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**Assessing the effectiveness of an exercise app:
An examination from the Health Action Process Approach**

A thesis
submitted in fulfilment
of the requirements for the degree
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Abstract

Exercise is beneficial for both physical and psychological wellbeing. Mobile software applications are a promising mode for initiation and maintenance of exercise but are under-studied.

This study examined the effectiveness of the Couch to 5k exercise app for initiating exercise for 17 participants with a mixed method design. Participants were examined using the app over a three month period. Scales from the Health Action Process Approach were utilised to explore relationships among constructs such as self-efficacy, planning and action control in relation to exercise initiation and behaviour. The DASS and SF-8 were used to examine mood and well-being, respectively. Amount of exercise completed over time was also recorded.

Overall, exercise increased within the sample. However, the researcher regarded the app as a starting point, as only one participant used the app for the entire usage period. For most participants, using the app prompted them to do exercise without the app and discover other options for exercise.

To improve the Couch to 5k app it was recommended that the guide to achieve running 5 kilometres extend to a period of 10-12 weeks instead of 8, consider combining the Couch to 5k app with the adjunct Couch to 10k app and use techniques to aid self-regulation and monitoring that smartphones are capable of such as accelerometry, GPS tracking and alerts and reminders.

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Introduction

Human beings have evolved to be active. Physical strength and endurance has played a pivotal role in the evolution of *Homo sapiens*. Early human beings needed to walk, run, carry, grasp and throw in order to hunt, gather and fight (Bouchard, Blair & Haskell, 2007). Without the ability to perform these essential physical demands, *Homo sapiens* would not have survived to present day. Human beings seem to function at their best when they lead a physically active lifestyle, however many people around the world do not engage in enough activity (Bouchard, Blair & Haskell, 2007).

Until modern times humans led physically demanding lives in order to grow food and create economic growth. However, during the 18th and 19th Century there was a shift towards encouragement of workers to be free from physically demanding work (Bouchard, Blair & Haskell, 2007). Since the industrial revolution and the creation of machines and tools to do daily jobs, work and transportation, physical activity on a global scale has dropped to a level where it is doing more harm than good. As a result of inactivity, rates of chronic disease have risen substantially (Bouchard, Blair & Haskell, 2007).

Exercise for the treatment and prevention of disease is an area of research that has grown in interest within the last 50 years. However, this concept is not new. Beliefs about physical activity promoting a healthy body and mind date back as early as 3000 BC (Bouchard, Blair & Haskell, 2007). Susruta, an Indian physician prescribed exercise to his patients in 600 BC. He told his patients that they should engage in activity of half the patients' capacity twice a day to make the body "stout, strong, firm, compact, and light which enhanced the growth of limbs and muscles, improved digestion and complexion, prevented laziness and reduced senility" (Tipton, 2014, p. 110).

Exercise as treatment was also a concept prevalent in ancient Greek society. Pythagoras, (570-490 BC) besides being an astronomer and mathematician, ran a 'philosophical medical centre' where he prescribed exercise to promote a healthy body and mind (Tipton, 2014). He believed that disease was caused by a disruption and lack of harmony between elements and tendencies of the body. To have the body working harmoniously he advised a programme of exercise, healthy diet, meditation and music (Tipton, 2014). Hippocrates (460-370 BC), is considered the father of preventive medicine and was known to prescribe exercise for physical and mental ailments (Bouchard, Blair & Haskell, 2007). Hippocrates, although not the first to prescribe

exercise to patients, was the first recorded physician to prescribe a written exercise prescription to cure 'consumption' (Tipton, 2014).

A connection between mind and body was at the forefront of treating ailments and disease in ancient times, however Descartes (1596-1650), a French philosopher, mathematician and scientist laid the groundwork for the positivist stance of the biomedical model (Mehta, 2011). The biomedical model encompasses the notion of mind-body dualism-a view that mind and body are separate entities (Mehta, 2011). The biomedical model has been considered the dominant means of promoting health in the Western world for some time and although it has been significant for treating and preventing many physical diseases and ailments, it has come under criticism for not considering health and wellness in a complete state (Mehta, 2011). Health and wellness are now considered more than the absence of physical disease or burden and encompass sound psychological, spiritual and social wellness in it's the definition (Mehta, 2011).

Mind-body therapies have increased in popularity among the Western world and are considered one of the most widely used techniques in complementary and alternative medicine (CAM) (Koithan, 2009). Some mind-body techniques are exercises of a physical nature, including tai chi, yoga and qigong and are often used to treat and prevent psychological disorders such as anxiety and depression (Koithan, 2009). The effects of vigorous aerobic and anaerobic exercise for treating and preventing physical disease and ailments has been known for some time, but within the last 20 years, more vigorous forms of exercise for treating and preventing psychological disorders has come into focus (Bouchard, Blair & Haskell, 2007).

Chapter 1: Literature Review

This chapter is an overview of the literature around various aspects relating to exercise. It is broken into four sections. The first section examines the benefits of exercise to the physical body as well as the benefits it can produce psychologically. The second section outlines recommended exercise dosage and variables associated with exercise. The third section is an overview of facilitators and barriers to exercise initiation and maintenance as well as an outline of popular health behaviour change models for exercise. The fourth section is an exploration of the use of technology to initiate and maintain exercise, in particular looking at mobile software applications.

Physical Health Benefits of Exercising

An inactive lifestyle is known to increase the risk of developing chronic physical diseases such as cardiovascular disease, hypertension, metabolic syndrome, diabetes, obesity and even some cancers. Therefore leading an active lifestyle by engaging in regular exercise can help to treat and even prevent chronic physical conditions that can be detrimental to people's lives (Warburton, Nicol & Bredin, 2006).

Cardiovascular disease and exercise.

Cardiovascular disease is a leading cause of mortality worldwide. It is predicted that by the year 2020, cardiovascular disease will be responsible for 25 million deaths around the globe (Agarwal, 2012). Particularly in industrialised countries, chronic diseases such as heart disease are a major burden upon society, notably on health-care systems (Agarwal, 2012; Vuori, 2007). Cardiovascular disease encompasses all aspects of heart-related disease including coronary heart disease, angina, myocardial infarction and hypertension (Bouchard, Blair & Haskell, 2007). These heart diseases generally develop due to an accumulation of plaque in the arteries that sustain the operation of the heart, leading to impairment of the pump function. This puts pressure on the heart, which can lead to a fatal or non-fatal heart attack (Vuori, 2007).

Cardiovascular disease is largely preventable. A strong body of evidence shows that a sedentary lifestyle is associated with a substantially higher risk for developing heart disease (Agarwal, 2012; Vuori, 2010). Sedentary behaviours such as sitting for long periods of time, excessive television watching and computer use are considered one of the leading causal risk factors for developing cardiovascular disease (Vuori, 2007; Vuori, 2010). Despite, the benefits of exercising, many people remain insufficiently active

(Agarwal, 2012). Exercising, or even leading a more active lifestyle is an inexpensive and efficacious way of preventing heart disease (Agarwal, 2012). Observational studies have shown that people who exercise frequently and lead more active lifestyles are at lower risk of cardiovascular morbidity compared to those who lead more sedentary lifestyles (Vuori, 2007). Exercising is beneficial for both preventing the onset of cardiovascular disease as well as to abate or reverse the disease (Warburton, Nicol & Bredin, 2006).

Hypertension, or high blood pressure is the most common risk factor for developing cardiovascular disease (Bouchard, Blair & Haskell, 2007; Kokkinos & Myers, 2010). Being overweight and a lack of physical activity are major risk factors for developing hypertension (Vuori, 2007; Kokkinos & Myers, 2010). Meta-analyses of randomised controlled trials of at least 8 weeks show that physical activity lowers elevated blood pressure, decreasing hypertension (Lakka & Laaksonen, 2007). Even a single bout of exercise can lower blood pressure for up to 20 hours (Vuori, 2007).

Metabolic Syndrome, Diabetes, Obesity and Exercise.

Overweight and obesity have become a worldwide epidemic. More than 1 billion adults are overweight and 300 million are obese globally (Vuori, 2007). Overweight, obesity, metabolic syndrome and diabetes are closely linked, with the latter conditions usually being caused by being overweight (Lakka & Laaksonen, 2007). Increased body fat is linked with a sedentary lifestyle which is a main causal factor for unhealthy weight gain (Bishop-Bailey, 2013; Kokkinos & Myers, 2010). Aerobic fitness and a sufficient amount of physical activity decrease the risk of becoming overweight, thus reducing the risk of developing metabolic syndrome or type 2 diabetes (Lakka & Laaksonen, 2007).

Metabolic syndrome (MetS) can be caused from a variety of unhealthy lifestyle factors such as a poor diet and a lack of physical activity, which leads to overweight or obesity. Obesity, particularly abdominal obesity can give rise to pre-diabetic conditions such as insulin resistance, as well as other conditions such as hypertension, high triglyceride levels and inflammation. As a consequence, MetS can then develop into type 2 diabetes and/or cardiovascular disease (Lakka & Laaksonen, 2007). However, physical activity and exercise can reduce or reverse the prominent features of MetS. A sufficient amount of exercise can result in weight loss as well as improve insulin sensitivity, decrease triglyceride levels and lower blood pressure (Lakka & Laaksonen, 2007).

Type 2 Diabetes is a consequence of metabolic syndrome and obesity. It is a chronic disorder characterised by the body's impaired ability to regulate blood glucose

levels due to an impairment in insulin secretion or insulin action (Bouchard, Blair & Haskell, 2007). Type 2 diabetes is also largely preventable. Having a healthy diet and engaging in sufficient levels of exercise can prevent the onset of type 2 diabetes as well as reverse the already existing condition (Lakka & Laaksonen, 2007; Warburton, Nicol & Bredin, 2006; Kokkinos & Myers, 2010). Many observational studies show that an increased amount of physical activity and exercise is associated with a much lower risk of developing type 2 diabetes (Lakka & Laaksonen, 2007). A randomised controlled trial assessing the effectiveness of a lifestyle intervention, which included at least 150 minutes of moderate physical activity per week proved to be more effective than metformin alone, a medication used to control type 2 diabetes for people who had, or were at high risk of developing type 2 diabetes (Knowler, Barrett-Connor, Fowler, Hammin, Lachin, Walker & Nathan, 2002).

Psychological Benefits of Exercising

As well as proving efficacious for preventing and reversing serious chronic health conditions, exercising can have a positive effect on mental and emotional well-being (Bouchard, Blair & Haskell, 2007). Exercise for the treatment and prevention for psychological disorders, notably Major Depressive Disorder, has become an extensive area of research within the last two decades (Wolff, Gaudlitz, von Lindenberger, Plag, Heinz & Strohle, 2011). Exercise is now seen as an effective modality for alleviating symptoms of prominent psychological disorders such as depression and anxiety as well as stress (Strohle, 2009). As well as exercise proving effective in alleviating symptoms of clinical psychological disorders it is also linked with improving internal psychological factors such as self-esteem and body-satisfaction (Herring, Lindheimer & O'Connor, 2013).

Exercise and Depressive Disorders.

According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), depressive mood disorders can encompass Major Depressive Disorder (MDD) including major depressive episode and Dysthymia, also known as persistent depressive disorder (American Psychiatric Association, 2013). The main characteristics of these depressive mood disorders are feelings of sadness and irritability, resulting in somatic and cognitive complaints. Some prominent features of these mood disorders are feelings of sadness almost all of the time for a period of at least 2 weeks, feelings of worthlessness, changes in sleep patterns (insomnia or hypersomnia) as well as fatigue.

These symptoms can have a significant negative effect on daily functioning (American Psychiatric Association, 2013).

Exercise and the preventive and mediating effects on depression is a growing body of literature (Knubben, Reichies, Adli, Schlattman, Bauer & Dimeo, 2007). Hundreds of studies on the topic have been published since the early 1990's (Rethorst, Wipfli & Landers, 2009). A significant amount of research has found a positive relationship with exercise and the alleviation of depressive symptoms (Daley, 2008). Reviews on exercise and depression have shown consistently positive effects. It has been shown that exercise for the treatment of depression is better than no treatment at all and is as effective as traditional treatments such as psychotherapy (Daley, 2008). In terms of prevention, cross-sectional studies have consistently shown that people who are more physically active have lower levels of depression (Salmon, 2001).

Although it is clear that exercise has a positive effect for the treatment and prevention of depression and depressive symptoms, the authors of reviews state that the effects should still be regarded with caution, mainly due to flaws in methodology (Daley, 2008). Daley (2008) states that many studies and reviews use observational methodology and non-randomised controlled trials. Randomised controlled-trials are considered the most accurate way to determine a causal relationship between variables. When studies assessing the effects of exercise on depression do not use this methodology, it is difficult to determine a cause and effect relationship (Singh, Kumar & Sarkar, 2011). However, even when randomised controlled trials (RCT's) are implemented, methodological flaws are still encountered. Blinding, inadequate control groups, and use of volunteers in studies have all been factors that have been criticised within exercise and mental health literature (Wolff et al., 2011; Faulkner & Biddle, 2004).

Blinding refers to the concealment of experimental conditions (Singh, Kumar & Sarkar, 2011). In other words, the participants are unaware of what intervention or treatment they are receiving to reduce the chance of participant or researcher observation bias (Singh, Kumar & Sarkar, 2011). Blinding is very difficult to do within exercise and mental health research as it is difficult to conceal the exercise condition. Participants become aware that they have been assigned to the group receiving exercise as treatment and then it is difficult to determine whether any changes in mood are due to the exercise itself or the expectation that exercise will have an effect and act

accordingly (Wolff et al., 2011; Singh, Kumar & Sarkar, 2011). Inadequate control groups have also come under scrutiny within the exercise and depression literature. Many studies have assigned the control group to a less vigorous form of exercise such as yoga or tai chi, in comparison to the experimental group (Josefsson, Lindwall & Archer, 2014). Yoga, tai chi and other forms of stretching and slow moving forms of exercise have mindfulness, relaxation and deep breathing components incorporated in them which are known to have an antidepressive effect. Therefore it is impossible to assess whether the assigned exercise regime has an antidepressive effect when compared to something that is also likely to produce a significant positive effect on mood (Josefsson, Lindwall & Archer, 2014). Using volunteers as participants in research assessing the effects of exercise on depression has also been criticised. It is likely that depressed people volunteering themselves for research are already considering change, as opposed to a depressed in-patient not actively seeking help. The results and effects of exercise between these two groups could be significantly different (Faulkner & Biddle, 2004).

Although methodological flaws have been noted within studies assessing the effectiveness of exercise for depression, there is growing consensus that exercise has a positive effect on depressive symptoms. Several good-quality RCTs have shown that exercise has an anti-depressive effect on depressed people. Josefsson, Linwall and Archer (2014) used RCTs in their meta-analysis and systematic review and concluded that exercise results in a reduction of depression. Rethost, Wipfli and Landers (2009) also found a significant positive effect of .80 for exercise in the treatment and reduction of depressive symptoms in their meta-analysis containing 58 randomised controlled trials. Within this meta-analysis it was found that exercise effects were greater for clinically depressed people compared with normal population and longer exercise bouts and intervention periods had a greater effect on clinically depressed participants, suggesting a dose-response relationship (Rethost, Wipfli & Landers, 2009).

Exercise and anxiety.

According to the DSM-5, anxiety disorders encompass disorders where there is persistent fear or anxiety about a perceived or immediate threat (American Psychiatric Association, 2013). Fear is an emotional response to an immediate situation or experience and anxiety is apprehension about a future event or situation (American Psychiatric Association, 2013). Characteristics of anxiety disorders often include muscle tension, worry, irritability, fatigue and avoidance behaviours (American Psychiatric Association, 2013; Herring, Jacob, Suveg & O'Connor, 2011). Examples of the most

typical anxiety disorders within the DSM-5 are Social Anxiety Disorder (SAD) which is characterised by fear or anxiety about social situations, Panic Disorder, a disorder characterised by unexpected and frequent panic attacks occurring from an anxious or a calm state and Generalised Anxiety Disorder (GAD) which is excessive fear and worry about a number of daily events such as work or school (American Psychiatric Association, 2013). Anxiety disorders are the most commonly occurring psychiatric condition worldwide and are very debilitating for people experiencing them (Herring, Lindheimer & O'Connor, 2013; Stonerock, Hoffman, Smith & Blumenthal, 2015).

Unlike the extensive research on the antidepressive effects of exercise, fewer studies have been conducted on the anxiolytic effects of exercise. Therefore less is known about exercise and the effects on anxiety disorders and anxiety symptoms (Stonerock et al., 2015). Meta-analyses, reviews and RCT's have produced mixed findings, with some studies reporting exercise as a promising potential treatment for some anxiety disorders, whereas others do not support exercise as treatment for anxiety disorders and anxiety-related symptoms (Herring, Lindheimer & O'Connor, 2013; Bartley, Hay & Bloch, 2013).

Despite less research on the effects of exercise on anxiety in comparison to depression, many studies do report positive effects and advocate for exercise in the reduction of already present anxiety symptoms and anxiety prevention (Herring, Lindheimer & O'Connor, 2013; Smits, Berry, Rosenfield, Powers, Behar & Otto, 2008; Stonerock et al., 2015). It has been noted that adults who engage in regular exercise are less likely to be diagnosed with an anxiety disorder compared to their sedentary counterparts (Stonerock et al., 2015). Other studies have reported positive effects for reducing anxiety sensitivity and alleviating symptoms of already diagnosed anxiety disorders (Smits et al., 2008; Broman-Fulks, Berman, Rabian & Webster, 2004; Herring et al., 2011). Anxiety sensitivity is regarded as a precursor to panic attacks and panic disorder and is characterised by a heightened sensitivity toward anxiousness (Broman-Fulks et al., 2004). It has been shown that both low and high intensity exercise is effective for lowering anxiety sensitivity, but high intensity exercise results in more rapid reductions (Broman-Fulks et al., 2004). Smits et al. (2008) also found that a 2-week exercise intervention lowered anxiety sensitivity in participants with heightened anxiety levels and results were clinically significant in comparison to the waitlist condition. Herring et al. (2011) also concluded that both resistance and aerobic exercise is an appropriate mechanism for the reduction in the symptoms of GAD, including irritability,

anxiety and low vigour. However, less is known about other anxiety disorders such as SAD and specific phobias and more research is required in these areas (Herring, Lindheimer & O'Connor, 2013).

Although there is some benefit for exercise and the reduction of anxiety-related symptoms, some studies state that it is difficult to draw any definitive conclusions (Stonerock et al., 2015; Bartley, Hay & Bloch, 2013). This is largely due to similar issues with depression and exercise literature in terms of conducting well-designed RCT's. Issues with blinding resulting in potential researcher and participant observation bias, inadequate control groups and a lack of clinically diagnosed anxiety disorders used within studies are all methodological shortcomings within the current exercise and anxiety literature (Stonerock et al., 2015). Another shortcoming of anxiety and exercise research is excessive heterogeneity of anxiety and exercise variables which makes conducting meta-analyses and drawing conclusions very difficult (Stonerock et al., 2015; Bartley, Hay & Bloch, 2013). Due to these issues and a lack of studies conducted within this area, it is difficult to determine a cause and effect relationship for the effect of exercise upon anxiety disorders and anxiety-related symptoms (Stonerock et al., 2015). Bartley, Hay and Bloch's (2013) meta-analysis consisting of seven RCT's comparing the anxiolytic effects of exercise with other treatments such as pharmacotherapy or psychotherapy for DSM-IV diagnosed anxiety disorders, did not find a significant benefit for using exercise as a primary treatment for anxiety disorders. They did however state that exercise may still be beneficial as an adjunctive treatment. There is clear consensus that more research needs to be conducted examining the anxiolytic effects of exercise (Herring, Lindheimer & O'Connor, 2013; Stonerock et al., 2015; Broman-Fulks et al., 2004).

Exercise and stress.

Stress is not a psychological disorder, but is considered a precursor or a component of many psychological disorders and physical diseases (Coulter, Dickman & Maradiegue, 2009). Defining stress is difficult and there is no universal definition of the word (Goodnite, 2014; Stults-Kolehmainen & Sinha, 2014). However, stress can be described as an unpleasant or overwhelming feeling resulting from an individual's perception that the demands of their environment are too great to deal with or control which threatens homeostasis (Goodnite, 2014; Stults-Kolehmainen & Sinha, 2014). Stress occurs from a combination of environmental and cognitive factors which then

results in an affective and physiological response (Goodnite, 2014; Stults-Kolehmainen & Sinha, 2014).

Experimental evidence for the effects of exercise on stress is limited (Stults-Kolehmainen & Sinha, 2014). The research that has been conducted in this area however, has resulted in inconsistent findings (Stults-Kolehmainen & Sinha, 2014). Stults-Kolehmainen and Sinha (2014) stated in their review of stress and exercising that RCT's have determined that exercising can help with the reduction of stress and stress symptoms. However, the majority of research has concluded that exercise only has an effect on stress reduction for people who have been in a consistent exercise regime for 6 months or more (Lutz, Stults-Kolehmainen & Bartholemew, 2010). It has been found that people who habitually engage in exercise will increase the duration and intensity of exercise when faced with stressful circumstances, whereas people who are not habitual exercisers will avoid engaging in this behaviour when stressed (Lutz, Stults-Kolehmainen & Bartholemew, 2010; Stults-Kolehmainen & Sinha, 2014). Avoidance of exercise behaviour among non-habitual exercisers when stressed may be because exercise seems burdensome. It may be perceived as one more thing that needs to be done along with other daily demands (Stults-Kolehmainen & Sinha, 2014). This is particularly true among women who have work, mothering and household duties to perform (Stults-Kolehmainen & Sinha, 2014; Coulter, Dickman & Maradiegue, 2009).

