).

Another limitation of our research is that post-program exercise transition success was subjectively defined by each participant (i.e., did they feel they had successfully transitioned?). We did not seek to quantify physical activity levels as an indicator of transition success; rather, we sought to understand participants' experiences around the challenge of maintaining (self-managed) exercise post-program. We note, nonetheless, that we did not obtain quantifiable information to understand the exercise levels and patterns of our study participants. In addition, we considered these transition experiences at a relatively fixed moment in time following program completion. Our interviews were also scheduled at a point in time following program completion such that participants were able to recollect information about the program, but had, at the same time, accrued sufficient opportunity for (the experience of) a relatively more or less successful transition. In the future, researchers may supplement our research design with more objective insight into exercise transition success, and may do so at multiple time points following the completion of a program of this nature. Finally, we also encourage researchers to apply these findings to the design and conduct of randomised controlled trials to assess the program components and psychological processes that we discuss above (e.g., the involvement of ßs, explicitly efficacy-enhancing or socially-supportive program content).

In this study, we explored university students' experiences during and following an on-campus exercise program designed to support mental health treatment—with the aim of understanding program elements that support engagement in-program and factors influencing students' post-program exercise participation. Exercise programs

aiming to explicitly support this population may be more successful in engaging students and supporting successful post-program exercise by targeting students' exercise self-efficacy, peer support, social environments, and dedicated transition planning. Our findings underscore the ways through which program designers can develop exercise interventions for students with mental illness that are engaging and psychologically safe, and that maximise the likelihood of maintained exercise involvement following program completion.

## 4.6 References


Abdeahad, N., & Mock, S. (2023). The role of past campus recreational sports participation in predicting students' stress and competence during the COVID-19 pandemic. *Https://Doi.Org/10.1080/00222216.2023.2165203*, *54*(2), 269–285. https://doi.org/10.1080/00222216.2023.2165203

Bailey, A. P., Hetrick, S. E., Rosenbaum, S., Purcell, R., & Parker, A. G. (2018). Treating depression with physical activity in adolescents and young adults: a systematic review and meta-analysis of randomised controlled trials. *Psychological Medicine*, *48*(7), 1068–1083. https://doi.org/DOI: 10.1017/S0033291717002653

Bandura, A. (1978). Social Learning Theory of Aggression. *Journal of Communication*, 28(3), 12–29. https://doi.org/10.1111/J.1460-2466.1978.TB01621.X

Beauchamp, M. R. (2019). Promoting Exercise Adherence Through Groups: A Self-Categorization Theory Perspective. *Exercise and Sport Sciences Reviews*, *47*(1), 54–61. https://doi.org/10.1249/JES.0000000000000177

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, *11*(4), 589–597.

Braun, V., Clarke, V., & Weate, P. (2016). Using thematic analysis in sport and exercise research. In *Routledge handbook of qualitative research in sport and exercise* (pp. 213–227). Routledge.

Browne, V., Munro, J., & Cass, J. (2017). Under the radar: The mental health of Australian university students. *JANZSSA-Journal of the Australian and New Zealand Student Services Association*, *25*(2).

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Nock, M. K., & Kessler, R. C. (2018). Mental health problems in

college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders*, *225*, 97–103. https://doi.org/10.1016/j.jad.2017.07.044

Carter, T., Pascoe, M., Bastounis, A., Morres, I. D., Callaghan, P., & Parker, A. G. (2021). The effect of physical activity on anxiety in children and young people: a systematic review and meta-analysis. *Journal of Affective Disorders*, *285*, 10–21. https://doi.org/https://doi.org/10.1016/j.jad.2021.02.026

Cobo-Rendón, R., Pérez-Villalobos, M. V., Páez-Rovira, D., & Gracia-Leiva, M. (2020). A longitudinal study: Affective wellbeing, psychological wellbeing, self-efficacy and academic performance among first-year undergraduate students. *Scandinavian Journal of Psychology*, *61*(4), 518–526. https://doi.org/10.1111/SJOP.12618

deJonge, M. L., Jain, S., Faulkner, G. E., & Sabiston, C. M. (2021). On campus physical activity programming for post-secondary student mental health: Examining effectiveness and acceptability. *Mental Health and Physical Activity*, *20*, 100391. https://doi.org/10.1016/j.mhpa.2021.100391

deJonge, M. L., Omran, J., Faulkner, G. E., & Sabiston, C. M. (2020). University students' and clinicians' beliefs and attitudes towards physical activity for mental health. *Mental Health and Physical Activity*, *18*, 100316.