Summary.

It is clear that there are many benefits for leading an active lifestyle and engaging in regular exercise. Exercising is a highly beneficial mechanism for preventing and reversing already present physical conditions such as heart disease, hypertension, obesity, metabolic syndrome and type 2 diabetes. Reversing and preventing these conditions can significantly improve longevity and quality of life. Exercising can also improve psychological wellbeing, with a clear relationship between exercise preventing and reducing depression. However, a prominent concern within the exercise and depression literature is a lack of good-quality studies and RCT's which makes it difficult to determine a robust cause-and-effect relationship between these variables. This concern is also present within the anxiety and exercise literature. Much less is known about the anxiolytic effects of exercise, and it is much harder to determine a cause-and-effect relationship due to the heterogeneity among anxiety disorders. Currently, exercise is seen as a promising adjunct therapy for some anxiety disorders, but more research is needed. Even less is known about the effects of exercise upon stress.

Although it seems as though exercise is effective for mitigating the effects of stress, research suggests this only to be the case for habitual exercisers.

How much is enough exercise?

It is clear that exercise is highly beneficial for physical and mental health. However, the recommended amount of exercise needed for satisfactory physical and mental health has been subject to changes over the last 40 years (US Department of Health and Human Services, 1995). Leading health and fitness reports, including the Surgeon General Report and recommendations from the Centres of Disease Control and Prevention and the American College of Sports Medicine published in the early 1990's form the basis of current exercise and physical activity guidelines for health and fitness in developed countries. Within these reports, exercise and physical activity variables are outlined, including definitions and appropriate exercise dosage.

Aerobic vs. anaerobic exercise.

Aerobic and resistance exercise are two different forms of exercising that are both beneficial in different ways for health and wellbeing (US Department of Health and Human Services, 1996). Aerobic exercise refers to exercise that effects and strengthens the capacity of the cardiorespiratory system (US Department of Health and Human Services, 1996). Aerobic exercise includes activities such as brisk walking, running, jumping and many sports where breathing becomes heavy and the heart pumps quickly (Bouchard, Blair & Haskell, 2007). Aerobic exercise improves cardiorespiratory fitness which essentially is the amount of time before one becomes fatigued from exercise of this nature (Bouchard, Blair & Haskell, 2007). Aerobic exercise is beneficial for heart health and weight management (Bouchard, Blair & Haskell, 2007).

Anaerobic exercise, or resistance exercise refers to exercise where the aim is to build muscular strength and endurance (US Department of Health and Human Services, 1996). Exercises of this nature includes lifting weights, or using own body weight for resistance while performing repetitive movements (Bouchard, Blair & Haskell, 2007). Heavier loads used for low repetitions (3-6) are used to build muscular strength and muscle mass. Lighter loads used for more repetitions (10-20) are performed to increase muscular endurance and power (Bouchard, Blair & Haskell, 2007). Resistance training is beneficial for people of any age and can increase balance, decrease falls, reduce body fat and improve heart function (Blair, Bouchard & Haskell, 2007).

Physical activity and exercise-what's the difference?

The terms physical activity and exercise are often used synonymously, yet there are distinctions in their meanings (US Department of Health and Human Services, 1996). Physical activity refers to bodily movements which result in energy expenditure, but not at a high intensity (Pate et al., 1995). Determining whether an activity is physical activity or exercise largely depends on the context it occurs. Physical activity within occupational, household or transportation settings is classed as the term physical activity as it is not being carried out on the basis to improve fitness (US Department of Health and Human Services, 1996). Exercise however, is performed with the intention to improve physical fitness and is performed in one's leisure time. It is generally planned, structured and repetitive with the sole purpose of gaining or maintaining strength and fitness (US Department of Health and Human Services, 1996).

Exercise and physical activity are both beneficial for maintaining or improving health and wellness (Dubbert, 2002). Becoming more physically active in day-to-day living can improve health. Changes such as taking the stairs as opposed to the elevator or walking or cycling to work are lifestyle changes that can have a significant positive impact on health and can make a person go from having a sedentary lifestyle, to a physically active one (US Department of Health and Human Services, 1996). However, if larger improvements in health or fitness are wanted to be achieved, longer, more intense exercise sessions need to be incorporated into one's life (US Department of Health and Human Services, 1996).

How much exercise is needed for physical health?

During the 1970's, a report from the American College of Sports Medicine recommended that aerobic exercise should be performed at a high intensity 3-5 times per week in order to achieve optimum health and fitness (Dubbert, 2002). However, it was recognised that only a small proportion of adults were able and willing to meet these guidelines (Dubbert, 2002). During the 1990's a shift occurred from high-intensity aerobic exercise being viewed as the only way to achieve optimum health and fitness, to moderate aerobic and resistance exercise that can easily be incorporated into daily-life recognised as beneficial. This is due to a significant amount of research concluding that a regular amount of moderate exercise was still effective for improving health and wellness and more manageable than high-intensity exercise (Dubbert, 2002).

The most current recommended exercise dosage is outlined in reports such as the Report from the Surgeon General (US Department of Health and Human Services, 1996), and a recommendation from the Centres of Disease Control and Prevention and the American College of Sports Medicine (Pate et al., 1995). These reports state that in order to achieve health and wellness, adults should be engaging in 30 minutes of moderate intensity exercise on most, if not all days of the week (US Department of Health and Human Services, 1996; Pate et al., 1995). In order to achieve the required 30 minutes of moderate exercise per day, short bouts of exercise or physical activity accumulated throughout the day is still seen as beneficial (US Department of Health and Human Services, 1996; Pate et al., 1995). Two sessions of resistance exercise per week is also recommended to maintain or improve musculoskeletal fitness (US Department of Health and Human Services, 1996; Pate et al., 1995). However, it is stated that those that wish to achieve greater health and fitness benefits should engage in more vigorous exercises for a longer period of time per day (US Department of Health and Human Services, 1996; Pate et al., 1995).

How much exercise is needed for improvements in psychological wellbeing?

The recommended exercise dose for improvements in psychological well-being is much less clear than it is for physical health (Stanton & Reaburn, 2014; Ensari, Greenlee, Motl & Petruzzello, 2015). The dose-response relationship with exercise and the reduction of symptoms related to psychological disorders is studied most frequently among populations with depression and depressive symptoms. Thus more is known about the appropriate exercise dosage for depression than there is for anxiety and stress (Ensari et al., 2015).

Stanton and Reaburn (2014) performed a meta-analysis of 12 publications which all examined the effectiveness of an exercise intervention on depression. Articles included in the meta-analysis ranged in intervention length, number of days per week and duration of exercise. The authors concluded that 3-4 exercise sessions per week at a moderate intensity for around 30-40 minutes for 9 weeks is beneficial for the treatment of depression. However, it was also noted that interventions ranging between four and 12 weeks have an effect, but interventions of longer duration are most beneficial, suggesting a cumulative effect of exercise upon the alleviation of depression. Following on from this point, there is some research to suggest that initial acute exercise results in a negative effect among people who have depression who are not regular exercisers.

Weinstein, Deuster, Francis, Beadling and Kop (2010) found that immediately after an exercise bout, depressed individuals had an alleviated mood; however 30 minutes after the exercise bout their mood dropped below baseline. This phenomenon is one possible explanation as to why depressed people often do not persevere with an exercise regime (Weinstein et al., 2010).

Research examining the effects of exercise on depression has frequently used aerobic exercise to test this effect. As a result, less is known about the effects of resistance training on depression (Stanton, Reaburn & Happell, 2013). However, within their review Stanton, Reaburn and Happell (2013) concluded that there is evidence to suggest that both resistance and aerobic exercise are effective either in combination or independently for the alleviation of depressive symptoms. Moreover, there is some research that shows exercise of preferred intensity in comparison to prescribed intensity is more beneficial for alleviating depressive symptoms and for exercise adherence (Callaghan, Khalil, Morres & Carter, 2011; Stanton & Reaburn, 2014).

There is considerably less research on the effects of exercise and anxiety, therefore little is known about the dose-response relationship and exercise variables for exercise on anxiety symptom reduction (Ensari et al., 2015). However, in Ensari et al.'s (2015) recent meta-analysis of 36 RCT's it was concluded that acute exercise has a small but statistically significant effect on state anxiety. Although this positive effect was found, it was noted that methodological flaws in the included RCT's make it difficult to determine a robust effect for acute exercise.

Summary.

American health and fitness reports including the Surgeon General Report and recommendations from the Centres of Disease Control and Prevention and the American College of Sports Medicine created in the mid-1990's, form the basis of current physical activity and exercise guidelines in developed countries. Thirty minutes of moderate intensity exercise per day is the current recommendation for maintaining health and wellness. Exercise recommendations for maintaining or improving psychological wellbeing is harder to determine. Currently, 3-4 sessions of exercise per week is considered beneficial for the treatment of depression.

Exercise-why we do, and why we don't

Despite the known benefits of exercising or having a physically active lifestyle the number of adults around the globe that do not engage regularly in exercise is vast. Thirty one percent of the world's population are not meeting minimum physical activity requirements (Kohl, Craig, Lambert, Inoue, Alkandari, Leetongin & Kahlmeier, 2012). Although most adults are aware of the benefits exercising can provide, many people find it difficult to initiate and then maintain an exercise regime. It is reported that as many as 50 percent of adults drop out of an exercise regime within 6 months of starting (Dishman, 2001). This is a phenomenon that has interested exercise psychologists for decades (Biddle & Mutrie, 2008).

Common exercise barriers.

There is a paucity of research examining why people lapse or dropout of exercising. Instead, most research focussed on those who maintain their exercise scheme (Kinnaick, Thogersen-Ntoumani & Duda, 2014). However, common barriers for initiating and maintaining an exercise regime have been examined (Brinthaup, Kang & Anshel, 2010). The most commonly reported barriers among various studies include inaccessibility of exercise facilities, poor health (Brinthaup, Kang & Anshel, 2010; Ebben & Brudzynski, 2008; Dishman, 2001) and lack of time (Brinthaup, Kang & Anshel, 2010; Dishman, 2001).

Research examining barriers to exercise participation frequently find that lack of time is the most common barrier cited (Pridgeon & Grogan, 2012; Dishman, 2001; Brinthaup, Kang & Anshel, 2010; Ebben & Brudzynski, 2008). Lack of time also includes having competing responsibilities, demands and conflicts which limit time to engage in exercise (Brinthaup, Kang & Anshel, 2010; Ebben & Brudzynski, 2008). This barrier is reported across a wide range of populations studied, such as college students (Ebben & Brudzynski, 2008), hypercholesterolemic men (Coghill & Cooper, 2009), unfit, non-exercisers (Brinthaup, Kang & Anshel, 2010), women with low income (Hoebeker, 2008), obese women (Leone & Ward, 2013) and people at risk of type 2 diabetes (Korkiakangas, Alahuhta, Husman, Keinanen-Kiukaanniemi, Taanila & Laitinen, 2011). However, lack of time is most commonly reported among women, especially working women with children (Moreno & Johnston, 2014). Women are more likely than men to fall below recommended exercise levels due to work and child-care responsibilities, thus limiting their time to do exercise (Moreno & Johnston, 2014).

Another common barrier to exercise participation is fatigue. Research shows that among varying populations many report that they are often too tired to do any exercise throughout the day (Korkiakangas et al., 2011; Hoebeke, 2008). In some studies examining barriers for exercising, fatigue or lack of energy was referred to the concept of 'laziness' by participants (Ebben & Brudzynski, 2008; Hoebeke, 2008). Although laziness is not a common barrier frequently reported among many studies, this was a factor admitted frequently among a sample of American college students (Ebben & Brudzynski, 2008). Laziness was also a barrier reported by low income American women (Hoebeke, 2008). Laziness was explained to occur due to feeling too tired after performing daily demands within both of these populations (Ebben & Brudzynski, 2008; Hoebeke, 2008).

Although lack of time and lack of energy are two of the most commonly reported barriers to exercise engagement, there are also many other common barriers that have been examined. Some of these barriers include, lack of enjoyment including discomfort or difficulty while exercising such as shortness of breath (Moreno & Johnston, 2014; Hoebeke, 2008; Ebben & Brudzynski, 2008; Pridgeon & Grogan, 2012), limited or no access to exercise facilities including not enough money to pay for gym memberships (Dombrowski, 2011; Dishman, 2001; Ebben & Brudzynski, 2008; Hoebeke, 2008), poor weather such as extreme cold or heat, rain and wind that limits outdoor exercise participation (Korkiakangas et al., 2011; Hoebeke, 2008) and lack of social support or company while doing exercise (Pridgeon & Grogan, 2012; Ebben & Brudzynski, 2008; Hoebeke, 2008). Among females other common barriers include lack of confidence to do exercise or stick to an exercise programme (Dombrowski, 2011), poor body image including the thought that they are too fat to exercise and people will judge them while exercising (Moreno & Johnston, 2014; Leone & Ward, 2013) and lack of child care which limits the ability to do exercise without disruption (Hoebeke, 2008).

Common facilitators for exercising.

Despite there being a number of barriers toward exercise participation, there is also a multitude of facilitators commonly noted among exercise adherers (Ebben & Brudzynski, 2008). Facilitators for exercising can broadly be broken down into extrinsic and intrinsic motivators. Extrinsic motivation is defined as motivation that is contingent on an external source, such as rewards or pleasing others (Buckworth, Lee, Reganc, Schneidherd & DiClemente, 2007). Intrinsic motivation, on the other hand, is motivation from an internal source, such as doing something purely for personal pleasure and

satisfaction (Buckworth et al., 2007). Although extrinsic motivators may be reasons for someone adopting an exercise regime initially, it is more likely that intrinsic motivators will be the reasons one maintains an exercise regime for the long term (Buckworth et al., 2007; Huberty, Ransdell, Sidman, Flohr, Shultz, Grosshans & Durrant, 2008).

A common intrinsic facilitator for exercise adoption and maintenance reported among various studies is the desire to be fit and healthy (Ebben & Brudzynski, 2008; Korkiakangas et al., 2011; Coghill & Cooper, 2009; Bauman, Reis, Sellis, Wells, Loos & Martin, 2012). Motivation to do exercise for health and fitness is a factor that is common among a diverse range of populations including people who are moderately healthy, to those that are unhealthy. This factor has been noted among American college students (Ebben & Brudzynski, 2008), men with high cholesterol (Coghill & Cooper, 2009) as well as people at risk of type 2 diabetes (Korkiakangas et al., 2011).

Another intrinsic facilitator that is commonly noted among research examining adherence and dropout from exercise is enjoyment (Leone & Ward, 2013; Ebben & Brudzynski, 2008; Korkiakangas et al., 2011). Although enjoyment is not normally experienced at the beginning of exercise adoption for previous non-exercisers, as time goes on enjoyment tends to be the factor that facilitates maintenance of this health behaviour (Buckworth et al., 2007). It was noted within Leone and Ward's (2013) study of exercise among obese women that the women interviewed began to exercise more as time went on as they found it easier and more enjoyable. This was a similar finding in Korkiakangas et al.'s (2011) research with people at risk of type 2 diabetes. Many of the participants in this study said that the more one exercised, the more enjoyable it became. Enjoyment was often mediated by personal successes the participants noted with their exercise regime.

Health and fitness and enjoyment are the two most common facilitators for exercise adoption and maintenance; however, there are other factors that are also facilitators for exercising. These include self-efficacy, the belief that you can do something even when faced with setbacks (Biddle & Mutrie, 2008; Carpenter, 2008; Bauman et al., 2012; Huberty et al., 2008); as well as self-worth (Huberty et al., 2008); monitoring and self-regulation such as goal setting (Huberty et al., 2008; Coghill & Cooper, 2009); and social support, including support and encouragement from others as well as exercise partners (Korkiakangas et al., 2011; Ebben & Brudzynski, 2008).

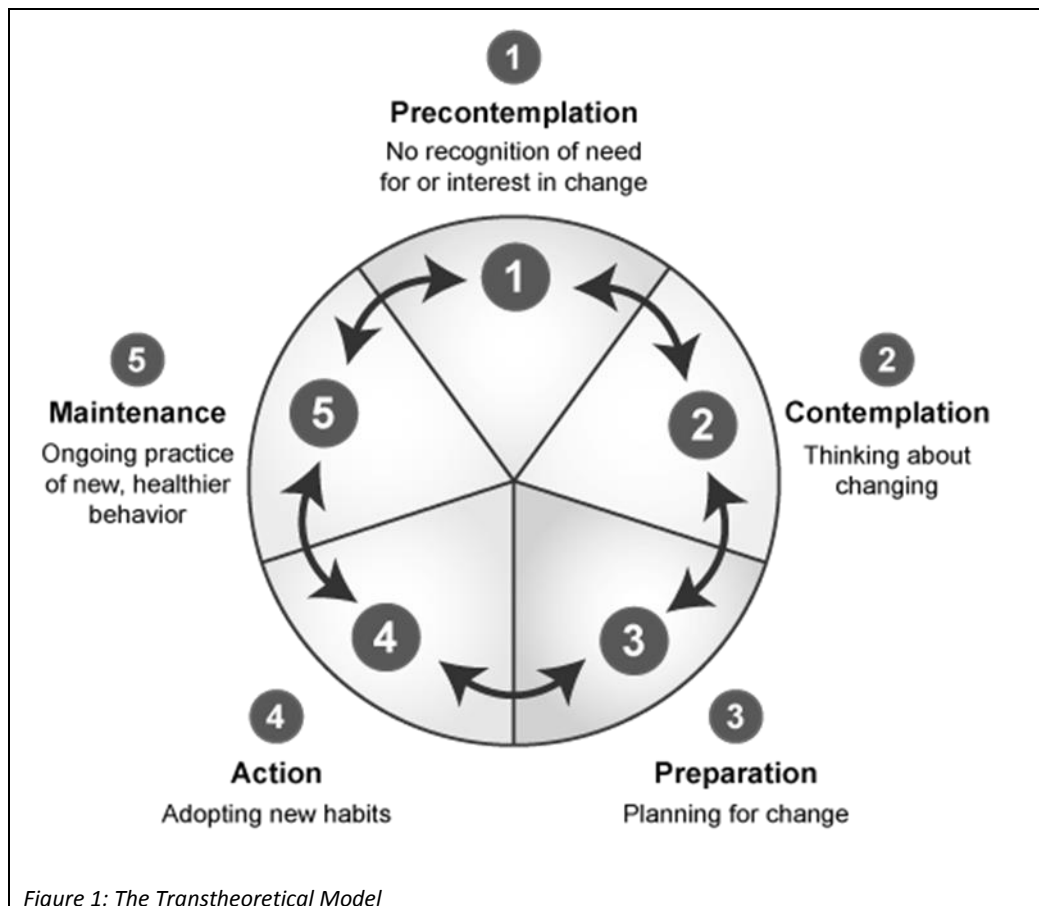
Health Behaviour Change Models

Health behaviour change models are frameworks which explain varying stages of change for people intending to adopt a health behaviour or cease an unhealthy behaviour (Nieuwenhuijsen, Zemper, Miner & Epstein, 2006). Many models have been created which identify or explain stages of change for things such as therapeutic change or smoking cessation (DiClemente, 2007). Some models have recently been adapted to explain the adoption and maintenance of exercise (Biddle & Mutrie, 2008). The most common health behaviour change models used to explain the adoption and maintenance of exercise are the transtheoretical model, the theory of planned behaviour and the health action process approach (Biddle & Mutrie, 2008).

The Transtheoretical Model.

The transtheoretical model (Prochaska & DiClemente, 1983) is a stage-based model for describing and understanding health behaviour change. It is an eclectic model, incorporating various aspects of behaviour change theories (DiClemente, 2007). Originally the model was used to describe readiness and the process of change in smoking cessation, but has more recently been applied to other health behaviours such as the adoption of exercise (Marshall & Biddle, 2001).

The transtheoretical model has five stages that describe the change process. These are: precontemplation, contemplation, preparation, action and maintenance (DiClemente, 2007). In the precontemplation stage, a person is not thinking about change, or in terms of exercising, is not thinking about becoming more active. Contemplation is the stage where a person is starting to think about perhaps adopting a particular health behaviour, such as becoming physically active within the next 6 months. In the preparation stage, a person has started to take small steps toward starting the behaviour (such as exercising) like planning it out, but is still not engaging in the behaviour. Action is the point in the model where the person is actively engaging in the chosen health behaviour, but only within the past 6 months. Maintenance is the stage where the person has been engaging in the health behaviour for 6 months or more and it has become a habitual part of their everyday life (Armitage, 2009; DiClemente, 2007; Marshall & Biddle, 2001).



There are three components considered to mediate the change process in the transtheoretical model. These factors are processes of change, decisional balance and self-efficacy (Marshall & Biddle, 2001). Processes of change are affective, cognitive and behavioural strategies to induce change (Biddle & Mutrie, 2008). Prochaska and DiClemente describe 10 strategies, with consciousness raising, dramatic relief, self-reevaluation, social-reevaluation and social liberation being the five cognitive strategies and environmental reevaluation, relationship fostering, counterconditioning, contingency management and stimulus control being the other five behavioural strategies (Prochaska & Marcus, 1994; Biddle & Mutrie, 2008).

Decisional balance is about weighing up potential advantages and disadvantages of adopting the health behaviour in question, such as exercising (Biddle & Mutrie, 2008). A person is likely to think about potential benefits and costs to self and others when deciding whether to adopt the health behaviour (Prochaska & Marcus, 1994). In the beginning stages, such as in contemplation and preparation, studies have shown that cons outweigh the pros in the decision making process (Prochaska & Marcus, 1994; Biddle & Mutrie, 2008). This suggests that influencing people's judgements about the

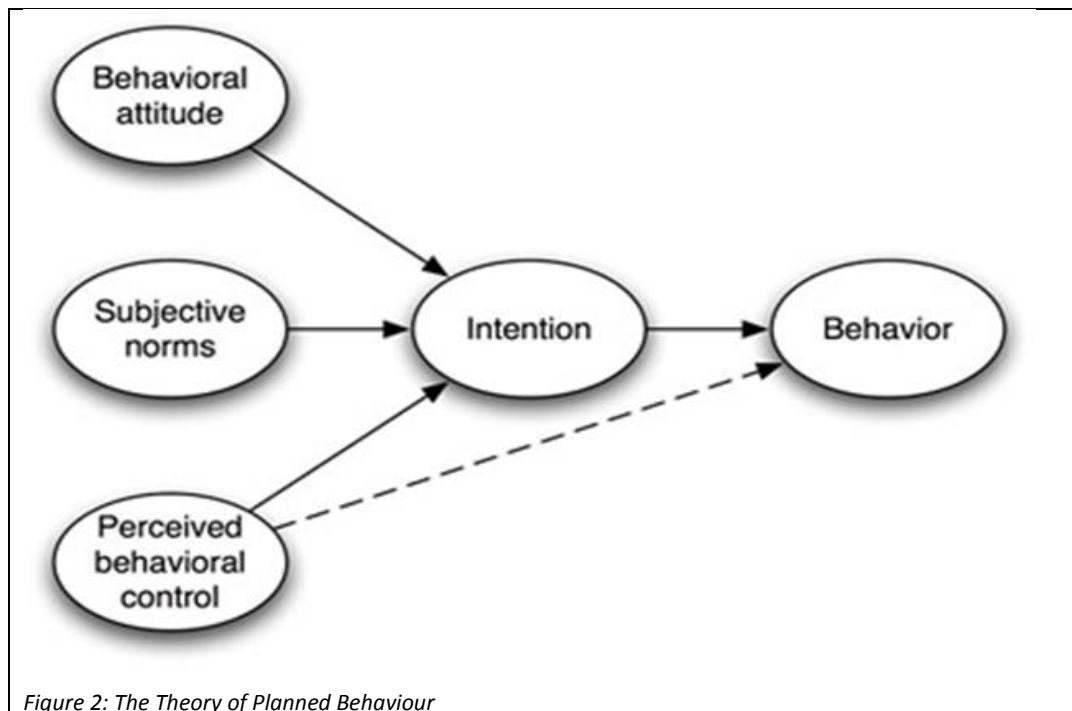
advantages and disadvantages of the behaviour may be required for behaviour change to occur (Biddle & Mutrie, 2008).

Self-efficacy, or the confidence people have in their ability to remain on track towards adopting a new behaviour or goal is another factor considered important in implementing change within the transtheoretical model (Prochaska & Marcus, 1994). There is evidence to show that higher levels of self-efficacy is related to a greater readiness to exercise and self-efficacy has also been found to increase as one moves through the stages of change (Biddle & Mutrie, 2008).

The Theory of Planned Behaviour.

The theory of planned behaviour (TPB) (Ajzen, 1985) is a linear model that predicts human social behaviour and the formation of intentions (Ajzen, 2011). It is a prominent model within the social psychology sphere and has been applied to intention formation and consequent behaviour within exercise psychology (Biddle & Mutrie, 2008). The theory of planned behaviour is an extension of the theory of reasoned action (TRA) (Ajzen & Fishbein, 1975) due to the TRA's limitations in describing behaviours where people did not have full volitional control (Ajzen, 1991). Thus, the Theory of planned behaviour has the additional factor of perceived behavioural control (PBC) to predict behaviours where people do not have full volitional control, such as exercise and physical activity as skills and resources are needed to perform this behaviour (Madden, Ellen & Ajzen, 1992).

The TPB is centred round the premise that engaging in a particular behaviour is predicted by the behavioural intention itself (de Bruijn, 2011). The stronger the intention, the more likely the behaviour will follow (Ajzen, 1991). Three socio-cognitive concepts are said to influence the intention to act, with these being attitudes, subjective norms, and perceived behavioural control (de Bruijn, 2011). The attitude component of the TPB refers to the person's thoughts about the behaviour in question. They may have a negative or positive attitude towards the behaviour (i.e., exercise) which will influence their intention to act upon it (Ajzen, 1991). Subjective norm is the component of the model that refers to social expectations. This component can refer to pressure from significant others to perform or not perform the behaviour in question or perceived social desirability to do the behaviour, such as exercise (Ajzen, 1991; de Bruijn, 2011).



Perceived behavioural control is the component that sets the TPB apart from the TRA (Ajzen, 1991). PBC reflects the perceived ease or difficulty of the behaviour in question and is somewhat mediated by past experiences (Ajzen, 1991; de Bruijn, 2011). PBC was added to the model to account for behaviours that were not under complete volitional control. This applies to exercise behaviour, as skills and resources are needed to control this behaviour (Biddle & Mutrie, 2008). Volitional control can be further explained as a conscious decision to perform a behaviour. Within the TPB, exercise is considered to not be under complete volitional control as personal and environmental factors can influence current and future exercise behaviours (Biddle & Mutrie, 2008). In other words, factors such as temptations or lack of motivation can influence one's internal drive to exercise.

Although the TPB is a widely-used theory for behaviour change, it has been scrutinised for only considering intentions and motivation. Although an intention is an important component of behaviour change, using it solely as a predictor of future behaviour has shown to be of limited use (Fernandez, Fleig, Godinho, Montenegro, Knoll & Schwarzer, 2015). People intending on changing their lifestyle and adopting a new health behaviour need more than intentions and motivations as they are often faced with obstacles and setbacks which can decrease or limit health behaviour participation (Fernandez et al., 2015).

The Health Action Process Approach.

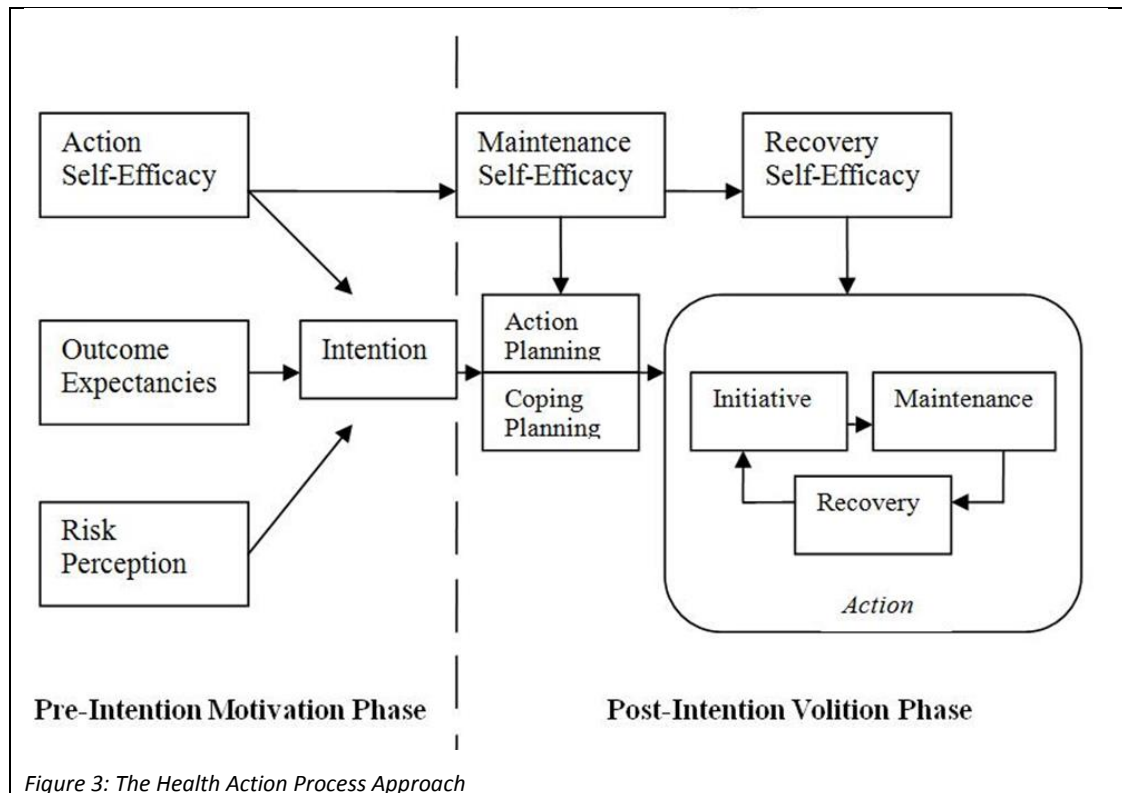
The health action process approach (HAPA) is a linear as well as a stage based model for health behaviour change and describes two main phases, motivation and volition (Schwarzer & Luszczynska, 2008; Schwarzer, 2008). The model was designed to overcome the limitations of linear models such as the TPB which primarily focus on intention as the main predictor of behaviour (Schwarzer, Lippke & Luszczynska, 2011). Schwarzer observed that it is common for people to not act in accordance with their intentions due to unforeseen barriers or temptations. Intentions not always giving rise to behavioural action is known as the 'intention-behaviour gap' (Schwarzer & Luszczynska, 2008). The HAPA outlines strategies to bridge the intention-behaviour gap, which support maintenance of a chosen health behaviour such as exercise.

The first phase of the model is the motivational phase, where behavioural intentions are formed (Schwarzer, 2008). Risk perception is one of the factors within this phase. This is where one is contemplating adopting a health behaviour based on their perceived risk. For example, one may consider whether one is at serious risk for developing heart disease and may consider doing exercise to minimise this risk. Alone, this factor may not be sufficient for forming an intention but it prompts one to start thinking about potential consequences and competencies (Schwarzer & Luszczynska, 2008; Schwarzer, Lippke & Luszczynska, 2011).

Outcome expectancies is another factor within the motivational phase of the HAPA. This describes how advantages and disadvantages of the health behaviour in question are weighed up and consideration of whether or not the health behaviour will have a predominantly negative or positive result (Schwarzer, 2008). Self-efficacy is another factor in the motivational phase of the HAPA. Perceived self-efficacy, or more specifically pre-action self-efficacy is the belief that one can successfully begin doing the proposed health behaviour, such as the belief they can begin exercising (Schwarzer, Lippke & Luszczynska, 2011). These factors influence the formation of a behavioural intention (Schwarzer & Luszczynska, 2008).

Once an intention is formed, the next step is to turn the intention into behaviour. Forming an intention into action is described by factors within the volitional stage of the HAPA (Schwarzer, 2008). This post-intention, volitional phase is the part of the approach that sets it apart from other models, as many other models do not describe how people turn motivations or intentions into behaviour (Schwarzer &

Luszczynska, 2008). Factors involved in the volitional phase are planning, action control, social support and maintenance and recovery self-efficacy (Schwarzer, Lippke & Luszczynska, 2011).



According to this model, intentions are more likely to turn into behaviours when there are strategies and plans in place for beginning and continuing the behaviour (Schwarzer, 2008). Planning can be broken down into action planning and coping planning. Action planning involves examining when, where and how the health behaviour in question will be performed. Coping planning involves considering potential barriers and ways to overcome them (Schwarzer, Lippke, Luszczynska, 2011). Whereas planning takes place before the prospective behaviour takes place, action control is a technique that takes place throughout the engagement of the health behaviour. It is a self-regulatory strategy where the person’s goals and expectations are constantly monitored. For example, a person who is trying to develop an exercise regime may monitor whether or not they have engaged in an appropriate amount of exercise for the week (Schwarzer, Lippke & Luszczynska, 2011). Social support is another factor within the volitional phase of the HAPA that could help with the initiation and maintenance of a given health behaviour. This could involve seeking encouragement from others, getting

reminded to do the behaviour, or doing the behaviour with other people (Schwarzer, Lippke & Luszczynska, 2011). Maintenance and recovery self-efficacy are extensions of the construct of self-efficacy. Maintenance self-efficacy is the belief one can continue to engage in the health behaviour, such as exercise even when faced with set-backs, whereas recovery self-efficacy is the belief one can start the behaviour again after relapsing or discontinuing the behaviour (Schwarzer & Luszczynska, 2008).

Summary.

Lack of time, energy and access to exercise facilities are the most commonly reported exercise barriers. However, a desire to be fit and healthy, enjoyment and self-efficacy are the most common reasons people begin and maintain an exercise regime. Health behaviour change models such as the transtheoretical model, the theory of planned behaviour and the health action process approach have been designed to explain the adoption and maintenance of health behaviours including exercise. The transtheoretical model is a stage-based model that explains readiness for change and steps and thought processes needed to progress through the stages. The end goal is to reach the maintenance stage. The theory of planned behaviour is based on the premise that intentions are the best predictor of future behaviour. However, Schwarzer has observed that it is common for people not to act in accordance with their intentions, also known as the intention-behaviour gap. The health action process approach was developed with this in mind. This model has two phases, the motivational phase where intentions are formed and the volitional phase where there are techniques to change the intentions into behaviours.

Technology and Exercise

The use of technology to increase levels of exercise participation among sedentary populations is on the rise and is a promising avenue for exercise initiation and maintenance (Kroeze, Werkman & Brug, 2006; Norman, Zabinski, Adams, Rosenberg, Yaroch & Atienza, 2007). Since the development of the computer and the emergence of the internet in the early 1990's, using technology and websites as a means to promote or engage people in a healthy lifestyle has been popular (Lupton, 2014). Now, with the emergence of smartphones that have the ability to download mobile software applications, commonly known as 'apps' (Lupton, 2014), health and fitness information and guidance has the potential to be accessed at convenience (Kirwan, Duncan, Vandalenotte & Mummery, 2012).

'eHealth'.

The use of computers and websites to convey and promote health messages is termed eHealth (Norman et al., 2007). Before the use of smartphones and handheld technology the concept of 'eHealth' was and is still popular for conveying messages and providing programmes for health and wellness (Norman et al., 2007). There are some studies that suggest that eHealth interventions are effective, but are under-studied (Hurley, Fairley & Dias, 2006). Norman et al. (2007) conducted a systematic review of eHealth interventions and found that 51% of studies showed an effective result in comparison to the control group for helping with an aspect of health behaviour change, including dietary changes and physical activity adoption. Although this is not an overwhelming result, the potential positive effect of eHealth interventions on a public health level was discussed. Interventions could be administered on a wide scale and individual tailoring of needs could be achieved with the use of technology (Norman et al., 2007). Hurley, Fairley and Dias (2006) conducted a trial of an internet-based exercise intervention that included 75 participants for a duration of 10 weeks. The more interactive design of the intervention resulted in higher user retention in comparison to the reference group and the control group receiving a less interactive version of the internet-based intervention. Participants using the more interactive design found that they created higher expectations for exercise and found they were more motivated to do exercise by using the system (Hurley, Fairley & Dias, 2006).

The concept of eHealth can be extended to hand-held technology. The use of personal digital assistants (PDA's) have been examined among a sample of middle aged older adults for increasing physical activity (King, Ahn, Oliveira, Atienza, Castro & Gardner, 2008). During the 8 week intervention, the intervention arm of the study used the PDA, which monitored daily and weekly physical activity levels, gave feedback on physical activity levels and assessed reported barriers and enablers for physical activity. In comparison to the control group, the intervention arm had increased physical activity levels. It was also reported that they found using the PDA enjoyable and easy to use (King et al., 2008).

Pedometers are another piece of technology that have been popular for tracking and monitoring walking. They are small devices that are worn on the hip that count the number of steps taken each day (McMurdo, Sugden, Argo, Boyle, Johnston, Sniehotta & Donnan, 2010). The device continually displays the accumulated number of steps taken on a small screen (Tudor-Locke & Lutes, 2009). A meta-analysis examining the

effectiveness of pedometer-based interventions across different variables found that generally pedometers are useful for increasing physical activity participation (Minsoo, Marshal, Barreira & Lee, 2009). They found that pedometer based interventions were most effective for adults and children (ES= 0.72 and 0.78 respectively) and were moderately effective for older adults (ES= 0.53). They also found that interventions with goals of 10,000 steps per day had a greater effect size (ES=0.84) than those with no set goals. Interventions of longer durations were more effective than shorter ones, with interventions of 15 weeks or more proving most effective (Minsoo et al., 2009).

Self-monitoring, goal setting and providing personalised feedback are techniques that make the pedometer effective (Tudor-Locke & Lutes, 2009). They are also easily accessible, easy to use and easy to understand devices that provide an immediate reflection of physical activity choice (Tudor-Locke & Lutes, 2009).

Fitbits are modern activity-tracking devices that have succeeded pedometers. Fitbits come in different forms, with the main ones able to be clipped on at the hip or worn around the wrist (Cadmus-Bertram, Marcus, Patterson, Parker & Morey, 2015). They have a built in accelerometer and record amount and intensity of activities performed throughout the day. Summaries of the data collected when using the fitbit can be accessed on the fitbit website in the form of graphs and charts (Cadmus-Bertram et al., 2015). As fitbits are recent, information on their effectiveness is limited. However, a randomised controlled trial assessing the effectiveness of fitbits with inactive, post-menopausal, overweight women found that activity levels increased more in the group using the fitbit in comparison to the group using the pedometer (Cadmus-Bertram et al., 2015). Ninety six percent of participants wore the fitbit four or more days during the week and 88% used the website. The fitbit group increased their steps by an average 789 steps per day.

Technologies such as fitbits bring about behaviour change by bringing awareness to current exercise behaviour as well as changes or improvements in exercise behaviour (Fritz, Huang, Murphy & Zimmermann, 2014). Fitbits also work on the basis of self-monitoring, goal setting and data-sharing via social networks (Fritz et al., 2014). In this study by Fritz et al. (2014), the social side of sharing goals and achievements recorded by the fitbit was key for successful long-term usage.

Health and fitness mobile software applications.

Mobile software applications, more commonly known as 'apps' are programmes that can be downloaded for use on smartphones (Lupton, 2014). Millions of apps have been created and downloaded since their release in 2008 (Lupton, 2014). In 2013 there were 127 apps under the term 'health and fitness' for iOS compatible smartphones (Kennedy & Blair, 2014). Despite the large range of health-related apps on the market, they remain untested and seem to be lacking in scientific evidence and theory (Kirwan et al., 2012). Apps only have to abide by the guidelines of the specified app store that it will be published in (Lupton, 2014). This means there are many differences among health and fitness apps and credibility is questioned (Lupton, 2014).

Apps for health and fitness offer enormous potential for targeting and engaging a large number of people for adopting health behaviours, including exercise (Kirwan et al., 2012; Conroy, Yang & Maher, 2014; Millington, 2014). With so many people owning smartphones in the Western world, millions of people have the potential to access information, tools and programmes about health and fitness whenever it is convenient (Millington, 2014). This technological advancement is an improvement on the eHealth phenomenon, as people can look up or log information into their smartphone rather than waiting to do it on their home computer, thus optimising convenience (Millington, 2014). Smartphones and apps can also perform highly advanced features that make health and fitness related applications appealing and easy to use. Most smartphones and apps have the capability to track and record information as well as GPS and accelerometry capabilities (Kirwan, Duncan & Vandelanotte, 2013). Apps also offer a range of features such as easy accessibility, user adjustability and can provide tailored feedback which makes using them convenient and fun (Middleweerd, Mollee, van der Wal, Brug & te Velde, 2014).

There are some studies assessing the extent to which health behaviour change theory factors were present within exercise and fitness apps that were previously and currently available in app stores. The presence of behaviour change theory within popular apps could improve credibility as well as prove more effective for users (Kirwan et al., 2012). Techniques such as self-regulation, self-monitoring, goal-setting and feedback that are common among health behaviour change theories can be easily incorporated into apps (Conroy, Yang & Maher, 2014). Middleweerd et al. (2014) conducted a content analysis of 64 apps downloaded from the app store and Google play store and found an average of 5 behaviour change techniques within each app. The

most common behaviour change techniques used among the apps were self-monitoring, providing feedback and goal setting. They found no difference in the number of behaviour change techniques between paid and free apps (Middleweerd et al., 2014). However, Cowan, Van Wagenen, Brown, Hedin, Seino-Stephan, Hall and West (2012) also did a content-analysis of 127 apps under the term 'health and fitness' in the Apple app store and found slightly dissimilar findings. They found that apps were generally lacking in health behaviour change theory content and also found a presence of more behaviour change content in paid apps in comparison to free apps (Cowan et al., 2012). Kirwan, Duncan and Vandelanotte (2013) also reported few behaviour change techniques and educational content among 81 apps from the Apple app store and Google Play. They did find however, that 69.1% of apps reviewed allowed for manual self-monitoring and 72.8% had automated self-monitoring techniques such as GPS tracking and accelerometry capabilities. They also found that 69.1% of apps examined had goal setting options and 97.5% provided feedback (Kirwan, Duncan & Vandelanotte, 2013).

Although there is evidence of some behaviour change techniques and theories present within exercise and fitness apps, the overall lack of techniques and theories is a missed opportunity for success in exercise adoption and maintenance (Kirwan, Duncan & Vandelanotte, 2013). There is a need for app developers to collaborate with experts in behaviour change theories and techniques in conjunction with doctors and sport and exercise specialists to create apps that are effective and credible (Cowan et al., 2012). Smartphones are highly prevalent among the Western world and are capable of technical features such as GPS tracking, accelerometry, information storing and providing feedback and are highly accessible which can be used to promote behaviour change (Kirwan, Duncan & Vandelanotte, 2013). Due to these capabilities, creating exercise apps that are grounded in behaviour change theory and techniques and designed in collaboration with sport and exercise experts, could revolutionise physical activity adoption and health behaviour change on a mass scale (Middleweerd et al., 2014). However, it is also clear that the use of apps to promote, educate and get people to engage in physical activity and other health behaviours is an understudied area (King et al., 2008; Lupton, 2014). Studies that have been conducted in this sphere have reported the potential of this avenue for exercise adoption and health behaviour change, yet have also reported that their studies remain inconclusive (Kirwan et al.,

2012; Conroy, Yang & Maher, 2014; Millington, 2014; Kirwan, Duncan & Vadelanotte, 2013).