Duffy, A., Saunders, K. E. A., Malhi, G. S., Patten, S., Cipriani, A., McNevin, S. H., MacDonald, E., & Geddes, J. (2019). Mental health care for university students: a way forward? *The Lancet Psychiatry*, *6*(11), 885–887. https://doi.org/10.1016/S2215-0366(19)30275-5

Finlay, L., & Gough, B. (2008). Reflexivity: A practical guide for researchers in health and social sciences. John Wiley & Sons.

Firth, J., Rosenbaum, S., Stubbs, B., Gorczynski, P., Yung, A. R., & Vancampfort, D. (2016). Motivating factors and barriers towards exercise in severe mental illness:

a systematic review and meta-analysis. *Psychological Medicine*, *46*(14), 2869–2881. https://doi.org/10.1017/S0033291716001732

Francis, P. C., & Horn, A. S. (2017). Mental Health Issues and Counseling Services in US Higher Education: An Overview of Recent Research and Recommended Practices. *Higher Education Policy*, *30*(2), 263–277. https://doi.org/10.1057/s41307-016-0036-2

Galante, J., Dufour, G., Vainre, M., Wagner, A. P., Stochl, J., Benton, A., Lathia, N., Howarth, E., & Jones, P. B. (2018). A mindfulness-based intervention to increase resilience to stress in university students (the Mindful Student Study): a pragmatic randomised controlled trial. *The Lancet Public Health*, *3*(2), e72–e81. https://doi.org/https://doi.org/10.1016/S2468-2667(17)30231-1

Gustavson, K., Knudsen, A. K., Nesvåg, R., Knudsen, G. P., Vollset, S. E., & Reichborn-Kjennerud, T. (2018). Prevalence and stability of mental disorders among young adults: findings from a longitudinal study. *BMC Psychiatry*, *18*(1), 65. https://doi.org/10.1186/s12888-018-1647-5

Herbert, C., Meixner, F., Wiebking, C., & Gilg, V. (2020). Regular Physical Activity, Short-Term Exercise, Mental Health, and Well-Being Among University Students: The Results of an Online and a Laboratory Study. *Frontiers in Psychology*, *11*(May). https://doi.org/10.3389/fpsyg.2020.00509

Ho, F. K. W., Louie, L. H. T., Chow, C. B., Wong, W. H. S., & Ip, P. (2015). Physical activity improves mental health through resilience in Hong Kong Chinese adolescents. *BMC Pediatrics*, *15*(1), 48. https://doi.org/10.1186/s12887-015-0365-0

Holt, M., & Powell, S. (2017). Healthy Universities: a guiding framework for universities to examine the distinctive health needs of its own student population. *Perspectives in Public Health*, *137*(1), 53–58.

Hurst, C. S., Baranik, L. E., & Daniel, F. (2013). College student stressors: A review of the qualitative research. *Stress and Health*, *29*(4), 275–285.

Jackson, B., & Dimmock, J. A. (2012). When working hard and working out go hand in hand: Generality between undergraduates' academic- and exercise-related self-regulatory efficacy beliefs. *Psychology of Sport and Exercise*, *13*(4), 418–426. https://doi.org/10.1016/J.PSYCHSPORT.2012.01.004

Jeftic, I., Furzer, B., Dimmock, J. A., Wright, K., Budden, T., Boyd, C., Simpson, A., Rosenberg, M., Sabiston, C., deJonge, M., & Jackson, B. (2023). The stride program: Feasibility and pre-to-post program change of an exercise service for university students experiencing mental distress. *Psychology of Sport and Exercise*, 102507. https://doi.org/10.1016/J.PSYCHSPORT.2023.102507