Summary.

The use of computers and apps to promote exercise participation is a promising avenue for exercise initiation and maintenance. Smartphones are prevalent in the Western world and have the ability to download apps. Apps and smartphones are capable of GPS tracking, accelerometry, information storing and providing feedback which can make using exercise apps effective, accessible and fun for people initiating exercise. However, research into exercise app effectiveness is scarce and the few studies available report that the findings remain inconclusive. Studies examining the presence of behaviour change theories and techniques show that many exercise apps do not contain evidence of enough techniques which therefore undermines the credibility and effectiveness of exercise apps currently on the market. The lack of behaviour change theories and techniques within current exercise apps is considered a missed opportunity for exercise initiation and maintenance on a mass scale.

Rationale for study

Exercise is necessary for optimum physical health and fitness and can prevent and even reverse serious health conditions related to heart health and obesity. Exercise is also efficacious for maintaining mental health and has shown to be effective for treatment for mental disorders, notably major depressive disorder. However, getting people to start exercising and continue doing it is a challenge faced by a large number of individuals and health professionals. Self-regulatory techniques including self-monitoring, feedback and goal setting are known to assist with the initiation and maintenance of exercise behaviour and are also techniques that are easily incorporated into exercise apps. Current research assessing available apps state that the presence of behaviour change theories and techniques are limited and more research needs to be conducted in this area. Following on from this point, articles examining the effectiveness of exercise apps from the everyday user's perspectives have not been found. Therefore the current study examines the effectiveness of a popular exercise app for establishing exercise from the perspective of users who were not exercising at the time of signing up. The study examined the participants' views on exercising and their perceived ability to start and maintain an exercise regime with scales from the Health Action Process Approach as well as changes in mood and wellbeing as a result of taking part in exercise.

The Health Action Process Approach was used for its consideration of techniques and strategies for helping one actually adopt exercise behaviour, rather than just form an intention. The overall experience of using the app was also investigated in order to assess what was liked and disliked about the app from the perspective of the everyday user.

Predicted study outcomes.

Hypothesis 1: Participants with higher scores for action planning and coping planning will be more likely to continue exercising throughout the duration of the intervention

Hypothesis 2: Participants with a higher level of pre-action self-efficacy are going to be more likely to continue exercising throughout the duration of the intervention

Hypothesis 3: Participants who use the app regularly will have higher scores for action control

Hypothesis 4: Participants' who increase exercise levels will improve their mood and wellbeing

Chapter 2: Method

This chapter outlines the intentions for the research and the way it was conducted. An outline of the study aim, the methodology used to collect the data as well as the tools and measures used are provided. The ethical review is then outlined, as well as the recruitment procedure, inclusion criteria and participant sign up process. Following this are the participant demographics and data analysis.

Research aim

The overall intention of this research was to examine the effectiveness of an exercise app for the initiation of exercise over a two month intervention period. The study looked at many aspects including mood and well-being, attitudes towards exercise, as well as overall experience of using the exercise app. The way these were assessed in the study was with a mixed method design.

Methodology

Mixed method methodology is a pragmatic design that uses both quantitative and qualitative methodologies in combination to assess the phenomenon in question (Bryers, van Teijlingen & Pitchforth, 2014). Quantitative research often involves using statistics to test a predetermined question or hypothesis, whereas qualitative research involves a more naturalistic design through interviews, focus groups or observation (Bryers, van Teijlingen & Pitchforth, 2014). More simply, quantitative research examines the 'how' or 'how many' whereas qualitative research examines the 'why' (Bryers, van Teijlingen & Pitchforth, 2014).

Using a mixed method design is advantageous as it can create a more comprehensive account of what is being examined that cannot be done when using one methodology alone. A mixed method design often results in a deeper understanding of the research question or circumstance (Green, Duan, Gibbons, Hoagwood, Palinkas & Wisdom, 2014). The strengths from qualitative and quantitative designs are taken advantage of whilst their weaknesses are aimed to be reduced. This means that the research outcome results in a higher degree of generalizability in comparison to using just one methodology (Green et al., 2014; Gelling, 2014).

However, there are limitations when implementing a mixed method research design. When combining two differing methodologies one risks implementing one aspect to a lesser quality than the other. It is important to maintain the quality of both

designs as well as combine findings from both methods appropriately to ensure the overall quality of the research is upheld (Gelling, 2014; Bryers, van Teijlingen & Pitchforth, 2014). Resources can also be an issue when conducting research from a mixed methods approach. To perform mixed method analysis well, it takes more time and money than using a single methodology (Bryers, van Teijlingen & Pitchforth, 2014). Often, combining both methodologies limits funding and resources which could have been used to conduct one quality piece of research from one methodology (Bryers, van Teijlingen & Pitchforth, 2014).

A mixed method approach was used for this research so that hypotheses, psychological scales and relationships between variables could be implemented and assessed as well as examining the overall experience of using the app through open-ended questions. Along with psychological scales of mood and wellbeing and statistical analysis of hypotheses and relationships, it was important for the researcher to examine the participants' experiences of using the app during the intervention period so that a thorough understanding of app usage and its effectiveness could occur.

Tools and Measures

Questionnaires.

A total of four questionnaires were designed to assess the effectiveness of an exercise app by using measures and scales examining attitudes towards exercise, amount of exercise done and mood and wellbeing. The questionnaires had a combination of scales and measures that were already available and questions made up by the researcher. These were created in questionnaire programming software, Qualtrics. Each questionnaire had a link pertaining to it so that they could be administered via email. This was so researcher contact could be reduced to minimise the potential of confounding; it was paramount that the results produced were due to using the app and exercising as opposed to social contact with the researcher. The four questionnaires were administered at different time points over a total period of three months. The baseline questionnaire was administered before exercise began so that changes in amount of exercise, attitudes about exercise and mood and wellbeing could be compared to baseline scores. The mid-intervention questionnaire was administered one month after beginning the intervention. The post-intervention questionnaire was administered two months after beginning the intervention, which also marked the end of the intervention period. This questionnaire contained open-ended long response

questions examining the overall effectiveness and likability of the app as well as already available scales and measures utilised in previous questionnaires. The follow-up questionnaire was administered one month after the intervention period to minimally assess maintenance of exercise behaviour and prolonged effects of exercise engagement. The scales and measures utilised in the questionnaires and the time points in which they were used follow.

Depression Anxiety Stress Scale (DASS).

The Depression Anxiety Stress Scale (DASS) is a psychological self-report measure used to examine mood disturbances (Lovibond & Lovibond, 1995). It consists of three scales that separately measure symptoms of depression, anxiety and stress (Lovibond & Lovibond, 1995). The depression scale assesses aspects of depression such as hopelessness and lack of interest. The anxiety scale assesses autonomic arousal and situational and perceived anxious affect and the stress scale is sensitive to factors associated with stress such as difficulty relaxing and becoming easily upset and agitated (Lovibond & Lovibond, 1995). There are 14 items for each of the three scales comprising the DASS, each assessed with a four point severity/frequency scale (Lovibond & Lovibond, 1995). The DASS can be used by clinicians as a tool to aid diagnosis as well as by researchers examining various properties of mood. It is a useful measure for tracking changes in mood and mood disturbances over time (Lovibond & Lovibond, 1995).

Psychometric data for the DASS demonstrates that it is a reliable and valid measure. Reliability, or the extent to which a measure yields the same results repeatedly, is high, with alpha levels for depression, anxiety and stress being .91, .84 and .90 respectively (Lovibond & Lovibond, 1995). Internal reliability, which determines whether items within a measure are measuring the same construct, is high for this test with the depression scale scoring .96, anxiety .89 and stress .93 (Lovibond & Lovibond, 1995; Akin & Cetin, 2007). For convergent validity, or the relatedness of constructs on similar measures is also good for the DASS. The DASS correlates well with the Beck Anxiety and Depression Inventories, with correlation coefficients of .74 for depression and .81 for anxiety (Lovibond & Lovibond, 1995; Akin & Cetin, 2007). The psychometric data for the Depression Anxiety Stress Scale is derived from non-clinical populations (Lovibond & Lovibond, 1995).

The DASS was used within this research to examine the presence of any mood disturbances as well as changes in mood throughout the duration of the exercise app

intervention. This psychometric test was chosen due to its ability to examine a broad range of constructs associated with mood and affect within one measure, its ability to track changes over time, as well as appropriate use on non-clinical populations (Lovibond & Lovibond, 1995). The DASS was administered within the questionnaires at baseline (before the intervention began), post-intervention (2 months after beginning) and follow up (1 month after completing the intervention).

SF-8 health and wellbeing measure.

The SF-8 is a brief measure examining wellbeing. It is a shortened version of the SF-36 and only contains 8 items. Each item examines one of the 8 domains that the SF-36 measures more thoroughly. The shortened version of this measure makes completion less burdensome for the user while still providing an accurate portrayal of current health status (Ware, Kosinski, Dewey & Gandek, 2001).

The 8 domains that the SF-8 assesses are bodily pain, general health, vitality as well as physical functioning which assesses the extent of or presence of physical limitations, role physical which assesses role limitations due to physical health problems, social functioning which assesses health-related aspects and whether they have impacted on social functioning, role emotional which assesses role limitations due to emotional disturbances and mental health which examines how much the respondent has been affected by emotional problems such as depression, anxiety and irritability (Ware et al., 2001). Together, this measure examines physical health, mental health and the extent to which these aspects effect everyday living giving a complete description of wellness (Ware et al., 2001).

Psychometric data show that the SF-8 is a reliable and valid measure. Alternate-forms reliability, the process of giving the same group of people an alternative form of the same test ranges between .88 and .82 for this measure. Construct validity, convergent and discriminant validity, criterion validity are favourable for this measure and is evident from factor analyses (Ware et al., 2001).

The SF-8 was chosen for this research so that wellbeing and everyday functioning could be examined. The researcher found it important to examine changes in physical and general functioning associated with exercising on top of examining mood. This measure was also chosen for its brevity whilst still providing a comprehensive overview of the respondent's wellbeing. The SF-8 was administered the same time as the DASS. The measure was administered within the questionnaire at

baseline (before the intervention began), post-intervention (2 months after beginning) and follow up (1 month after completing the intervention).

Health Action Process Approach scales.

Scales that assess readiness, planning, coping and self-efficacy for exercise initiation and maintenance have been created by Schwarzer that make up the health action process approach model for health behaviour change. These scales have been developed to briefly assess components that have shown to be important for exercise initiation and maintenance (Schwarzer, 2008). User's views about a statement pertaining to a situation regarding exercise initiation or maintenance are assessed with a four point scale. The scales are as follows:

Pre-action Self-efficacy: Refers to the person's perceived capability to do exercise before they have started engaging in it.

Maintenance self-efficacy: Refers to the person's perceived capability of continuing exercise once they have started

Recovery self-efficacy: Refers to the person's perceived capability of resuming exercise again after a lapse

Action Planning: Assesses the planning of exercise behaviour (i.e., what days exercise will be done, what type of exercise will be done and where exercise will be done).

Coping Planning: Assesses the degree to which a person has considered what will happen if faced with potential barriers when doing exercise

Action Control: Assesses monitoring of exercise behaviour (Schwarzer, 2008).

These constructs were examined at various points throughout the duration of the study. Pre-action Self-Efficacy, Action Planning and Coping Planning were assessed within the Baseline questionnaire (before the intervention began) to examine participants beliefs about their abilities to begin an exercise programme and whether they had considered when and where they would do exercise (planning). Maintenance self-efficacy, recovery self-efficacy and action control were assessed within the mid-intervention (1 month into intervention), post-intervention (2 months after beginning intervention) and follow-up (1 month after completing intervention) questionnaires. This was to examine participants beliefs about their ability to continue exercising once started, their beliefs about restarting exercise if a lapse was to occur and their awareness and efforts around their prescribed exercise app programme (action control).

Assessment of these scales is examined through proposing a statement and checking a response that corresponds best to where the participants' beliefs are at that current moment. The four points are as follows: Not true at all (1), barely true (2), mostly true (3), exactly true (4).

Psychometric data for the HAPA scales were not available, so internal reliability was assessed by the researcher with the data collected for the sample. For the planning scales, internal reliability for action planning is .81 and for coping planning it is .94. For the self-efficacy scales, the internal reliability for pre-action self-efficacy is .89. Internal reliability for maintenance self-efficacy at mid-intervention is .89, at post-intervention it is .97 and at follow-up it is .97. Internal reliability for recovery self-efficacy at mid-intervention is .84, at post-intervention it is .91 and at follow up it is .98. Internal reliability for action control at mid-intervention is .90, at post-intervention it is .91 and at follow up it is .94. These scores show that the scales used at various times throughout the study period have excellent internal reliability. This means that the items used within the scales are measuring the same constructs.

Couch to 5K exercise app.

The Couch to 5K (C25K) running app is a smartphone app created by Zenlabs compatible on both Samsung and Apple iPhones. It has designated workouts to do three times a week for 8 weeks and is designed specifically for people who are new to exercising. The workouts start out at an easy intensity, alternating between walking and running. Over time this increases to running for longer durations. The app includes a stop watch and prompts when to switch from walking to running and vice versa. The workouts are the same for a week and when the week has been completed the user can choose to go onto the next week which increases in difficulty. The app is flexible for the user, as they can choose to repeat weeks or workouts, or skip ahead if necessary. It claims that by following this programme, users will be able to run 5 kilometres at the end of 8 weeks.

This app was chosen for this study due to it being designed for people new to exercising. Having an app that considered beginner exercisers was important to the researcher so that participants would not be deterred before they signed up or whilst using the app during the intervention period. The Couch to 5k app also recommends an amount of exercise that is comparable to current recommendations for improvements

in mental health which is 3-4 exercise sessions per week for 30-40 minutes for 9 weeks (Stanton & Reaburn, 2015).

Assessment of exercise

Amount of exercise performed was examined at all four time points (baseline, mid-intervention, post-intervention and follow-up). Participants were asked how many times per week over the last two weeks they engaged in vigorous and mild or moderate exercise and for what duration each time. Vigorous exercise was defined as “intense exercise which resulted in heavy puffing or sweating”. An example was provided of exercises such as intensive swimming, running or cycling as well as other exercises that require a lot of effort. Mild or moderate exercise was classified as “exercise which may result in increased breathing or minor sweating” with an example of swift walking or slow cycling being provided. Participants were asked not to include physical activities that were part of their jobs or household duties. Participants previous exercise experience was also examined at baseline.

Assessment of app usage

At the end of the intervention period within the post-intervention questionnaire, a five point scale was used to determine degree of app usage among participants. The questions asked, “If you used the Couch to 5k app, how long did you use it for? The responses included: I didn’t use it (1), one week or less (2), two-four weeks (3), four-six weeks (4), the whole 8 weeks (5).

Qualitative data

Qualitative data was obtained within the questionnaire administered at post-intervention to examine what they thought about using the app once the app usage period was over. Long response questions were asked, where there was a box for participants to type in their answers. Questions included: How did using the app go for you? What were some things you liked about the app? What were some things you did not like about the app? Please explain how the app was helpful or unhelpful for you. Did you do any other forms of exercise other than using the app for the 8 week period? Do you have any suggestions on what could have helped you more for starting exercise?

Overview of questionnaires

Table 1:

Overview of questionnaires

Baseline	<ul style="list-style-type: none"> •Demographics •Reasons for taking part in study/previous exercise experience •DASS •SF-8 •Pre-action self-efficacy •Action planning •Coping planning •Amount of exercise performed
Mid-intervention	<ul style="list-style-type: none"> •Maintenance self-efficacy •Recovery self-efficacy •Action control •Amount of exercise performed
Post-intervention	<ul style="list-style-type: none"> •DASS •SF-8 •Maintenance self-efficacy •Recovery self-efficacy •Action control •Amount of exercise performed •Rating scales examining overall experience of using the app •Qualitative questions
Follow-up	<ul style="list-style-type: none"> •DASS •SF-8 •Maintenance self-efficacy •Recovery self-efficacy •Action control •Amount of exercise performed •Comments on continuation/discontinuation of exercising/using the app

Ethics review

This research was reviewed and approved by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato in April 2015.

Recruitment

Flyers that had a brief outline of the study, requirements for participation and contact details were hung around the University of Waikato grounds and WINTEC hub. This same flyer was uploaded to the researcher's Facebook profile to advertise the research. A request for the researcher's Facebook friends to 'share' the post was also

made so that the request could go further than just the researcher's Facebook friends. A press release article was created in collaboration with the person in charge of the Faculty of Arts and Social Sciences marketing and communications department at the University of Waikato. This article was published on a national online news site 'Scoop', an online news site for the Bay of Plenty region 'Sunlive' and the local Cambridge newspaper, the Cambridge Edition. A condensed version of this article was published in the Waikato Times. The article was also released in the Faculty of Arts and Social Sciences staff e-News and the Faculty of Arts and Social Sciences Facebook page.

Inclusion criteria

To be eligible to take part in this study, participants must have been doing no exercise or very minimal in order for exercise initiation to be assessed. Upon making contact with the researcher, participants were screened for eligibility by asking if they were doing any exercise currently. If participants said that they weren't doing any exercise, or doing less than an hour per week then they were considered eligible to take part. Participants must have also been within the ages of 18-65, well enough to engage in an exercise programme and have access to a smartphone or device capable of downloading apps. The researcher requested that everyone who wanted to join the study consult with their general practitioner before starting to exercise.

Participant sign up

People who were interested in participating in the study contacted the researcher via email or phone. After they had made contact, a copy of the participant information sheet was emailed to them to read which explained the study and participant requirements in detail. Once participants had read the participant information sheet and they said they wanted to take part, then a time and place was organised for the researcher to meet with them to sign the consent forms and download the app. If the researcher was unable to meet with the participant due to them being too far away or time constraints, then the option of them being emailed the consent forms and scanning them back was given. After signed consent was obtained, then another information sheet was given which had instructions for downloading the app, information about the app and a list of psychological services for the Waikato area. While the researcher was in the presence of the participant, assistance with downloading the app was given and any questions they had were answered. After meeting with the participant, the link to the baseline questionnaire was emailed to them

with a request to complete it the day they received it. The subsequent links to the questionnaires were emailed to the participants when required.

Participants

A total of 45 people contacted the researcher interested in participating in the study. Eighteen of these people did not meet inclusion criteria as they were either doing too much exercise, did not have a smartphone, were too old or had a physical disability. Five of these people decided not to participate due to time constraints or did not get back to the researcher in time to sign up. A total of 22 participants met inclusion criteria and signed up to the study. Five participants dropped out during the study period due to injury previous to the study (n=2), time constraints (n=1) or failing to complete questionnaires within the given time period (n=2). This made the total sample 17. Fifteen of these participants were female and two were male. Twelve identified as New Zealand European, two as New Zealand European/New Zealand Maori, one as New Zealand Maori, one as Asian, and one as New Zealand European/Middle Eastern. Participants ranged from 19-63 years of age. Place of residence ranged in this sample, with participants residing in Wellington (n=1), Christchurch (n=1), Auckland (n=1), Tauranga (n=1), Hamilton (n=8), Morrinsville (n=3) and Cambridge (n=2), both small towns in the Waikato region.

Data Analysis

Quantitative analysis.

Statistical analysis was performed using SPSS statistical package. Before statistical tests were run on the data, normality was examined. The Shapiro-Wilk normality test was used to examine whether data collected followed a normal distribution as this test is more robust than the Kolmogorov-Smirnov test (Field, 2009). Results showed that at follow up for the DASS, exercise at all time points and the HAPA scales were significant. Therefore, this meant for most of the scales, normality was violated. Therefore, because most scales did not follow a normal distribution, non-parametric tests were used throughout the whole analysis as they require fewer assumptions (Field, 2009).

Friedman's ANOVA was used to assess changes between time points for exercise, mood and wellbeing. Friedman's ANOVA is the non-parametric equivalent to a one way repeated measures ANOVA (Field, 2009). Wilcoxon signed-rank post-hoc test was used to further explore any significant results.

Spearman's rank-order correlation was used to examine the relationship between HAPA scales and exercise or app usage. Spearman's was used due to the small sample size, ordinal data and because most scales violated parametric assumptions (Field, 2009). For most scales a correlation was performed with total amount of exercise at various time points to examine whether the participants beliefs were related to changes in amount of exercise performed during the study period. Action control was correlated with app usage throughout the intervention period to examine whether the app usage was associated with higher scores on action control. Correlations were also used to examine the relationship between mood and self-efficacy and amount of exercise performed at all time points and mood.

Qualitative analysis.

Thematic analysis was used to analyse the qualitative data. Thematic analysis involves grouping common points made by participants into 'themes'. Themes are commonly occurring points that many participants have said that have been observed by the researcher within the data set (Braun & Clarke, 2006).

The level at which themes were identified was with a semantic approach. The semantic approach involves analysing what the participants say at face value as opposed to the latent approach where responses are interpreted and the researcher goes beyond what the participants say and examine it at a deeper level (Braun & Clarke, 2006).

Data from all participants was grouped under the question asked to form the data set. The researcher read through this three times to get a sense of what the participants were saying. Commonly occurring points were acknowledged and basic themes were formed. Once these basic themes were formed, the researcher went through the data set and grouped responses from participants within these themes to see if these themes were covering most points raised. After some refining, themes were finalised. These themes are: variation and structure of the app, progression of the app, the app as a starting point for exercise, motivation and app use, barriers towards exercise and social support.

Chapter 3: Results

This chapter will present data collected from the questionnaires. The first half will show the quantitative data and statistical analysis and the second half will show the qualitative data.

Quantitative results

Motivation for exercise and exercise history.

When asked what their reasons were for wanting to start exercise, all 17 of participants (100%) said that they wanted to get fit and healthy, just over half of the sample (52.9%) said they wanted to improve their mood and well-being and just under half of the sample (47%) said they wanted to lose weight.

Previous exercise experience was also examined. Two participants (11.7%) had never had a regular exercise programme, seven (41.1%) had done some exercise on and off, four (23.5%) used to do exercise but stopped a year or more ago and four (23.5%) used to do exercise but stopped less than a year ago.

Changes in amount of exercise performed.

Overall, exercise levels increased for the sample. The means and standard deviations for mild/moderate exercise and vigorous exercise for all four time points are presented in Table 2.

Table 2:

Average amount of times exercise was performed each week and average duration of each sessions over the course of the intervention

	Vigorous exercise		Mild/moderate exercise	
	Times per week	Average duration (minutes)	Times per week	Average duration (minutes)
Baseline	0.35 (SD=0.86)	3.5 (SD= 8.62)	2.20 (SD=1.65)	29.88 (SD=37.6)
Mid intervention	2.15 (SD= 1.95)	25.59 (SD=20.68)	2.73 (SD=1.79)	29.70 (SD=22.74)
Post intervention	2.03 (SD=1.92)	22.76 (SD=20.7)	2.76 (SD=2.36)	35.00 (SD=30.46)
Follow up	2.88 (SD= 2.57)	24.70 (SD=21.47)	3.65 (SD=2.03)	34.12 (SD=33.6)

Figure 4: Vigorous exercise sessions performed per week over time

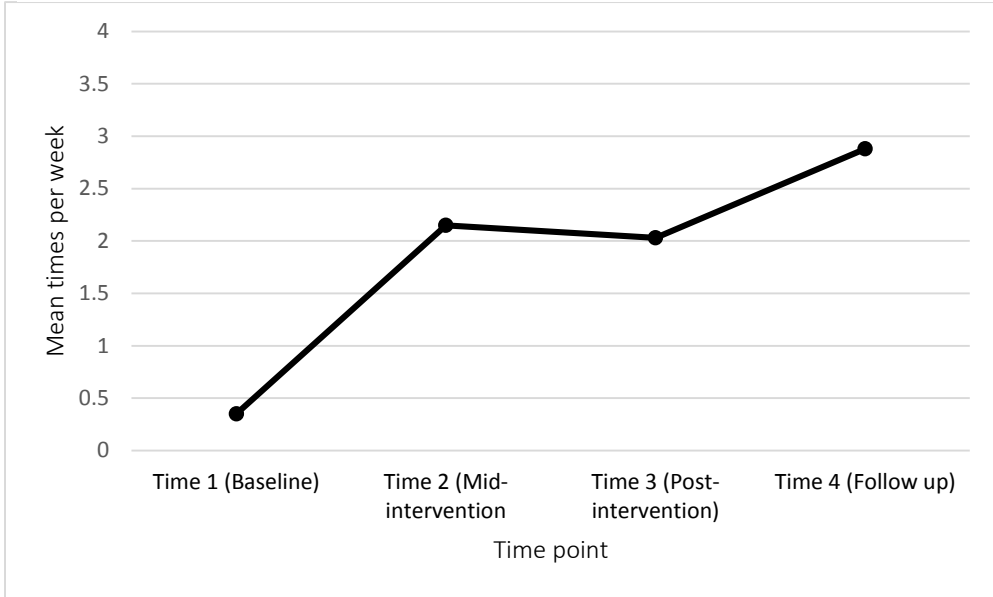
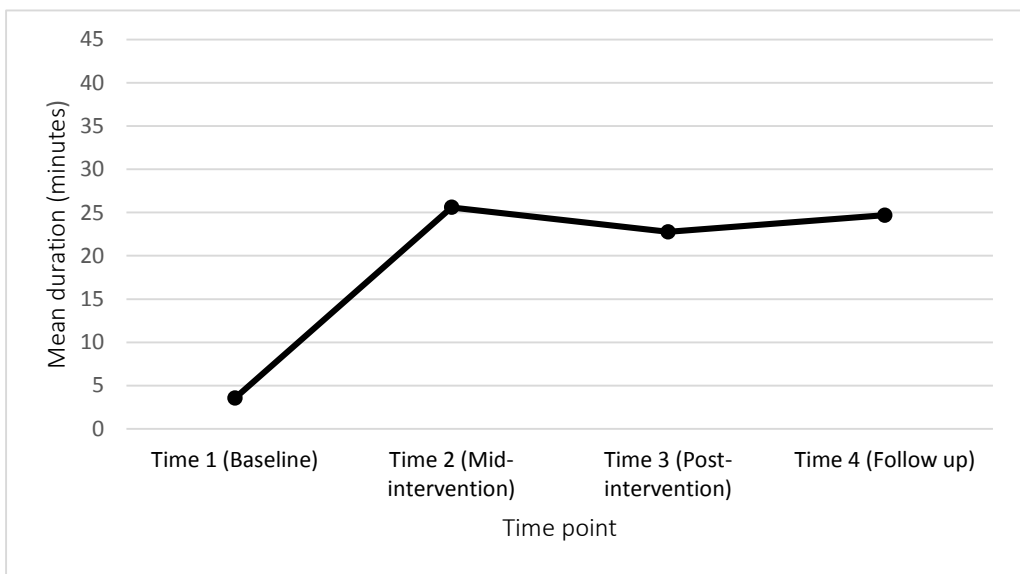
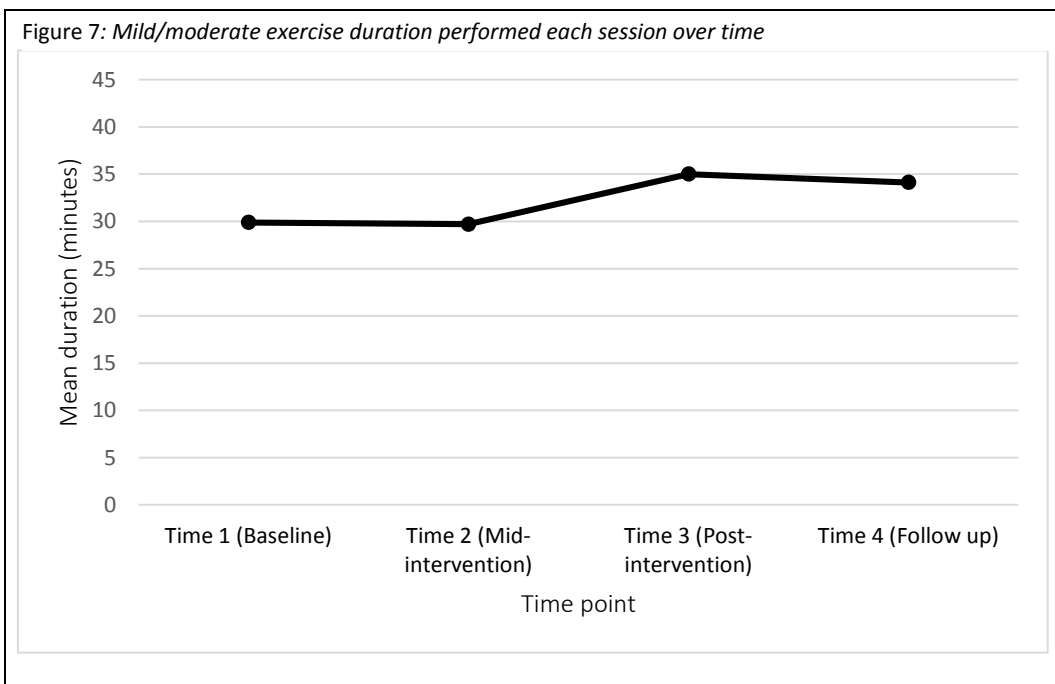
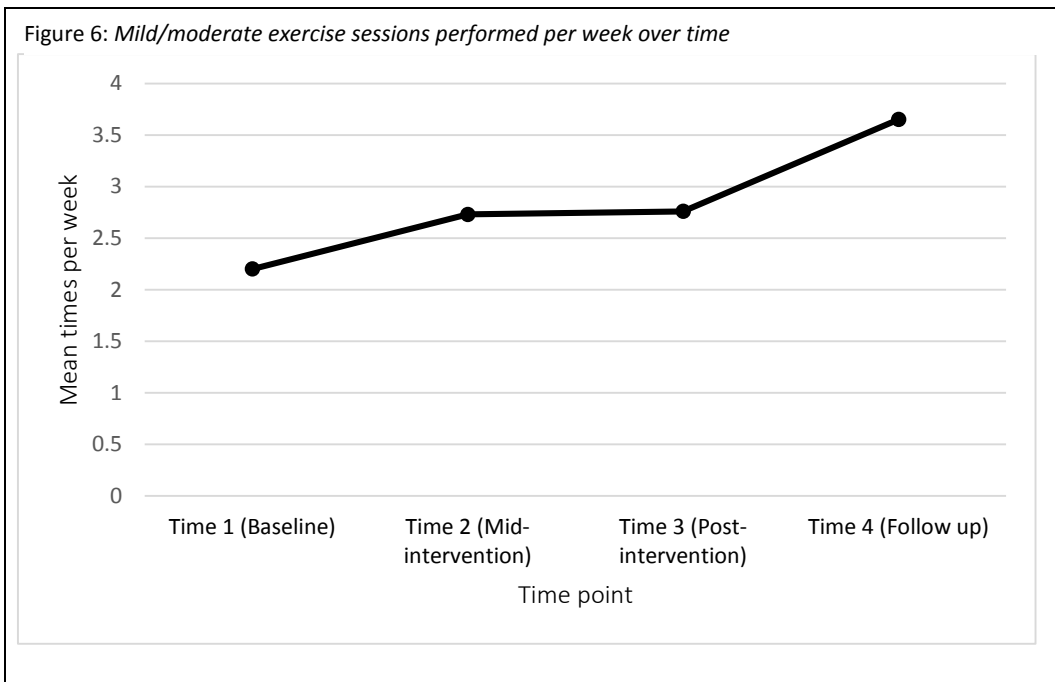


Figure 5: Vigorous exercise duration performed each session over time





Friedman’s ANOVA was used to examine any significant differences in amount of exercise throughout the intervention period. Over the course of the intervention, vigorous exercise sessions per week significantly increased, $\chi^2 (3) = 0.002p = > 0.05$. Wilcoxon signed-ranks test was used to follow up this finding. A Bonferroni correction of 0.0125 was applied, therefore all effects are reported at this level of significance. There was a significant difference in how many times per week vigorous exercise was

performed between baseline and mid-intervention ($Z = -2.82, p = .005$). There was no significant difference between mid-intervention and post-intervention ($Z = -.213, p = .831$) and there was also no significant difference between post-intervention and follow-up ($Z = -1.78, p = .074$). Therefore, for the number of times per week participants did vigorous exercise, the largest change was between the time they signed up to the study and at mid-intervention (4 weeks). There was also a significant difference in the average duration of vigorous exercise throughout the course of the intervention, $\chi^2(3) = 0.001, p = > 0.05$. Wilcoxon signed-ranks test was used to follow up this finding. A Bonferroni correction of 0.0125 was applied. A significant change in average duration of vigorous exercise performed was detected between baseline and mid-intervention ($Z = -2.95, p = .003$). There was no significant difference between mid-intervention and post-intervention ($Z = -.772, p = .44$) and there was also no significant difference between post-intervention and follow-up ($Z = -1.05, p = .29$). Therefore, the greatest change in duration of vigorous exercise was between the time participants signed up to the study and at mid-intervention (4 weeks).

There was no significant change in the times per week moderate exercise was performed, $\chi^2(3) = 0.097, p = < 0.05$. There was also no significant difference in the average duration of moderate exercise performed throughout the intervention, $\chi^2(3) = 0.265, p = < 0.05$.

Self-efficacy.

The mean for pre-action self-efficacy was 3.06 (SD=0.58), indicating the majority of the sample had a fairly strong belief in their ability to begin exercising.

At mid-intervention the mean score for maintenance self-efficacy was 2.8 (SD=0.52). At post-intervention the mean score was 2.94 (SD=.79) and at follow-up the mean score was 3.05 (SD=0.81).

Spearman's rank-order correlation was performed to examine the relationship between self-efficacy and total exercise performed over time. The results for pre-action self-efficacy and exercise are shown in Table 3.

Table 3:

Pre-action self-efficacy and total exercise performed at various time points correlation matrix

Mid-intervention	Post-intervention	Follow-up
$r = .38, p = .13$	$r = .19, p = .45$	$r = .42, p = .09$

Spearman's rank-order correlation was also used to examine the relationship between maintenance self-efficacy and total amount of exercise performed over time. The results are shown in Table 4.

Table 4:

Maintenance self-efficacy and total exercise performed at various time points correlation matrix

Mid-intervention	Post-intervention	Follow-up
$r = .59, p = .01^*$	$r = .60, p = .01^*$	$r = .50, p = .04^*$

Planning.

The mean score for action planning within this sample was 2.17 (SD=0.86) and the mean score for coping planning was 1.5 (SD=0.68). These statistics suggest that participants had not put much thought into planning the logistics of their exercise as well as planning what would happen if their exercise plans did not go as intended.

Spearman's rank order correlation was used to examine the relationship between planning and exercise performed over time. The results for action planning at total exercise performed at various time points is shown in Table 5.

Table 5:

Action planning and total exercise performed at various time points correlation matrix

Mid-intervention	Post-intervention	Follow-up
$r = .39, p = .12$	$r = -.11, p = .67$	$r = .02, p = .94$

Spearman's rank order correlation was also used to examine the relationship between coping planning and total amount of exercise performed over time. The results are shown in Table 6.

Table 6:

Coping planning and total exercise performed at various time points correlation matrix

Mid-intervention	Post-intervention	Follow-up
$r = .45, p = .07$	$r = .07, p = .79$	$r = .33, p = .20$

Action control.

Action control was a scale used to examine self-monitoring and self-regulation behaviour during the intervention period. This scale was used at mid-intervention, post-

intervention and follow-up. At mid-intervention, the mean for action control was 2.72 (SD=0.76). At post-intervention the mean score was 2.73 (SD=0.82) and at follow-up the mean was 2.59 (SD=0.22).

Spearman’s rank-order correlation was used to examine the relationship between action control and app usage throughout the duration of the intervention. The results are shown in Table 7.

Table 7:

Action control and app usage scores at various time points correlation matrix

Mid-intervention	Post-intervention	Follow-up
$r = .68, p = .002^*$	$r = .79, p = .00^*$	$r = .48, p = .05^*$

Mood and well-being.

Depression Anxiety Stress Scale (DASS)

Mood was assessed throughout the intervention period with the DASS. This scale was used at baseline, post-intervention and follow-up. The mean scores and standard deviations are presented in Table 8.

Table 8:

DASS scores at various time points throughout the intervention

	DASS total score	Depression score	Anxiety score	Stress score
Baseline	22.29 (SD=12.6)	6.35 (SD=5.16)	5.00 (SD=3.72)	10.94 (SD=6.05)
Post intervention	14.59 (SD=11.42)	5.00 (SD=4.11)	2.70 (SD=3.8)	6.88 (SD=5.5)
Follow up	13.53 (SD=13.17)	4.47 (SD=5.86)	2.53 (SD=3.83)	6.59 (SD=5.5)

Figure 8: DASS total sample mean scores over time

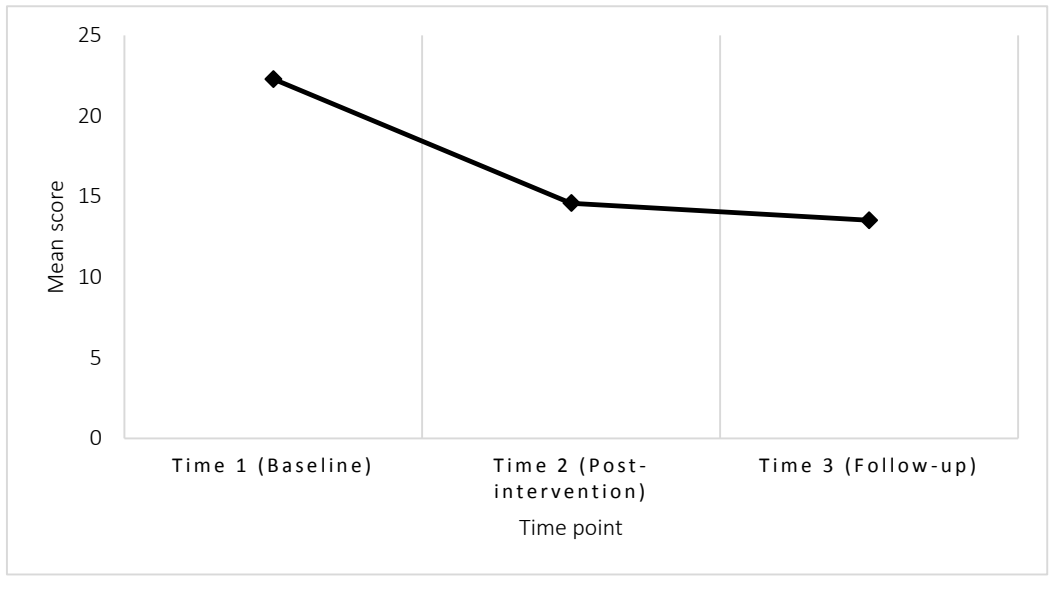


Figure 9: DASS depression sample mean scores over time

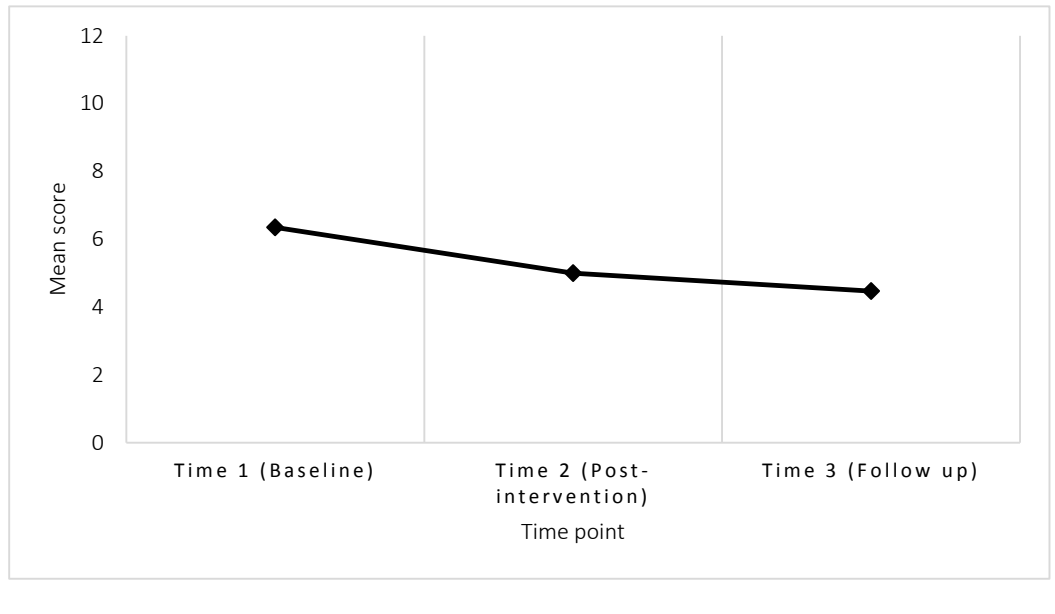


Figure 10: DASS anxiety sample mean scores over time

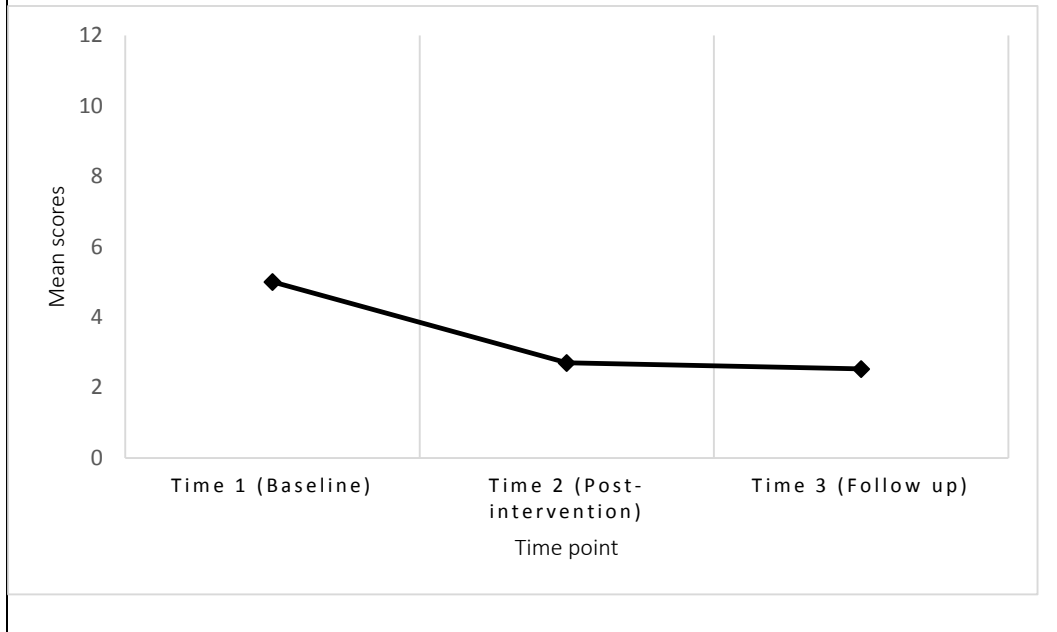
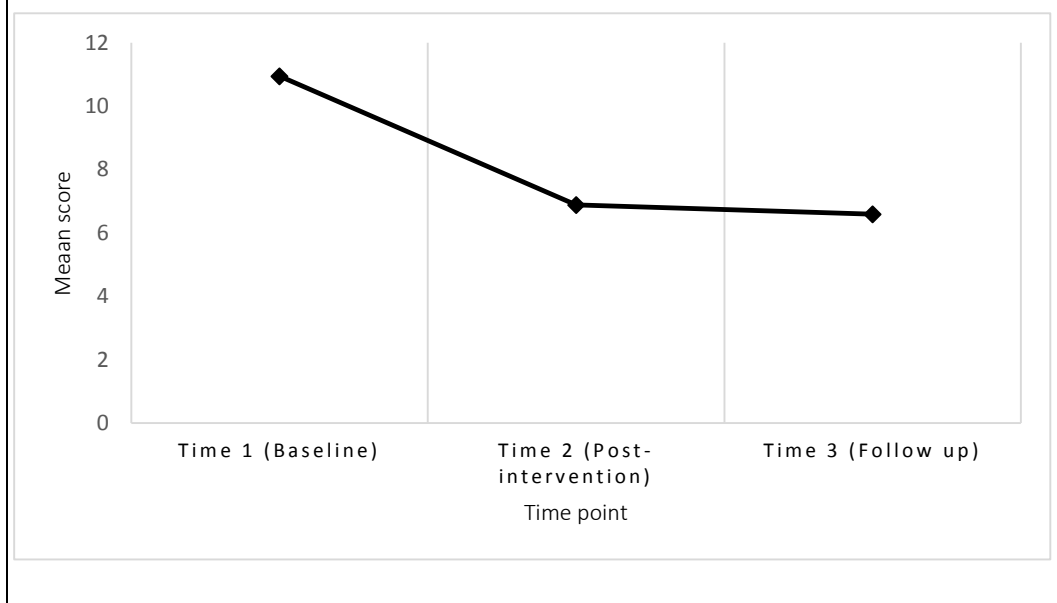