Keeler, L. A., Skidmore, B., Leenstra, T., MacDonald, J. R., & Stewart, D. (2019). Treating University Students' Depression using Physical Activity with Peers: Two Field-Based Quasi-Experiments Grounded in the Self-Determination Theory. *Journal of College Student Psychotherapy*, *35*(3), 205–223. https://doi.org/10.1080/87568225.2019.1660293

Kwan, M. Y. W., Graham, J. D., Healey, C., Paolucci, N., & Brown, D. M. (2020). Stopping the Drop: Examining the Impact of a Pilot Physical Literacy-Based Intervention Program on Physical Activity Behaviours and Fitness during the Transition into University. *International Journal of Environmental Research and Public Health 2020, Vol. 17*, Page 5832, 17(16), 5832. https://doi.org/10.3390/IJERPH17165832

Larsson, I., Staland-Nyman, C., Svedberg, P., Nygren, J. M., & Carlsson, I.-M. (2018). Children and young people's participation in developing interventions in health and well-being: a scoping review. *BMC Health Services Research*, *18*(1), 507. https://doi.org/10.1186/s12913-018-3219-2

Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. *The Sage Handbook of Qualitative Research*, *4*(2), 97–128.

Low, J. (2019). A Pragmatic Definition of the Concept of Theoretical Saturation. *Sociological Focus*, *52*(2), 131–139. https://doi.org/10.1080/00380237.2018.1544514

Marginson, S. (2016). The worldwide trend to high participation higher education: dynamics of social stratification in inclusive systems. *Higher Education*, *72*(4), 413–434. https://doi.org/10.1007/s10734-016-0016-x

Martens, M. P., Cimini, M. D., Barr, A. R., Rivero, E. M., Vellis, P. A., Desemone, G. A., & Horner, K. J. (2007). Implementing a screening and brief intervention for high-risk drinking in university-based health and mental health care settings: Reductions in alcohol use and correlates of success. *Addictive Behaviors*, *32*(11), 2563–2572.

McCloughen, A., Foster, K., Huws-Thomas, M., & Delgado, C. (2012). Physical health and wellbeing of emerging and young adults with mental illness: An integrative review of international literature. *International Journal of Mental Health Nursing*, *21*(3), 274–288. https://doi.org/https://doi.org/10.1111/j.1447-0349.2011.00796.x

McIntyre, J. C., Worsley, J., Corcoran, R., Harrison Woods, P., & Bentall, R. P. (2018). Academic and non-academic predictors of student psychological distress: the role of social identity and loneliness. *Journal of Mental Health*, *27*(3), 230–239. https://doi.org/10.1080/09638237.2018.1437608/SUPPL_FILE/IJMH_A_1437608_SM5484.DOCX

Middelkamp, J., van Rooijen, M., Wolfhagen, P., & Steenbergen, B. (2017). The Effects of a Self-Efficacy Intervention on Exercise Behavior of Fitness Club Members

in 52 Weeks and Long-Term Relationships of Transtheoretical Model Constructs. *Journal of Sports Science & Medicine*, *16*(2), 163. /pmc/articles/PMC5465977/

Milne, L., Keating, S., & Gabb, R. (2007). Student peer mentoring at Victoria University. *Victoria University*.

More, A., Jackson, B., Dimmock, J. A., Thornton, A. L., Colthart, A., & Furzer, B. J. (2017). Exercise in the Treatment of Youth Substance Use Disorders: Review and Recommendations. *Frontiers in Psychology*, *8*, 1839. https://doi.org/10.3389/fpsyg.2017.01839

Morton, S., Mergler, A., & Boman, P. (2014). Managing the Transition: The Role of Optimism and Self-Efficacy for First-Year Australian University Students. *Australian Journal of Guidance and Counselling*, *24*(1), 90–108. https://doi.org/10.1017/jgc.2013.29

Muir, I. L., Munroe-Chandler, K. J., Loughead, T. M., Sutherland, C. A., & Hawksley, K. G. (2020). The UWorkItOut UWin Program: Improving University Students' Psychological Distress through Physical Activity. *International Journal of Kinesiology and Sports Science*, *8*(3), 36. https://doi.org/10.7575/aiac.ijkss.v.8n.3p.36

Oswalt, S. B., Lederer, A. M., Chestnut-Steich, K., Day, C., Halbritter, A., & Ortiz, D. (2020). Trends in college students' mental health diagnoses and utilization of services, 2009–2015. *Journal of American College Health*, *68*(1), 41–51.