Figure 11: DASS stress sample mean scores over time

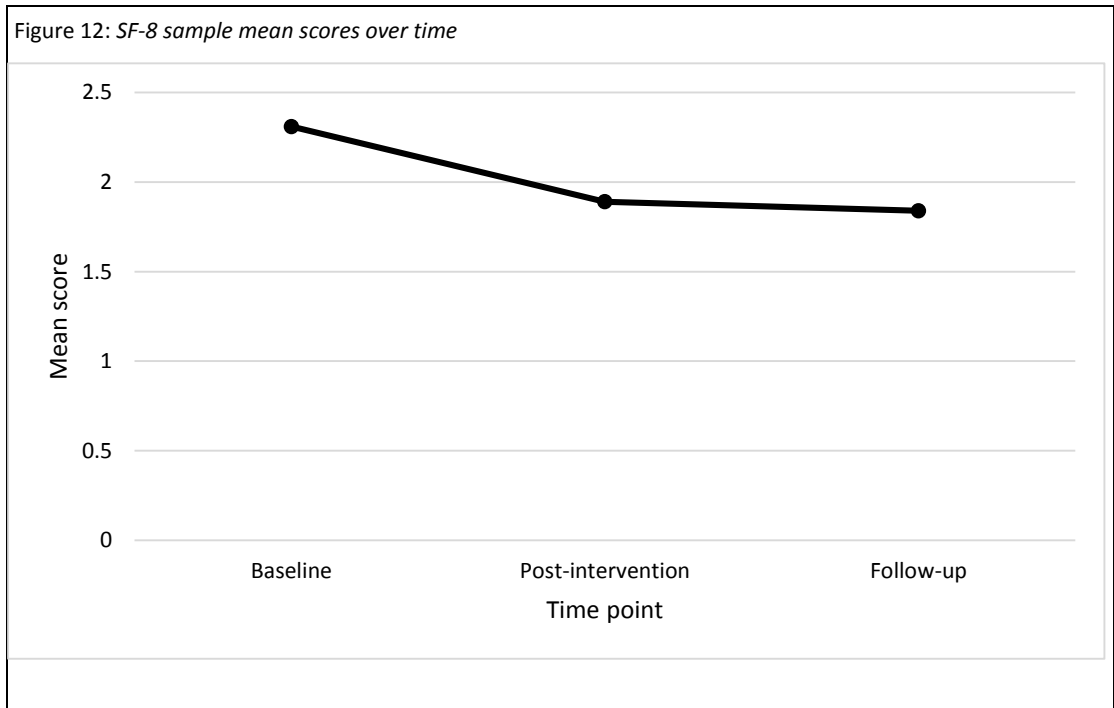


Friedman's ANOVA was used to examine the changes in the overall representation of mood throughout the intervention. There was a significant change in total DASS scores, $X^2(2) = 0.018$, $p < 0.05$. A Wilcoxon signed rank test was used to follow up these findings. A Bonferroni correction of 0.0167 was used and statistical significance was determined at this level. No significant difference in mood was found between baseline and post-intervention ($Z = -1.97$, $p = .049$), as well as between post-intervention and follow-up ($Z = -1.14$, $p = .252$). The significant difference in mood lay

within the outcome of the whole intervention with a significant difference being found between baseline and follow-up ($Z = -2.70, p = .007$).

SF-8

Wellbeing was examined during the intervention with the SF-8. This scale was used at baseline, post-intervention and follow-up. At baseline, the mean score for wellbeing was 2.31 (SD=0.58). At post-intervention the mean score was 1.89 (SD=0.42) and at follow-up the mean score was 1.84 (SD=0.47).



To examine whether there was any significant changes in wellbeing scores throughout the intervention period, Friedman's ANOVA was utilised. Results showed that there was not a significant difference in wellbeing scores throughout the intervention, $\chi^2 (2) = 0.053, p = > 0.05$.

Relationship between mood and exercise.

Spearman's rank-order correlation was used to examine the relationship between total DASS score and amount of exercise performed throughout the duration of the intervention. The results are shown in Table 9.

Table 9:

Total DASS score and total exercise performed at various time points correlation matrix

Baseline	Post-intervention	Follow-up
$r = -.31, p = .15$	$r = .35, p = .17$	$r = .34, p = .19$

Relationship between mood and self-efficacy.

Spearman's rank-order correlation was used to examine the relationship between total DASS score and self-efficacy throughout the duration of the intervention. The results for pre-action self-efficacy and maintenance self-efficacy and mood are presented in Table 10.

Table 10:

Pre-action self-efficacy and maintenance self-efficacy and total DASS score correlation matrix

Baseline	Post-intervention	Follow-up
$r = .21, p = .42$	$r = -.19, p = .47$	$r = .14, p = .60$

The results for recovery self-efficacy and total DASS score are presented in the Table 11.

Table 11:

Recovery self-efficacy and total DASS score correlation matrix

Post-intervention	Follow-up
$r = .11, p = .66$	$r = .23, p = .38$

App usage.

At post-intervention participants were asked how long they used the Couch to 5k app for. Three participants (17.6%) didn't use the app, three participants (17.6%) used it for one week or less, seven participants (41.2%) used it for two-four weeks, three participants (17.6%) used it for four-six weeks and one participant (5.8%) used it for the whole 8 weeks.

Effectiveness rating of the app.

At post-intervention, participants were asked to rate the overall effectiveness of the Couch to 5k exercise app. One participant (5.8%) found the app very ineffective, three participants (17.6%) rated the app as ineffective, six participants (35.3%) rated the

app neither effective nor ineffective, five participants (29.4%) rated the app as effective and two participants (11.7%) rated the app as very effective. Participants that rated the app low for effectiveness, did not use the app at all or as regularly as those who rated the app as effective.

Qualitative results

The following section outlines the qualitative findings from the study. Six themes were identified within the data set. These were: variation and structure of the app, progression of the app, the app as a starting point for exercise, motivation and app use, barriers towards exercise and social support.

Variation and structure.

Many participants had positive comments on the features of the app and the way the app was set out. Many participants mentioned that they liked the timer component and the fact that their exercise regime was all set up for them and they just had to follow the prompts.

[I liked] the set up with the timing and the way that it went well with music that was playing in the background. It was very clear. Participant 6

The app is helpful in that it is all set up and basically tells you what to do. Participant 14

When I was just starting out this app I needed a bit of motivation to keep running so it was helpful to have a guide to tell me when I can start walking and have a break. If you're not strong willed it's very easy to just think to yourself "I could just stop running" but this app made you create goals and follow the instructions. Participant 2

Participants also said that they liked the variation of running and walking so that they could gradually work up to getting fitter and training for longer and greater intensities.

I really liked the way it kept track of when I needed to walk, and when I needed to run, and how it encouraged me by letting me know I was halfway, and when I had a minute to go. Participant 1

I liked how it let me get used to jogging gradually. It was nice to know when to stop and start jogging without looking at a watch or timer. Participant 7

I liked how it was spaced out. The exercise began rather simply then had just the right amount of difficulty added each week. I liked how it had a

warmup and warm down section also. I was able to keep up with the difficulty as it increased so it was perfect for me. Participant 2

Participants also commented on the flexibility of the app and although it told you what to do, they commented on how you could repeat sessions if necessary and choose the days of the week the sessions could be done.

It had the weeks and the days clearly outlined on the app page. It wasn't so rigid that you had to stick to a certain day you just had to make sure that you did three days a week. Participant 6

Easy to follow instructions and graded intensity program was good to use. It was helpful to be able to go back and repeat a session when I felt I had struggled with the activity. Participant 15

One participant also mentioned that the flexibility was good as she could work out when she could fit exercising into her schedule but could also examine how hard the exercise was going to be that week or session and figure out where she was going to run depending on the degree of difficulty.

It had a clear schedule of exercise for each week, which made it easier for me to see how many times I did or needed to do exercise that particular week. I could plan in advance which course I should jog depending on the schemes, which was very helpful. Participant 7

Although the layout and structure of the app was held in positive regard for most participants, a small number of participants did not like the app because they felt overly constrained by it.

I felt it was quite unhelpful for me. I prefer to have a more flexible exercise pattern and to have variety rather than have something so structured. Participant 16

I do not like feeling regimented in my exercise. Participant 4

Another negative point that some participants mentioned was the fact that the app did not give reminders or alerts to do exercise. It also did not track and store one's progress once started.

It didn't give me reminders about how many exercises left in a week. Participant 5

It would have been good to have a way of viewing the sessions including times and distances as achieved. Participant 15

App progression.

Many participants commented on how the app progressed. The majority of participants who commented on how the app advanced said that it progressed too quickly for them.

I used the app for about the first 4 or 5 weeks however I found the level getting a bit intense, and if I missed a few days it was really hard to get back into it. Participant 6

The level of exercise went up too quickly for me personally. Participant 11

It went well until I got to the week five, when the exercise scheme suggested by the app became too hard for me, so I decided to repeat the easier one so that I did not feel too reluctant Participant 7

I found it pushed me too far in the beginning. Participant 5

Although the majority of participants who commented on how the app advanced said it progressed too quickly, there were some participants who said that it advanced too slowly. This made them feel frustrated and as a result, made them turn away from using the app.

I felt the app progressed very slowly, so I lost interest in using it as I felt I wasn't being pushed. Participant 16

As I used to be quite physically fit I thought the app took a while to build into things. I myself prefer to go hard out at the start of training or when I start training again after a break as I feel like that's how the most gains are made. That's why after about three weeks I started doing my own stuff. Participant 9

I have looked at it before and found it started too slowly and was frustrating. Participant 8

Using the app as a starting point.

Most participants who started using the app during the study, discontinued its use at some point during the intervention period. Most of these participants however, started running without using the app or started other forms of exercise, suggesting that the app may be a good starting point for people.

It laid out a plan which was useful when I had no idea of where to start really and not much motivation. It gave ideas even if I didn't follow it exactly. Participant 11

I believe it is a good starter for those who haven't done any exercise for a long time. The exercise regime is very easy to start with and gradually becomes harder as a runner gets used to jogging. Participant 7

C25K encouraged me to look at other options for tracking exercise and intensity of exercise. Participant 4

I continued doing cardio and continued going to the gym however without using the app. I am not a huge fan of cardio so that could be a reason that I discontinued its use. However the app did get me into a good exercise regime which I have managed to keep up quite regularly since starting to use it. Since using the app I have been focusing on doing moderate intensity cardio and weights training both at the gym and outside. Participant 6

I stopped using the app but it was good to get me restarted in physical activity again. Participant 9

Motivation and app use.

Although many participants liked the app and the features of it, some commented on motivation being outside the realms of the app. They mentioned that motivation is something external to the app and you have to have the motivation and eagerness to use the app in the first place, which was difficult for some people.

I found the app useful for motivating me when I was exercising, but found that it didn't make much difference in my motivation to actually do the exercise in the first place...For me personally it wasn't enough motivation to keep exercising. Participant 3

The effectiveness of the app also depends on the degree of a user's eagerness. There is no external pressure, so maybe some people might find it difficult to stick to it. Participant 7

Unfortunately it is only as good at the person using it and I have just not had the motivation I should to follow the programme properly. Participant 14

I think the app is good to help plan what you could do and should do, but it doesn't make you actually get up and get out there and do it. The motivation still has to come from within, and if you are feeling down or can't be bothered or feel like hibernating because it's winter, then the app doesn't really help with that...the app doesn't 'make' you do the exercise - that bit is still up to you. Participant 11

Barriers.

Many participants commented on the difficulty in finding time to use the app and exercise. For many, work and family commitments hindered their ability to find time to use the app.

The app worked really well for me. Unfortunately I had many assignments due from week three onwards and was unable to complete the 8 weeks. I will be starting the app again when the university semester begins. Participant 1

I found the time was never right to get going and that my family commitments always came before the exercise that I planned...I'm a single parent with 4 busy kids. I thought doing the exercise for the project would spur me on, but it didn't. Participant 8

As well as work and family responsibilities, participants also talked about barriers related to the winter months such as bad weather, getting dark too quickly and being run down with illnesses which made it hard to find time to use the app and exercise.

I got sick three weeks ago and haven't fully recovered from it yet, so unfortunately I haven't been able to do as much exercise as I would like to. I'm intending to be back on track once I feel better. Participant 7

Haven't continued using the app and struggled with using it over the 8 weeks. Due largely to having found the winter months really difficult to stay motivated with any exercise and have had a period of one month where I did no intentional exercise. The app itself works well when I used it...have just found it difficult to use that particular one at this time of the year with family and work commitments during the daylight hours. Have used a different app instead 'sworKit' to do workouts at home which gave me a bit more flexibility Participant 14

When asked what would have helped them to exercise and use the app during this time some participants said:

Summer time!! More daylight, warmer and not rundown and sick with colds. Participant 14

Lots more time and a lot less work! Participant 15

Social support.

Many participants said that if they had someone to exercise with, or even do the app with, exercise would have happened more regularly and motivation would have increased.

An exercising buddy could help to make sure that I didn't make excuses to myself to avoid my planned exercise. The past couple of months have not been routine in our household so that made it a bit harder to establish good regular exercise habits. Participant 12

Having someone to exercise with would have also made a difference.
Participant 16

More people that I knew doing the app would have been nice to compare our routines! Participant 2

Over the last two weeks my main motivator has been that my partner is joining me in using a 'walkmeter' app on my phone and coming for walks with me. Which also means I am not limited to the daylight hours.
Participant 14

Some participants also mentioned the online social community linked with the app, and how this was beneficial.

The app also has a social community where people can share their experiences or any problems they might have, which, for some people, would be a great motivation to keep doing exercise. Participant 7

I found the app very effective as when I completed each workout I could share the success with friends if I wanted to. Participant 1

Chapter 4: Discussion

This study examined the effectiveness of an exercise app for the initiation of exercise over a two month intervention period. In this chapter the findings presented in the results section will be examined in depth. This will include an examination of results found for all the scales and measures and what they all suggest as well as a thorough exploration of the qualitative data. Strengths and limitations of the study will be discussed as well as recommendations for exercise app development and future directions.

Changes in exercise

Overall, exercise levels increased in the sample for both moderate and vigorous exercise. Notably, the number of sessions as well as duration of vigorous exercise was performed each week significantly increased, with the significant difference found between baseline and mid-intervention. This means that the largest change in the number of times vigorous exercise was performed each week as well as the average duration of each session was between the time the participants signed up to the study and four weeks after beginning the study. Although there appeared to be a trend towards increasing sessions of mild or moderate exercise, this did not reach significance. However, this may be because the app was designed to encourage vigorous exercise which may have replaced milder exercise sessions. The change in duration for mild or moderate exercise sessions also did not reach significance.

Likely benefits on physical health

The recommended amount of exercise to develop and maintain optimum health and wellness is 150 minutes per week (US Department of Health and Human Services, 1996; Pate et al., 1995). At mid-intervention and post-intervention, the average amount of exercise performed in the sample was just under this recommendation at 136 and 142 minutes respectively. However at follow-up the average amount of exercise performed by the sample exceeded this amount and were performing on average 195 minutes per week. This is an encouraging result, as by increasing exercise to the recommended levels, participants in this study will be receiving the benefits exercise can offer for physical health.

The increase in overall exercise has meant that if participants continue to exercise they will be improving their health and even decrease the risk of early

mortality. Although it was unknown whether participants in this study were at current risk of physical diseases related to inactivity such as heart disease, metabolic syndrome or type 2 diabetes, by increasing their exercise levels as well as these levels meeting guidelines, participants are more likely to reverse or prevent these diseases from happening (Warburton, Nicol & Bredin, 2006; Vuori, 2007; Lakka & Laaksonen, 2007; Argarwal, 2012)

Couch to 5k app helpful for exercise initiation and comments on maintenance

The increase in exercise found in the sample suggests that the app may have aided exercise initiation. However, long-term maintenance of exercise behaviour is beyond the scope of the study. According to the Transtheoretical model, maintenance of a behaviour can only be considered if it is performed continuously for 6 months or more (Prochaska & DiClemente, 1983; DiClemente, 2007). Within this study, the intervention period was only two months with maintenance minimally assessed one month after. This meant that participants who continued to exercise during the whole study period had only been exercising for a total of 3 months, therefore it is not clear whether the app prompted longer-standing maintenance of exercise behaviour. Participants who continued to exercise throughout the whole 3 month period could be considered within the action phase of the Transtheoretical model (DiClemente, 2007).

Many participants discontinued use of the app during the intervention period. This suggests that this particular app would not be useful for encouraging exercise over a long period of time. However, despite many participants ceasing use of the app during the intervention period, many of these participants continued to exercise without using the app as a guide. Although the app was not used for a long period of time, the fact that it prompted exercise for many people is still encouraging. Many participants stated that it gave them a good idea of what they should be doing in terms of how many times per week they should be exercising and at what intensity. It also prompted some participants to try other exercise modalities such as resistance training.

Most of the participants in the sample stated that they did not use the app for the whole intervention period which suggests that it may not be suitable for long-term use. The app sets a goal of running 5 kilometres or running continuously for 30 minutes at the end of 8 weeks. This is ideal for someone who has a personal goal of running 5 kilometres; however for someone who may have a goal of running further or a desire for

a general running guide, the Couch to 5k app may be less useful for long-term use. Once the goal or usage period is over, people may stop exercising all together after 5 kilometres have been achieved. Zenlabs also have a Couch to 10k running app that is a good adjunct to the Couch to 5k app. However, to minimise the risk of users discontinuing use after achieving the app's featured goal it may be more beneficial to combine both apps to create a running guide for the long-term. Having an option to have a running guide over a longer period of time is more likely to encourage maintenance of exercise behaviour by setting both short and long-term goals. However, it is important to consider that the developers may have made two separate apps to minimise the chance of potential user's becoming discouraged by a 10 kilometre guide. Five kilometres is a much more achievable distance for a beginner exerciser and therefore more appealing to a beginner exerciser.

Progression of the running guide: Exploration of the exercise intensity-affect relationship

Three participants commented on how the app's running guide progressed too slowly for them, which deterred them from future use. This small number of participants that said the running guide progressed too slowly were exercisers who have had exercise experience in the past, indicating that they had an exercise regime that they discontinued less than a year ago. These participants became frustrated with the low intensity of the outlined schemes at the beginning of the guide which lead them to discontinue use. These few participants favoured having a more difficult exercise plan as they preferred to go straight back into challenging exercise after discontinuing their previous exercise regime.

This finding is consistent with a study examining predictors of exercise adherence for both moderate and high intensity exercise in a group of sedentary adults (Anton, Perri, Riley, Kanasky, Rodrigue, Sears & Martin, 2005). In this study, the researchers found that participants who had previous exercise experience had better adherence to higher intensity exercise than participants who did not have past exercise involvement. They also found that participants with previous exercise experience had poorer adherence to moderate intensity exercise than participants with lower levels of exercise involvement (Anton et al., 2005). Therefore participants who had previous involvement with exercising preferred to exercise at a higher intensity from the beginning rather than ease into their exercise regime. It was mentioned that this may have been due to the participants' confidence in their ability to begin at a higher

intensity due to their previous experience (Anton et al., 2005). This phenomenon was evident in the current study, as participants who had a regular exercise regime but stopped less than a year ago had higher pre-action self-efficacy ratings ranging between 3 and 3.6, in comparison to participants who had less prior experience exercising.