Otter.ai. (2023). *Otter.ai*. https://otter.ai

Peterson, N. E., Zera, J. N., Tompkins, C. L., Rothermel, M. A., Davidson, C., Mandla, S., Jeffreys-Heil, R., Shirazi, Z., Stuhr, R. M., & Winters, C. S. (2022). Exercise is Medicine on Campus: A Scoping Review of Evidence 2009 to 2021 and Call to Action. *Current Sports Medicine Reports*, *21*(8).

https://journals.lww.com/acsm-csmr/Fulltext/2022/08000/Exercise is Medicine_on_Campus _A_Scoping_Review.7.aspx

QSR International Pty Ltd. (2020). *NVivo* (released in March 2020). https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home

Ritter, L. J., Hilliard, T., & Knox, D. (2023). 'Lovesick': Mental Health and Romantic Relationships among College Students. *International Journal of Environmental Research and Public Health*, *20*(1). https://doi.org/10.3390/ijerph20010641

Smith, B., & Sparkes, A. C. (2020). Qualitative Research. In *Handbook of Sport Psychology* (pp. 999–1019). https://doi.org/https://doi.org/10.1002/9781119568124.ch49

Sparkes, A. C., & Smith, B. (2013). Qualitative research methods in sport, exercise and health: From process to product. Routledge.

Stallman, H. M., & Kavanagh, D. J. (2018). Development of an Internet Intervention to Promote Wellbeing in College Students. *Australian Psychologist*, *53*(1), 60–67. https://doi.org/10.1111/ap.12246

Stanton, R., Rosenbaum, S., Kalucy, M., Reaburn, P., & Happell, B. (2015). A call to action: exercise as treatment for patients with mental illness. *Australian Journal of Primary Health*, *21*(2), 120. https://doi.org/10.1071/py14054

Turnock, L. A. (2021). 'There's a difference between tolerance and acceptance': Exploring women's experiences of barriers to access in UK gyms. *Wellbeing, Space and Society*, *2*, 100049. https://doi.org/10.1016/J.WSS.2021.100049

Vallianatos, H., Friese, K., Perez, J. M., Slessor, J., Thind, R., Dunn, J., Chisholm-Nelson, J., Joober, R., Boksa, P., Lal, S., Malla, A., Iyer, S. N., & Shah, J. L. (2019). ACCESS Open Minds at the University of Alberta: Transforming student mental health services in a large Canadian post-secondary educational

institution. *Early Intervention in Psychiatry*, *13*(S1), 56–64. https://doi.org/https://doi.org/10.1111/eip.12819

Vella, S. A., Sutcliffe, J. T., Fernandez, D., Liddelow, C., Aidman, E., Teychenne, M., Smith, J. J., Swann, C., Rosenbaum, S., White, R. L., & Lubans, D. R. (2023). Context matters: A review of reviews examining the effects of contextual factors in physical activity interventions on mental health and wellbeing. *Mental Health and Physical Activity*, *25*, 100520. https://doi.org/10.1016/J.MHPA.2023.100520

Vieira, D. A., Cnossen, F. J., Bjerkeset, O., Grøtan, K., & Sund, E. R. (2019). *Mental Health, Academic Self-Efficacy and Study Progress Among College Students – The SHoT Study, Norway*. https://doi.org/10.3389/fpsyg.2019.00045

Waghorn, G., & Lloyd, C. (2005). The employment of people with mental illness. *Australian E-Journal for the Advancement of Mental Health*, *4*(2), 129–171. https://doi.org/10.5172/jamh.4.2.129

Wheeler, A. J., Roennfeldt, H., Slattery, M., Krinks, R., & Stewart, V. (2018). Codesigned recommendations for increasing engagement in structured physical activity for people with serious mental health problems in Australia. https://doi.org/10.1111/hsc.12597

Wiedenman, E. M., Kruse-Diehr, A. J., Bice, M. R., McDaniel, J., Wallace, J. P., & Partridge, J. A. (2023). The role of sport participation on exercise self-efficacy, psychological need satisfaction, and resilience among college freshmen. *Https://Doi.Org/10.1080/07448481.2023.2177817*. https://doi.org/10.1080/07448481.2023.2177817

Williams, P., Barclay, L., & Schmied, V. (2004). Defining Social Support in Context: A Necessary Step in Improving Research, Intervention, and Practice. *Http://Dx.Doi.Org/10.1177/1049732304266997*, *14*(7), 942–960. https://doi.org/10.1177/1049732304266997

Zilvinskis, J., Barber, R. E., Brozinsky, J. L., Hochberg, S. R., & Weston, M. (2023). Mediation Effects of Academic Advising Behaviors for First-Year Students with Learning Disabilities and Mental Health Disorders. *Journal of Postsecondary Education & Disability*, *35*(4), 319–337. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=eue&AN=161239481&site=ehost-live&custid=s3358796

# Chapter 5:

## *General Discussion*

## 5.0 Chapter Foreword

In this Chapter, we briefly synthesise key findings from the previous studies, discuss practical and conceptual implications, and offer cross-cutting limitations and future research directions.

## 5.1 Research Summary

This purpose of the research presented in this thesis was to (1) develop an exercise program to support students experiencing mental health challenges (i.e., the *Stride* program), (2) evaluate the feasibility of the program and determine pre- to post-program change in key 'outcomes', (3) gain understanding into the associations between exercise enjoyment, exercise intensity, session duration, and health outcomes, and (4) explore participants' experiences during the Stride program, and of transitioning to on-going exercise following program completion.

In Chapter 1, we presented a review of the literature supporting the notion that university students are at high risk of experiencing mental health challenges, and that tertiary institutions should integrate alternative mental health support avenues due to overwhelming demand for support. We then highlighted the gap that exists in servicing of this nature and in our understanding of *how* to develop such exercise programs. In Chapter 2, we presented a study exploring program feasibility and pre- to post-program change in key health indicators associated with program participation. In this chapter, we also provided a detailed description of the Stride program. Results from the study suggest that participants perceived the program as an important support for their mental health, that most aspects were well received by participants, and that participants found it to be largely enjoyable. Additionally, the outcomes that were measured as part of our pre- to post-program change indicated that the program may be efficacious in improving various health-related outcomes, most notably depressive symptomatology, but also quality of life, physical activity levels, self-efficacy, dietary intake, and blood pressure. In Chapter 3, we presented an intensive repeated measures assessment of key variables within the Stride program. Our results suggested that there were significant and favourable associations at both between- and within-person levels for exercise enjoyment, depressive symptomatology, self-esteem, and perceived physical health.

Finally, in Chapter 4, we explored participants' experiences during and on transition out of the Stride program. Our results highlighted several inter-related themes that suggest improving participants' self-efficacy during the program, and integrating social support both during and following the program, are important aspects to promote exercise experiences and adherence for students experiencing mental health challenges.

## 5.2 Implications

### 5.2.1 Conceptual Implications

As discussed throughout this thesis, and particularly in Chapter 1, there have been repeated calls to provide university students experiencing mental health challenges (i.e., mental illness or psychological distress) with further support. In Chapter 1, we argued that scientific evidence provides considerable support for exercise as an alternative—but supplementary to existing—avenue of support for students experiencing mental health challenges. We also provided examples of the few on-campus exercise programs that have been implemented and reported in the literature prior to the work outlined in this thesis (e.g., *Move.U.Happy.U.,* deJonge et al., 2021). We provided a novel *conceptual review* that outlined four broad considerations grounded in scientific literature (i.e., exercise psychology, exercise physiology, and implementation science) to guide future exercise-program development. These four broad considerations guided the development of the Stride program, and in Chapter 2 we assessed program feasibility and sought to provide evidence of pre- to post-program change in key health indicators. Participants perceived the program to be feasible, and our results provided important evidence that such exercise programs accompany (and may support) mental health improvement in students experiencing mental health challenges. These results provide additional evidence that exercise is an important aspect in the treatment of a variety of mental illnesses, and in various demographic groups (Stubbs & Rosenbaum, 2018).