Although a small number of participants said that the app's running guide progressed too slowly, a much greater number said that the guide progressed too quickly for them. There is extensive research stating that exercise that is too intense; feels unpleasant, which results in an avoidance of future exercise behaviour, thus decreased adherence. This phenomenon is known as the exercise-intensity-affect relationship (Ekkekakis, Parfitt & Petruzzello, 2011; Ekkekakis, Hall & Petruzzello, 2008). The exercise-intensity-affect relationship is based on the premise that humans tend to seek out and continue experiences that are pleasurable and avoid those that cause discomfort (Ekkekakis, Parfitt & Petruzzello, 2011). There is substantial research to suggest that people that perform exercise at a high intensity are less likely to adhere to their programmes in the future (Ekkekakis, Hall & Petruzzello, 2008). This is likely due to exercise that is performed at a high intensity feeling aversive, especially for a beginner exerciser. Therefore a person who has exercised at this intensity may avoid exercise in the future as they associate exercise with feelings of discomfort (Ekkekakis, Hall & Petruzzello, 2008).

The exercise-intensity-affect relationship can be explained more thoroughly with the dual-mode theory. The dual-mode theory explains this phenomenon from an evolutionary perspective that examines exercise as an adaptive response for survival (Ekkekakis, Parfitt & Petruzzello, 2011). The theory states that the adaptive responses to exercise are determined through an interaction between cognitive factors and physiological cues (Ekkekakis, Parfitt & Petruzzello, 2011; Parfitt & Hughes, 2009). A core component of this theory is the relationship between exercise intensity and the ventilatory threshold. The ventilatory threshold at a basic level is the point at which breathing becomes laboured and the breathing rate is disproportionate to the amount of oxygen required to function at that level of activity (Kent, 2006). Cognitive factors such as self-efficacy are said to be prominent during exercise that is performed below the ventilatory threshold that contribute to positive affect. Exercise performed at or around the ventilatory threshold will differ between people, with some reporting increased positive affect and others decreases. For some, cognitive factors are still prominent, therefore positive affect is upheld and for others, physiological cues become

more prominent such as signals from, baroreceptors, chemoreceptors, visceroreceptors and thermoreceptors. Therefore exercising starts to become a physical strain and becomes unpleasant. This often differs due to individual preference and tolerance for high intensity exercise also. For most people exercising above the ventilatory threshold, physiological cues are prominent and exercise is almost always reported as unpleasant (Ekkekakis, Parfitt & Petruzzello, 2011; Parfitt & Hughes 2009). Therefore, pleasure starts to decline once the ventilatory threshold has been exceeded and can be used as a gauge for maintaining positive affect (Ekkekakis, Hall & Petruzzello, 2008).

Pleasurable exercise experiences have also been examined in relation to prescribed versus self-selected exercise intensity. Lind, Ekkekakis & Vazou (2008) explored this phenomenon with a within-subjects design consisting of 25 middle aged-sedentary women. Participants completed two 20 minute treadmill exercise conditions, one where they self-selected their exercise intensity and the other was prescribed at 10% higher than their self-selected intensity. The researchers found that during the self-selected condition participants' ratings of pleasure remained stable, whereas in the prescribed condition, ratings of pleasure decreased. The researchers speculated that when participants were able to self-select their exercise intensity, they were exercising below or near their ventilatory threshold, thus the experience remained pleasurable. The small increase in imposed intensity may have pushed participants passed their ventilatory threshold, therefore could explain why a decrease in pleasure was noted (Lind, Ekkekakis & Vazou, 2008).

The promotion of self-selected exercise intensity is supported in other research also. Ekkekakis, Parfitt and Petruzzello (2011) state that the self-selection of exercise may add to increased adherence by fostering a sense of autonomy. Rather than the exercise being imposed, creating a sense of it being something that one is forced to do, it is felt as something one freely chooses to do (Ekkekakis, Parfitt & Petruzzello, 2011). It is also mentioned that with increased enjoyment and positive affect experienced within self-selected exercise conditions, long-term adherence is much more likely (Raedeke, 2007).

To help understand preference and tolerance for intensity of exercise, Ekkekakis, Hall and Petruzzello (2005) developed the Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIEQ). The reason for developing this scale stems from noting individual preferences and tolerance for exercise intensity and how

this contributes to exercise adherence or drop out. A 16 item self-report questionnaire has been formed with 8 items assessing tolerance, and 8 assessing preference for exercise intensity (Ekkekakis, Hall & Petruzzello, 2005). The scale was pilot tested among several college-aged, healthy and reasonably active groups and showed it was effective, however, the authors recognised that further testing is needed among, middle-aged, older adult, unfit and sedentary groups (Ekkekakis, Hall & Petruzzello, 2005; Ekkekakis, Thome, Petruzzello & Hall, 2008). Although the scale is yet to be tested among differing groups, this is still a promising measure for assessing individual preference and tolerance of exercise intensity which could be a useful tool in aiding exercise adherence (Ekkekakis, Hall & Petruzzello, 2005).

These findings from previous research can be taken into consideration for improving the existing Couch to 5k app and for assisting with future app development. This research suggests that exercise plans within apps should consider individual needs as well as the progression of given exercise plans and routines to include gradual advancement. A person who has already had some experience with exercise will most likely want an exercise regime that is more intense at the beginning. However, it is also important to consider the needs of a beginner exerciser. A beginner exerciser will need a regime that is moderate at the beginning so that the experience is not unpleasant which could result in avoidance of future exercise. Future work outs will need to progress at a steady pace and not push the user too hard so that the exercise experience remains pleasant. This will likely increase the likelihood of long-term adherence. Having scales and measures before commencing the exercise guide that assess views and preferences for exercise may increase feelings of ownership for creating an individualised exercise plan which may make a user feel as though they are in control of their programme. This also may foster adherence. A positive point associated with the progression of the running guide in the Couch to 5k app was the gradual advancement of the running guides and the flexibility in choosing what plan to run. If participants felt the suggested plan for the day or week was too difficult then there was the option to repeat certain workouts until they were ready to move on. Although this was an option, it should be mentioned that only one participant mentioned doing this. Most participants commented on how it became too difficult and as a result stopped using the app.

Planning

Action planning and coping planning were examined at baseline to get a sense of participants preparation for taking on an exercise regime. Average scores showed that overall, the sample had not put much thought into planning the logistics of their exercise such as when they would exercise, what they would do and how often they would do it as well as planning what they would do if their original exercise plans were not possible. The score for action planning was 2.15, corresponding with a 'barely true' response and the score for coping planning was 1.5, corresponding between a 'not true at all' response and a 'barely true' response. These low responses for planning scales may be due to the possibility that participants were waiting to see what the researcher wanted them to do for exercise. In a natural setting, people would be more likely to seek out themselves what they would do for an exercise programme, therefore may take more ownership in planning it all out.

The correlation coefficients for the planning scales and overall exercise show some variability. The figures show that the hypothesis of participants with higher scores for action planning and coping planning will be more likely to continue exercising throughout the duration of the intervention was not supported as the relationship between action planning and coping planning scores and total exercise was weak. It is possible that some of the variability with these scores could be due to the small sample size, thus should be interpreted with caution. However, there is some evidence to suggest that there is a relationship between action planning and coping planning and exercising near the beginning of the study as moderate correlations were found at mid-intervention. It could be likely that planning has a stronger influence at the beginning of a new exercise regime than it does in the later stages of a programme. It could be possible that other factors such as self-efficacy and action control have a stronger influence for maintaining an exercise regime, than planning does.

Action control

Action control is a prominent construct within the volitional phase of the HAPA and constitutes self-regulation and monitoring of exercise behaviour (Schwarzer, Lippke & Luszczynska, 2011). During the volitional phase a person is considered to have a higher rating on action control if they successfully monitor their exercise behaviour and goals in terms of how often they engage in exercise and whether they have consistently trained at the right intensity (Schwarzer, Lippke & Luszczynska, 2011). Action control is

considered an essential process in maintaining an exercise regime (Schwarzer, 2008; Schwarzer & Luszczynska, 2008; Schwarzer, Lippke & Luszczynska, 2011).

The relationship between action control and app usage was examined and showed that these variables correlated strongly with one another and also reached significance. This means that as app usage increased, action control scores increased alongside. This could mean that the Couch to 5k app may have aided self-regulation and monitoring of exercise behaviour. Thus, the hypothesis of participants who use the app regularly will have higher scores for action control was supported. It is interesting to note that although the correlation coefficient at follow-up was still moderate and significant, the coefficient was weakest at this point, which is also the point at which the app usage period had been over for one month. This point further strengthens the possibility that the Couch to 5k app was aiding self-regulation and monitoring of exercise behaviour.

Although it seems as though the Couch to 5k app was aiding self-monitoring and self-regulation of exercise behaviour, some participants commented on features that were lacking in the app that could have further assisted with action control. Some participants said that they would have liked the app to store information or create feedback for completed workouts. This could include distance travelled, speed in which they were travelling and steps taken which could then be stored to look back on and track improvements. Some participants said that the app did not have alerts or reminders to do exercise or alerts to show how many more times exercise needed to be done that week. Not including these features were seen as a disadvantage of the app by some participants and are also things that could easily be incorporated into the Couch to 5k app or other future exercise apps (Kirwan, Duncan & Vandelanotte, 2013; Middleweerd, et al., 2014).

Exercise apps are capable of performing many functions such as the ability to track and record information and are GPS and accelerometry capable whilst also being interactive and appealing to users (Kirwan, Duncan & Vandelanotte, 2013; Middleweerd, et al., 2014). As smartphones are capable of performing these aspects, these features that participants expressed they would have liked to have seen within the Couch to 5k app can be considered a missed opportunity for creating a more efficacious app for exercise initiation and maintenance. However, with an already strong significant relationship between action control and app usage for this study, the potential for

adding to the app's capabilities is a promising avenue for an even more effective exercise app.

Self-efficacy

Self-efficacy scales were used to examine participants' beliefs in themselves to start or continue exercise at all points in the intervention. Pre-action self-efficacy scores indicated that at the beginning of the study before exercise had begun, participants had a fairly strong belief in their ability to begin exercising. The average score for pre-action self-efficacy was 3.06 which corresponds with 'mostly true' responses on the scale. The relationship between participants' belief in their ability to begin exercising and total exercise at all points of the intervention was examined and showed that at mid-intervention and follow-up, correlation coefficients were moderate and positive. At post-intervention this relationship was much weaker with a weak positive correlation found. This could suggest that belief in oneself is more pertinent at the beginning of an exercise programme and other factors such as action control may be a stronger influence for continuing.

The relationship between maintenance self-efficacy and total amount of exercise at all time points was also examined and showed that these variables had a robust relationship. Strong correlations were found at all time points. This indicates that as maintenance self-efficacy scores increased, amount of exercise performed also increased alongside. These correlation coefficients and raw scores for maintenance self-efficacy are stronger than the pre-action self-efficacy correlation coefficients and raw scores which could suggest that once participants started exercising, their belief in their ability to continue exercising became stronger than their belief in themselves when they started.

Research on exercise behaviour and self-efficacy is extensive. Social cognitive theories for behaviour change such as the Transtheoretical model, the HAPA and the TPB maintain that self-efficacy is a driving factor for initiation and maintenance of exercise behaviour (Proachaska & Marcus, 1994; Ajzen, 1991; Schwarzer, Lippke & Luszczynska, 2011). It is well established that people with higher self-efficacy are more likely to adhere to their exercise programme (Bui, Kemp & Howlett, 2010; Shields, Brawley & Lindover, 2006; Jackson, 2010; Slovinec D'Angelo, Pelletier, Reid & Huta, 2014). One of the main components that bolsters self-efficacy is mastery experience (Bui, Kemp & Howlett, 2010; Jackson, 2010). Mastery experience is the previous

involvement and accomplishments one has achieved while exercising (Jackson, 2010). As one gains more mastery over their exercise activities, belief in one's ability to perform the task strengthens, thus improving self-efficacy (Jackson, 2010). Mastery experience could explain how self-efficacy levels increased throughout the intervention period of the present study. This could be due to participants accomplishing tasks set by the app, therefore their belief in their ability to maintain exercising in the future strengthened.

Mastery experience can be enhanced through psychological techniques (Jackson, 2010). Techniques such as goal-setting, reminders of past personal experiences, appropriate exercise design and exercise logs are means to improve self-efficacy through mastery experience (Jackson, 2010). Reminders of past personal experiences and exercise logs are also tools which can aid action control and are mechanisms that can easily be incorporated into the Couch to 5k app as well as existing and future apps as previously mentioned. Again, not incorporating features for tracking exercise is a missed opportunity for production of an efficacious app for initiating and maintaining exercise through boosting self-efficacy and aiding self-regulation and monitoring (Kirwan, Duncan & Vandelanotte, 2013).

Mood and wellbeing

Mood and wellbeing were examined at baseline, post-intervention and follow-up. Mood was examined with the DASS and well-being with the SF-8. Mood significantly improved throughout the duration of the intervention. The significant change was detected within the outcome of the whole study between baseline and follow-up. Although a promising finding, this significant effect should be interpreted with caution. With the effect being found between baseline and follow-up, this means the time frame in which this was detected is 3 months. Although exercise may have improved participants mood, it could also be likely that time itself or other factors contributed to the improvement in mood shown.

Another point to raise in relation to mood are the scores found at baseline. The average score found at baseline fell within normal ranges (Lovibond & Lovibond, 1995). Due to this fact, significant changes would be less likely to be detected. This is understandable with the use of a nonclinical sample. Results might have looked different with the use of a clinical population, as higher scores for depression, anxiety or stress at baseline would have been more likely to show a significant change over time.

Change in mood could also be associated with the time of year in which the study was conducted. The majority of participants began the study during May and June which is the middle of winter in New Zealand, and finished the study moving into spring. There is a lot of research to suggest that mood changes align with changes in seasons (Magnusson & Boivin, 2003; Gudenas & Brooks, 2013; Michalak, Wilkinson, Hood & Dowrick, 2002). In more extreme cases, a diagnosis of Seasonal Affective disorder can be given (American Psychiatric Association, 2013).

Exercise for the treatment of Seasonal Affective Disorder has been explored, but remains inconclusive (Peiser, 2009). Peiser (2009) discussed barriers for exercise interventions for the treatment of SAD within his review and noted difficulty with getting sufferers to engage in exercise when feeling, sad, stressed or fatigued. Although it is not possible to know whether participants within the current study were suffering from SAD, this information can provide some insight into possible reasons for improvement in mood during the intervention period.

No significant change was detected for wellbeing within the sample. This is also likely due to a ceiling effect with participants rating their wellbeing fairly highly at baseline. Therefore, detecting significant changes were also less likely for this construct.

Relationship between mood and exercise

At post-intervention and follow-up, the relationship between exercise and mood showed there was a moderate positive correlation between these variables. This means that as exercise increased, mood improved alongside. However, because this finding is a correlation, it is difficult to determine which variable is influencing the other. There is a significant amount of research to show that exercising has a positive effect on mood but research to show how mood affects exercise initiation and maintenance is less prominent (Carels, Coit, Young & Berger, 2007). However, there is some research to explain this relationship.

Rogerson, Murphy, Bird & Morris (2012) did a qualitative examination of barriers and facilitators for exercise among patients with coronary heart disease and depressive symptoms. They found that low mood was commonly reported as a barrier to engaging in exercise as well as other factors relating to low mood such as low motivation to exercise and negative perceptions towards life changes. Mood and the effects on exercise has also been examined in relation to the Health Action Process

Approach (Kramer, Helmes, Seelig, Reinhard, Fuchs & Bengal, 2014). Kramer et al. (2014) found that in comparison to their non-depressed control group, the depressed sample showed a significantly lower intention to do exercise. Furthermore, the subset of depressed individuals who had a high intention to exercise were less able to convert their intentions into actions. This showed that people with a lower mood were less likely to form an intention to exercise as well as a volitional deficit (Kramer et al., 2014). Therefore it is important to consider how mood may affect exercise initiation, as people who are more distressed may find it much harder to initiate an exercise regime.

However, it should also be mentioned that at baseline, the relationship between exercise and mood was moderate and negative. This means as one of these variables increased, the other decreased. This could mean as mood increased, exercise decreased. A possible explanation for this could be that people who were more distressed at the beginning of the study were trying to do something to regulate their mood, thus may have been turning to exercise to help them do so. However, the people who were less distressed at the beginning of the study may have just been waiting for instructions from the researcher to begin exercising. This is an interesting finding that must be examined with caution. It is also possible that the variability found among these scores could be due to the small sample size. This is a factor that warrants further exploration.

Motivation: Moving through the motivational phase to the volitional phase of the HAPA

A common qualitative theme among participants was the construct of motivation being seen as something external to the app. Many participants said that the app was helpful and a good mode for encouraging exercise but that it took a lot of motivation to actually use it. Therefore motivation to do the exercise was seen as something external to the app's capabilities. Although an app cannot actually make one get up and do the exercise, it is possible that features could be incorporated into an app to bring self-awareness to the user's motivation and reasons for exercising. A check list or questionnaire could be utilised before embarking on an exercise app's guide so users can bring awareness to the reasons for beginning exercise as well as a report indicating the likelihood of long-term exercise behaviour based on responses. Prompts or notifications could be utilised that remind the user to exercise that have a caption pertinent to their reason for exercising. These could include phrases such as: 'Remember to exercise today-you'll feel better physically and emotionally!' Or, 'By exercising today you'll be taking a step towards improving your health!'

As well as a scale measuring motivation for exercise, other scales could be used to bring awareness to the user's intentions for exercise. Scales for the motivational phase of the HAPA could be implemented such as ones for risk perception, outcome expectancies and self-efficacy to bring awareness to the user's reasons for beginning to exercise as well as their perceived confidence to start exercising. Using scales of this nature within an exercise app could help a user move through the motivation phase of the HAPA and into the volitional phase by bringing awareness to the user's intentions but by also providing feedback. Once in the volitional phase, questionnaires and scales could still be used intermittently to bring awareness to their efforts and views whilst continuing to exercise which would aid action control.

Barriers for exercise reported by participants

Participants commented on many factors that are commonly reported in other research that made exercise hard to begin or continue. Time of year was a common barrier raised by participants. This included a lack of daylight to complete exercise after work, cold weather which made exercising outside unpleasant as well as the winter months meaning participants and their family members were run down with colds and illnesses. Participants also mentioned lack of time to be a main reason as to why exercise was difficult to do or maintain. Many participants said that work and family commitments did not leave them with a lot of spare time to do exercise. Lack of time and constraints by the weather are common barriers for a wide range of people (Prideon & Grogan, 2012; Dishman, 2001; Brinthaup, Kang & Anshel, 2010; Ebben & Brudzynski, 2008; Korkiakangas et al., 2011; Hoebeke, 2008).

Social support

A number of participants mentioned that a lack of social support made exercising more difficult and if more social support was provided then they thought exercise would have been more feasible. Lack of social support is another commonly reported barrier for exercise participation (Prideon & Grogan, 2012; Ebben & Brudzynski, 2008; Hoebeke, 2008). It has been reported that people, especially women with children, feel as though they need the support of family members to take care of household duties so that they are given the time to exercise (Hoebeke, 2008). It is also common for people to want to exercise with a partner to motivate them and maintain their exercise routine (Prideon & Grogan, 2012; Ebben & Brudzynski, 2008). These points were raised by the participants in the current sample.

Social support is also a key factor within the volitional phase of the HAPA (Schwarzer, Lippke & Luszczynska, 2011). Lack of social support in the form of an exercise partner or in terms of support for household duties or childcare may explain why some participants struggled to use the app to exercise or exercise in general. With some participants raising the point of receiving limited social support-hindering their ability to exercise highlights the importance of social support being a necessary factor within the volitional phase of the HAPA.

Strengths of the study

A strength of this study included variation within the sample. Although few in number, the participants that made up the sample varied in many respects. There was a wide age range with the youngest participant being 19, and the oldest 63. In terms of ethnicity, although New Zealand Europeans predominantly made up the sample there were still a diverse range of other ethnicities included such as New Zealand Maori, Asian and Middle Eastern. Participants' professions also varied with some participants working in information technology, as doctors, teachers, students and in administration. Participants mostly came from around the Waikato region, mainly Hamilton, however there were some participants residing outside of this area. Participants from Wellington, Christchurch, Tauranga and Auckland were included in the sample.

Another strength of the study was the restriction of researcher and participant contact. The researcher met with the participant when signing up to the study if they lived nearby, however all other contact throughout the duration of the study was done via email. This is a strength of the study because this means that the effects found were not accountable to social contact with the researcher.

This study also provides preliminary understanding into exercise app effectiveness especially from the everyday users' perspective. The results found can give valuable insight into development of future exercise apps. The strengths and weaknesses for the Couch to 5k app that have been noted by participants as well as by statistical analysis can be taken and applied to strengthening already existing exercise apps as well as for development of future exercise apps. All findings are also grounded within the Health Action Process Approach behaviour change model. This means that future recommendations come from a behaviour change framework, thus making points raised legitimate from a psychological perspective.

Limitations

Some limitations for this study include the small sample size. The data did not follow a normal distribution and showed a high degree of variability. This meant it was harder to detect any significant effects. A significant drawback of a small sample is the increased chance of error (Field, 2009).

All data collected was via self-report. Therefore exercise participation was not verified with other means such as GPS tracking which would give an objective measure of exercise participation. This means that there is a chance that participants may have under or over-estimated the amount of exercise they had done.