In Chapter 3, we investigated the associations between exercise enjoyment and health outcomes, resulting in evidence—albeit non-causal—that *suggests* exercise enjoyment has significant meaning in the treatment of mental illness and effectiveness of exercise programs within a student population. It is important to further understand ideal exercise dosage (e.g., session duration, exercise intensity, intervention length; Meyer et al., 2016), and avenues to best tailor sessions for individuals (Stanton et al., 2018); however, efforts to stimulate positive affective responses within programs of this nature may support exercise engagement and more meaningful improvements in mental health. Our qualitative study, about program experiences and post-program transitions, provides further advancement to the literature in this area. First, participants highlighted that exercise self-efficacy played a role in promoting exercise engagement during and following the program; and second, they noted that social support (i.e., within- and post-program) contributed to more positive exercise experiences (e.g., social support from their mentor) and transition success (e.g., exercising with friends). From the perspective of their contribution to the literature, the studies in Chapter 3 and Chapter 4 showed that experiencing positive affect during sessions (i.e., enjoyment), a strong sense of self-efficacy, and the perception of social support, are integral to successful intervention design for programs and populations of this nature. Although these concepts have been addressed and incorporated in various exercise program interventions (e.g., Furzer et al., 2021), this thesis provides in-depth insight into *why* such considerations are important *for this population*.

### 5.2.2 Practical Implications

In this thesis, we offer several notable practical implications. Initially, we developed a practical tool—in the form of four considerations—to help guide future program developers, with the hope of encouraging further integration of on-campus exercise programs that support students experiencing mental health challenges. We

incorporated various aspects of these four considerations into the development of the Stride program and provided preliminary insight into the efficacy of the program. In doing so, we provided evidence that the implementation of an on-campus exercise program to support students experiencing mental health 'works' on an Australian University campus, in line with the findings of similar programs based in Canada (Muir et al., 2020) and the United States (Keeler et al., 2019). Although the programs are similar in design and intention, there are distinct differences between each program (e.g., program length), and our findings emphasise that program design should be tailored for individual institutions (e.g., location, available resources, or student demographic, etc.). Of particular importance for program design is the need to structure exercise sessions that promote positive experiences for students experiencing mental health challenges. More specifically, exercise instructors in such programs may support positive experiences by helping students to improve their exercise self-efficacy, to identify enjoyable exercise options, and to integrate social networks as part of exercise sessions. Perhaps the most noteworthy practical implication of the work presented in this thesis is that the Stride program appears to be the first program of its kind to be developed and integrated at a university in Australia. In the program's operating time (i.e., May 2020 – December 2022) associated with this doctoral thesis at the University of Western Australia, there were over 150 students experiencing mental health challenges that were supported by the Stride program. As such, the successful implementation of this program at the University of Western Australia— highlighted by the positive findings of our feasibility study—have already led to discussions about, or the delivery of, the Stride program at a handful of other Australian universities.

### 5.3 Limitations and Future Research Directions

The first limitation that should be acknowledged is that information on the other mental health treatment options that may have been used by participants (e.g.,

psychological or counselling services) was not collected. Specifically, within our feasibility study, while we did collect information regarding to the type of medication participants may be prescribed and the reason they were referred into the program, we did not collect information on the *amount* of medication they were on, nor did we collect information about other mental health treatment services they may be using. Thus, this limits the conclusions we can draw about the effectiveness of the program. Second, and related to the previous limitation, we note that in our feasibility study we adopted a single-group study design (i.e., not randomised or with a control group). As such, we cannot make any statements regarding the efficacy of the Stride program relative to (a) a control group, (b) other alternative treatment programs, or (c) existing treatment services. Third, the feasibility trial was situated at a single Australian University, and so it is difficult to ascertain whether (and how) the Stride program would be feasible on other campuses. The connection of the three limitations outlined above leads to one of the key recommendations from our studies for future research designers—to design and conduct a multi-site randomised controlled trial of the Stride program according to CONSORT recommendations (Schulz et al., 2023). In the delivery of such future trials, it will be important for researchers to consider appropriate wait-list control groups to ensure safety for participants (Freedland et al., 2019). A multi-site randomised controlled trial will provide more conclusive insight into the efficacy of the Stride program, while also assessing the feasibility of the Stride program on other University campuses. In addition, such a trial will provide researchers with the ability to assess the significance of certain program elements. For example, although our studies indicate that session intensity may be associated with health outcomes, it would be interesting to assess whether strict controls (e.g., a minimum session intensity) on such program elements affect program efficacy or participant experiences (Vella et al., 2023). Finally, due to the Stride program providing an alternative avenue of support

specifically for students experiencing mental health challenges, we do not know whether this program would help improve *any* students' mental health (i.e., those not experiencing mental health challenges), or whether it would be applicable for other populations. Although this was not an explicit aim of our work, researchers should explore whether such concepts are feasible and efficacious—for example, with students at other educational levels (e.g., primary or high school students).

## 5.4 Conclusions

This thesis provides novel insight into methods for supporting students who are experiencing mental health challenges. The studies in this thesis highlight that on-campus exercise programs are a feasible and potentially efficacious approach to supporting students experiencing mental health challenges, that enjoyment during exercise sessions in such programs is associated with more favourable mental health, and the various program experiences that promote exercise engagement during and following the program. As someone who has lived experience with mental illness, it was a privilege, throughout my doctoral candidature, to have been involved in the design and implementation of a novel support service for vulnerable students. I was provided an opportunity to listen and learn from students who had been through the Stride program, and I am grateful beyond words to all of the students who, while experiencing mental health challenges, supported our research.

## 5.5 References

deJonge, M. L., Jain, S., Faulkner, G. E., & Sabiston, C. M. (2021). On campus physical activity programming for post-secondary student mental health: Examining effectiveness and acceptability. *Mental Health and Physical Activity*, *20*, 100391. https://doi.org/10.1016/j.mhpa.2021.100391

Freedland, K. E., King, A. C., Ambrosius, W. T., Mayo-Wilson, E., Mohr, D. C., Czajkowski, S. M., Thabane, L., Collins, L. M., Rebok, G. W., & Treweek, S. P. (2019). The selection of comparators for randomized controlled trials of health-related behavioral interventions: recommendations of an NIH expert panel. *Journal of Clinical Epidemiology*, *110*, 74–81.

Furzer, B., Rebar, A., Dimmock, J. A., More, A., Thornton, A. L., Wright, K., Colthart, A., & Jackson, B. (2021). Exercise is medicine… when you enjoy it: Exercise enjoyment, relapse prevention efficacy, and health outcomes for youth within a drug and alcohol treatment service. *Psychology of Sport and Exercise*, *52*, 101800. https://doi.org/10.1016/j.psychsport.2020.101800

Keeler, L. A., Skidmore, B., Leenstra, T., MacDonald, J. R., & Stewart, D. (2019). Treating University Students' Depression using Physical Activity with Peers: Two Field-Based Quasi-Experiments Grounded in the Self-Determination Theory. *Journal of College Student Psychotherapy*, *35*(3), 205–223. https://doi.org/10.1080/87568225.2019.1660293

Meyer, J. D., Koltyn, K. F., Stegner, A. J., Kim, J. S., & Cook, D. B. (2016). Influence of exercise intensity for improving depressed mood in depression: A dose-response study. *Behavior Therapy*, *47*(4), 527–537. https://doi.org/10.1016/j.beth.2016.04.003

Muir, I. L., Munroe-Chandler, K. J., Loughead, T. M., Sutherland, C. A., & Hawksley, K. G. (2020). The UWorkItOut UWin Program: Improving University Students'

Psychological Distress through Physical Activity. *International Journal of Kinesiology and Sports Science*, *8*(3), 36. https://doi.org/10.7575/aiac.ijkss.v.8n.3p.36

Schulz, K. F., Altman, D. G., Moher, D., & CONSORT Group (2010). CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. *Annals of internal medicine*, 152(11), 726–732. https://doi.org/10.7326/0003-4819-152-11-201006010-00232

Stanton, R., Rosenbaum, S., Lederman, O., & Happell, B. (2018). Implementation in action: how Australian Exercise Physiologists approach exercise prescription for people with mental illness. *Journal of Mental Health*, 27(2), 150–156. https://doi.org/10.1080/09638237.2017.1340627

Stubbs, B., & Rosenbaum, S. (2018). *Exercise-based interventions for mental illness: physical activity as part of clinical treatment*. Academic Press, an imprint of Elsevier.

Vella, S. A., Sutcliffe, J. T., Fernandez, D., Liddelow, C., Aidman, E., Teychenne, M., Smith, J. J., Swann, C., Rosenbaum, S., White, R. L., & Lubans, D. R. (2023). Context matters: A review of reviews examining the effects of contextual factors in physical activity interventions on mental health and wellbeing. *Mental Health and Physical Activity*, *25*. https://doi.org/10.1016/J.MHPA.2023.100520

*Appendices*

# Appendix A: Ethical Approval

THE UNIVERSITY OF WESTERN AUSTRALIA

**Human Ethics**
**Office of Research Enterprise**

The University of Western Australia
M459, 35 Stirling Highway
Crawley WA 6009 Australia

T +61 8 6488 3703 / 4703
F +61 8 6488 8775
E humanethics@uwa.edu.au

CRICOS Provider Code: 00126G

**Our Ref:** RA/4/20/6055

29 May 2020

Assistant Professor Ben Jackson
School of Human Sciences
MBDP: M408

Dear Professor Jackson

**HUMAN RESEARCH ETHICS APPROVAL - THE UNIVERSITY OF WESTERN AUSTRALIA**

***Assessing the feasibility and preliminary efficacy of an on-campus referral-based exercise program for students with mental health problems***

Ethics approval for the above project has been granted in accordance with the requirements of the *National Statement on Ethical Conduct in Human Research* (National Statement) and the policies and procedures of The University of Western Australia. Please note that the period of ethics approval for this project is five (5) years from the date of this notification. However, ethics approval is conditional upon the submission of satisfactory progress reports by the designated renewal date. Therefore initial approval has been granted from 29 May 2020 to 28 May 2021.

You are reminded of the following requirements:

1. The application and all supporting documentation form the basis of the ethics approval and you must not depart from the research protocol that has been approved.
2. The Human Ethics office must be approached for approval in advance for any requested amendments to the approved research protocol.
3. The Chief Investigator is required to report immediately to the Human Ethics office any adverse or unexpected event or any other event that may impact on the ethics approval for the project.
4. The Chief Investigator must submit a final report upon project completion, even if a research project is discontinued before the anticipated date of completion.

Any conditions of ethics approval that have been imposed are listed below:

**Special Conditions**

*None specified*

The University of Western Australia is bound by the *National Statement* to monitor the progress of all approved projects until completion to ensure continued compliance with ethical principles.

The Human Ethics office will forward a request for a Progress Report approximately 30 days before the due date.

If you have any queries please contact the Human Ethics office at humanethics@uwa.edu.au.

Please ensure that you quote the file reference – RA/4/20/6055 – and the associated project title in all future correspondence.

Yours sincerely

[redacted]

Manager, Human Ethics

| ***Name*** | ***Faculty / School*** | ***Role*** |
|---|---|---|
| Assistant Professor Ben Jackson | School of Human Sciences | Chief Investigator |
| Associate Professor Michael Rosenberg | School of Human Sciences | Co-Investigator |
| Dr Bonnie Furzer | School of Human Sciences | Co-Investigator |

***Student(s):*** Ivan Jeftic