Another point to consider was the time of year that the study was conducted. All data was collected in the winter months which can restrict exercise occurring outside due to cold temperatures, rain and darkness. Other factors such as being more prone to getting sick in the winter months as well as a general lack of desire to do many activities in winter have likely contributed to the difficulty some participants expressed to begin and maintain the exercise programme outlined by the app. It is important to consider that exercise levels may have been greater if this study was conducted in milder times of the year such as spring and autumn.

A major shortcoming of the study is that cause and effect cannot be determined. No control group was used to compare changes with users of the app. Therefore it is impossible to determine whether the app definitely helped initiate exercise, help with mood due to exercise or help with improving constructs such as action control or planning. Although some promising findings were found within this preliminary study, only relationships between the variables could be examined at this stage.

Although the study was designed to be as naturalistic as possible, it is possible that with participants signing up for research purposes, it may have affected how participants used the app. As participants were aware that they were being monitored, it may have prompted them to engage in more exercise.

Implications

Recommendations for the couch to 5k app.

The Couch to 5k app had many positive points associated with it as outlined by participants comprising this sample. Participants mentioned that they liked the timer

component associated with the running guide and that there were prompts telling them when to start running or walking. They also liked how it progressed slowly and was a good way to ease into exercising. Another positive point mentioned was the flexibility of the guides where participants could have the option to repeat certain workouts if they found it necessary.

Despite these positive points, there are some findings from this research that suggest that the Couch to 5k app could be improved. Although the Couch to 5k app attempts to ease a beginner exerciser into running, the overall guide seems to progress too quickly for the average user. Around the 4-5 week mark, participants commented that the guides were too difficult for them and thus became deterred. Exercise that is too intense feels unpleasant, minimising the chances one will engage in exercise in the future (Ekkekakis, Parfitt & Petruzzello, 2011). Therefore a recommendation for improvement for the Couch to 5k app would be to lengthen the period in which it claims to have people running 5 kilometres in (i.e. 8 weeks) to perhaps 10-12 weeks. This way escalation of the guides each week can be more gradual and therefore more pleasant for the user, increasing the likelihood that they will adhere to the programme.

Although the Couch to 5k app has been developed to target people who are new to running and may have a goal of running 5 kilometres, for participants in this study it was only useful for a short period of time. Once this goal has been achieved it is very likely that user's will stop using it which may even result in the user ceasing exercise all together. Therefore it may be beneficial to combine Zenlabs adjunct to the Couch to 5k app, the Couch to 10k running guide together to create a more comprehensive running guide that could be used for a longer period of time, thus minimising the chance of dropout of exercise all together.

To make the Couch to 5k app more efficacious, developers could consider including features to assist with self-regulation and monitoring which would likely assist with exercise adherence. Participants commented on a lack of alerts or reminders to do exercise or to remind users how many exercise sessions they had left in a week. This is a feature that could easily be incorporated into the app to assist with self-regulation and monitoring as well as higher rates of app usage. Features such as GPS tracking to show where the user has been and accelerometry to show distance travelled and at what speed could also be incorporated into the app for further self-regulation and monitoring. Participants said they would have liked to have known this sort of

information as feedback so that improvements could be tracked. This would also assist with action control, an essential theoretical construct to aid maintenance of exercise.

Recommendations for future exercise apps.

Although findings from this study are applicable to the Couch to 5k app, findings generated from this study can also be generalised for recommendations for future exercise apps. Firstly, it is clear that many exercise apps are not grounded in health behaviour change theory, thus lack psychological knowledge. It is important for future exercise app developers to collaborate with health behaviour change experts and apply psychological techniques such as self-regulation and monitoring that are known to assist with exercise adoption and maintenance.

To aid with the incorporation of health behaviour change theory, developers could consider using measures within the app that could be implemented before exercising to generate insight into the user's reasons and motivations for exercise as well as the user's readiness to exercise. The responses from these scales could generate a report outlining the user's intentions and likelihood of maintenance based on scores which will bring awareness to the user's proposed exercise intentions. Other scales could also be used to create an individualised exercise plan. The preference and tolerance scale could be implemented to assess the user's preferences for exercise intensity and their tolerance for high intensity exercise to create a plan that is enjoyable to the user, furthermore maximising the chances for adherence. A scale assessing what types of exercise the user likes (i.e cardio or resistance or both) and generate an individualised exercise guide based on the user's responses. A combination of exercises that the user has noted they would like to do could be considered to create an exercise plan that has variability which would keep the user more engaged. Scales corresponding to the volitional phase of the HAPA could be used intermittently once the user has begun exercise to continually bring awareness to the users' views and efforts towards exercise which would then aid self-regulation and monitoring. It is also important to consider having a graded intensity programme. Recommended exercise that is too intense is likely to result in decreased adherence.

It is important for future exercise apps to also include interactive features that aid self-monitoring and regulation. Alerts and reminders are features that can aid action control. Also incorporating GPS tracking, accelerometry, steps taken, heart rate

monitoring and feedback logs would help users' to track their exercise progress which would therefore help with adhering to their exercise programme.

Future directions

The current study is preliminary and did not utilise a randomised controlled trial, therefore cause and effect cannot be determined. It would be interesting to replicate the current study implementing an RCT design to determine causal relations. It would also be important to gather a larger sample if replicated.

The findings from this study could also be used to create an exercise app grounded in behaviour change theory. The points raised within the recommendations for future app development could be implemented in creating a new exercise app. The app could be tested with a randomised controlled trial to examine the effectiveness.

Due to a growing epidemic of physical and mental disease throughout the Western world caused by a lack of physical activity, an effective exercise app grounded in health behaviour change theory could be revolutionary. Health professionals such as doctors and mental health professionals see many people with problems related to physical inactivity and because exercise prescription goes beyond the scope of their practice, a known effective exercise app could overcome this barrier. As most people in the Western world own a smart phone, the prescription of an effective exercise app by health professionals could help individuals initiate and maintain an exercise regime and in the process prevent or reverse physical or mental health complaints.

Conclusion

Exercise is beneficial for reversing and preventing many physical diseases, including obesity, diabetes and heart disease. It is also known to have an effect for treating psychological disturbances, notably major depressive disorder. Despite these benefits, health professionals and people in the general population have been challenged with getting people to begin and maintain an exercise programme. Health behaviour change theories such as the Health Action Process Approach have been beneficial for describing and implementing techniques for exercise adoption and maintenance. The emergence of smartphones which are capable of downloading mobile software applications have become popular for exercise regimes. However, existing research states that many of the current exercise apps on the market are not grounded in health behaviour change theory (Cowan et al., 2012; Kirwan et al., 2012). The current

study examined the effectiveness of the Couch to 5k running app from a quantitative and qualitative perspective using scales and measures from the Health Action Process Approach.

From the findings gathered, recommendations for improving the Couch to 5k app were outlined as well as recommendations for future exercise app development. To improve the Couch to 5k app, the developers should consider spreading out the running guide to 10-12 weeks to make the exercise more gradual, thus more pleasant for the user and a higher chance for adherence. They may also consider combining the Couch to 5k and the Couch to 10k guides to create a more comprehensive guide that could help users with creating long and short term goals. Inclusion of techniques to further aid self-regulation and monitoring such as accelerometry, GPS tracking, alerts and reminders would also make this app more effective. Future exercise apps should also consider techniques such as accelerometry, GPS tracking, heart rate monitoring, steps taken and alerts and reminders to aid action control. Developers of future exercise apps should also consider using scales and measures at the beginning of using the app to gauge the participants exercise intentions, gauge preference and tolerance of exercise as well as preference for specific exercises to create an individualised exercise plan. A gradual intensity plan should also be implemented so that the user does not discontinue exercise.

References

- Agarwal, S.K. (2012). The cardiovascular benefits of exercise. *International Journal of General Medicine*, 5, 541-545. doi: 10.2147/IJGM.S30113.
- Ajzen, I. (1991). The theory of planned behaviour. *Organisational Behaviour and Human Decision Processes*, 50, 179-211. doi: 10.1016/0749-5978(91)90020-T.
- Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology and Health*, 26(9), 1113-1127. doi: 10.1080/08870446.2011.613995.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, D.C: American Psychiatric Association.
- Anton, S.D., Perri, M.G., Riley, J., Kanasky, W.F., Rodrigue, J.R., Sears, S.F., & Martin, A.D. (2005). Differential predictors of adherence in exercise programs with moderate versus levels of intensity and frequency. *Journal of Sport and Exercise Psychology*, 27, 171-187. Retrieved from: http://www.researchgate.net/profile/Stephen_Anton/publication/33784414_Differential_predictors_of_adherence_in_exercise_programs_with_multiple_levels_of_intensity_and_frequency._/links/53dd556e0cf2a76fb667c942.pdf.
- Armitage, C.J. (2009). Is there utility in the Transtheoretical Model? *British Journal of Health Psychology*, 14, 195-210. doi:10.1348/135910708X368991.
- Bartley, C.A., Hay, M., & Bloch, M.H. (2013). Meta-analysis: Aerobic exercise for the treatment of anxiety disorders. *Progress on Neuro-Psychopharmacology and Biological Psychiatry*, 45, 34- 39. doi:10.1016/j.pnpbp.2013.04.016.
- Bauman, A.E., Reis, R.S., Sallis, J.F., Wells, J.C., Loos, R.J.F., & Martin, B.W. (2012). Correlates of physical activity: Why are some people physically active and others not? *Lancet*, 380(9838), 258-271. doi: 10.1016/S0140-6736(12)60735-1.
- Biddle, S.J.H., Mutrie, N. (2008). *Psychology of Physical Activity: Determinants, well-being and interventions (2nd edition)*. Routledge, New York: NY.
- Bishop-Bailey, D. (2013). Mechanisms governing the health and performance benefits of exercise. *British Journal of Pharmacology*, 170, 1153-1166. doi:10.1111/bph.12399.
- Bouchard, C., Blair, S., & Haskell, W.L. (2007). *Physical Activity and Health*. Human Kinetics, Champaign: IL.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. doi: 10.1191/1478088706qp063oa.
- Brinthaupt, T.M., Kang, M., & Anshel, M.H. (2010). A delivery model for overcoming psycho-behavioural barriers to exercise. *Psychology of Sport and Exercise*, 11, 259-266. doi:10.1016/j.psychsport.2010.03.003.
- Broman-Fulks, J.J., Berman, M.E., Rabian, B.A., & Webster, M.J. (2004). Effects of aerobic exercise on anxiety sensitivity. *Behaviour Research and Therapy*, 42, 125-136. doi: 10.1016/S0005-7967(03)00103-7.

- Bryers, M., van Teijlingen, & Pitchforth. (2014). Advocating mixed-method approaches in health research. *Nepal Journal of Epidemiology*, 4(5), 417-422. doi: 10.3126/nje.v4i5.12018.
- Buckworth, J., Lee, R.E., Regan, G., Schneider, L.K., & DiClemente, C.C. (2007). Decomposing intrinsic and extrinsic motivation for exercise: Application to stages of motivational readiness. *Psychology of Sport and Exercise*, 8, 441-461. doi:10.1016/j.psychsport.2006.06.007.
- Bui, M., Kemp, E., & Howlett, E. (2011). The fight against obesity: Influences of self-efficacy on exercise regularity. *Journal of Nonprofit & Public Sector Marketing*, 23(2), 181-208. doi:10.1080/10495142.2011.572709.
- Cadmus-Bertram, L.A., Marcus, B.H., Patterson, R.E., Parker, B.A., & Morey, B.L. (2015). Randomized trial of a fitbit-based physical activity intervention for women. *American Journal of Preventive Medicine*, 49(3), 414-418. doi:10.1016/j.amepre.2015.01.020.
- Callaghan, P., Khalil, E., Morres, I., & Carter, T. (2011). Pragmatic randomised controlled trial of preferred intensity exercise of women living with depression. *BMC Public Health*, 11(1), 465-473. doi: 10.1186/1471-2458-11-465.
- Carels, R.A., Coit, C., Young, K., Berger, B. (2007). Exercise makes you feel good, but does feeling good make you exercise? An examination of obese dieters. *Exercise Psychology*, 29(6), 706-722. Retrieved from: <http://journals.humankinetics.com.ezproxy.waikato.ac.nz/AcuCustom/Sitename/Documents/DocumentItem/13682.pdf>.
- Coghill, N., & Cooper, A.R. (2009). Motivators and de-motivators for adherence to a program of sustained walking. *Preventive Medicine*, 49, 24-27. doi:10.1016/j.ypmed.2009.04.017.
- Conroy, D.E., Yang, C., & Maher, J.P. (2014). Behaviour change techniques in top-ranked mobile apps for physical activity. *American Journal of Preventive Medicine*, 46(6), 649-652. doi:10.1016/j.amepre.2014.01.010.
- Coulter, P.A., Dickman, K., & Maradiegue, A. (2009). The effects of exercise on stress in working women. *The Journal for Nurse Practitioners*, 5(6), 408-413. Retrieved from: <http://www.sciencedirect.com.ezproxy.waikato.ac.nz/science/article/pii/S155415508003061>.
- Cowan, L.T., Van Wagenen, S.A., Brown, B.A., Hedin, R.J., Seino-Stephan, R.Y., Hall, P.C., & West, J.H. (2012). Apps of steel: Are exercise apps providing consumers with realistic expectations? A content analysis of exercise apps for presence of behaviour change theory. *Health Education & Behavior*, 40(2), 133-139. doi: 10.1177/1090198112452126.
- Daley, A. (2008). Exercise and depression: A review of reviews. *Journal of Clinical Psychology in Clinical Settings*, 15, 140-147. doi: 10.1007/s10880-008-9105-z.

- De Bruijn, G. (2011). Exercise habit strength, planning and the theory of planned behaviour: An action control approach. *Psychology of Sport and Exercise, 12*, 106-104. doi:10.1016/j.psychsport.2010.10.002.
- DiClemente, C.C. (2007). The Transtheoretical Model of intentional behaviour change. *Drugs and Alcohol Today, 7*(1), 29-33. Retrieved from: <http://search.proquest.com.ezproxy.waikato.ac.nz/docview/213599425/fulltextPDF/CF00D8D394B4452BPQ/1?accountid=17287>.
- Dishman, R. (1994). *Advances in Exercise Adherence*. Champaign, IL: Human Kinetics.
- Dishman, R.K. (2001). The problem of exercise adherence: Fighting sloth in nations with market economies. *Quest, 53*(3), 279-294. doi: 10.1080/00336297.2001.10491745.
- Dombrowski, J.J. (2011). Barriers to physical activity among working mothers. *American Association of Occupational Health Nurses Journal, 59*(4), 161-167. doi:10.3928/08910162-20110328-02.
- Dubbert, P.M. (2002). Physical activity and exercise: Recent advances and current challenges. *Journal of Consulting and Clinical Psychology, 70*(3), 526-536. doi: 10.1037//0022-006X.70.3.526.
- Ebben, W., & Brudzynski, L. (2008). Motivations and barriers among college students. *Journal of Exercise Physiology Online, 11*(5), 1-11. Retrieved from: <https://www.asep.org/asep/asep/EbbenJEPonlineOctober2008.pdf>
- Ekkekakis, P., Hall, E.E., & Petruzzello, S.J. (2005). Some like it vigorous: Measuring individual differences in the preference for and tolerance of exercise intensity. *Journal of Sport and Exercise Psychology, 27*, 350-374. Retrieved from: <http://journals.humankinetics.com.ezproxy.waikato.ac.nz/AcuCustom/Sitename/Documents/DocumentItem/4999.pdf>.
- Ekkekakis, P., Hall, E.E., & Petruzzello, S.J. (2008). The relationship between exercise intensity and affective responses demystified: To crack the 40-year-old nut, replace the 40-year-old nutcracker! *Annals of Behavioural Medicine, 35*, 136-149. doi: 10.1007/s12160-008-9025-z.
- Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities: Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine, 41*(8), 641-671. doi: 10.2165/11590680-000000000-00000.
- Ekkekakis, P., Thome, J., Petruzzello, S.J., & Hall, E.E. (2008). The preference for and tolerance of the intensity of exercise questionnaire: A psychometric evaluation among college women. *Journal of Sports Sciences, 26*(5), 499-510. doi: 10.1080/02640410701624523.
- Ensari, I., Greenlee, T.A., Motl, R.W., & Petruzzello, S.J. (2015). Meta-analysis of acute exercise effects on state anxiety: An update of randomised controlled trials over the past 25 years. *Depression and Anxiety, 1-11*. doi: 10.1002/da.22370.

- Faulkner, G., & Biddle, S.J.H. (2004). Exercise and depression: Considering variability and contextuality. *Journal of Sport and Exercise Psychology*, 26, 3-18.
Retrieved from:
<http://journals.humankinetics.com.ezproxy.waikato.ac.nz/AcuCustom/Sitename/Documents/DocumentItem/2775.pdf>.
- Fernandez, B.R., Fleig, L., Godinho, C.A., Montenegro, E., Knoll, N., & Schwarzer, R. (2015). Action control bridges the planning-behaviour gap: A longitudinal study on physical exercise in young adults. *Psychology and Health*. doi: 10.1080/08870446.2015.1006222.
- Field, A. (2009). *Discovering statistics using SPSS (3rd edition)*. Sage Publications Ltd, London.
- Fritz, T., Huang, E.M., Murphy, G.C., & Zimmermann, T. (2014). Persuasive technology in the real world: A study of long-term use of activity sensing devices for fitness. *City Health International*. Retrieved from:
http://delivery.acm.org.ezproxy.waikato.ac.nz/10.1145/2560000/2557383/p487-fritz.pdf?ip=130.217.227.3&id=2557383&acc=OA&key=65D80644F295BC0D%2E4F7864357EF1ECB7%2E4D4702B0C3E38B35%2E49BA0C42E504AC09&CFID=711418718&CFTOKEN=57700472&__acm__=1441767054_5477788e428d38904be0058bc4b38c30.
- Gelling, L. (2014). When to use mixed methods. *Nurse Researcher*, 21(4), 6-7.
Retrieved from:
<http://web.a.ebscohost.com.ezproxy.waikato.ac.nz/ehost/detail/detail?sid=52f8b64b-f061-40e2-9e55-098ad9318e8d%40sessionmgr4004&crlhashurl=login.aspx%253fdirect%253dtrue%2526scope%253dsite%2526db%253da9h%2526AN%253d95274834%2526msid%253d201379288&hid=4106&vid=0&bdata=JnNpdGU9ZWWhvc3QtbGl2ZQ%3d%3d#db=a9h&AN=95274834>.
- Goodnite, P.M. (2014). Stress: A concept analysis. *Nursing Forum*, 49(1), 71-74. doi: 10.1111/nuf.12044.
- Green, C.A., Duan, N., Gibbons, R.D., Hoagwood, K.E., Palinkas, K.A., & Wisdom, J.P. (2014). Approaches to mixed methods dissemination and implementation research: Methods, strengths, caveats, and opportunities. *Administration and Policy in Mental Health*. doi: 10.1007/s10488-014-0552-6.
- Gudenas, J., & Brooks, M. (2013). Seasonal Affective Disorder. *Journal of Consumer Health on the Internet*, 17(2), 224-237. doi: 10.1080/15398285.2013.780576.
- Herring, M.P., Jacob, M.L., Suveg, C., & O'Connor, P.J. (2011). Effects of short-term exercise training on signs and symptoms of generalised anxiety disorder. *Mental Health and Physical Activity*, 4, 71-77.
doi:10.1016/j.mhpa.2011.07.002.
- Herring, M.P., Lindheimer, J.B., & O'Connor, P.J. (2013). The effects of exercise training on anxiety. *American Journal of Lifestyle Medicine*, 8(6), 388-403. doi: 10.1177/1559827613508542.

- Hoebeke, R. (2008). Low-income women's perceived barriers to physical activity: Focus group results. *Applied Nursing Research, 21*, 60-65. doi:10.1016/j.apnr.2006.06.002.
- Huberty, J.L., Ransdell, L.B., Sidman, C., Flohr, J.A., Schultz, B., Grosshans, O., & Durrant, L. (2008). Explaining long term exercise adherence in women who complete a structured exercise program. *Research Quarterly for Exercise and Sport, 79*(3), 374-384. Retrieved from: <http://search.proquest.com.ezproxy.waikato.ac.nz/docview/218567804?pq-origsite=summon>.
- Hurling, R. Fairley, B.W., & Dias, M.B. (2006). Internet-based exercise intervention systems: Are more interactive designs better? *Psychology & Health, 21*(6), 757-772. doi: 10.1080/14768320600603257.
- Jackson, D. (2010). How personal trainers can use self-efficacy theory to enhance exercise behavior in beginning exercisers. *Strength and Conditioning Journal, 32*(3), 67-71. Retrieved from: <http://search.proquest.com.ezproxy.waikato.ac.nz/docview/870319586?pq-origsite=summon>.
- Josefsson, T., Lindwall, M., & Archer, T. (2014). Physical exercise intervention in depressive disorders: Meta-analysis and systematic review. *Scandinavian Journal of Medicine and Science in Sports, 24*, 259-272. doi: 10.1111/sms.12050.
- Kennedy, A.B., & Blair, S.N. (2014). Motivating people to exercise. *American Journal of Lifestyle Medicine, 324*-329. doi: 10.1177/1559827614524135.
- Kent, M. (2006). Minute ventilation method. In the Oxford Dictionary of Sports Science & Medicine. *Oxford University Press*. Retrieved from <http://www.oxfordreference.com.ezproxy.waikato.ac.nz/view/10.1093/acref/9780198568506.001.0001/acref-9780198568506-e-4383>.
- King, A.C., Ahn, D.K., Oliviera, B.M., Atienza, A.A., Castro, C.M., & Gardner, C.E. (2008). Promoting physical activity through hand-held computer technology. *American Journal of Preventive Medicine, 34*(2), 138-142. doi:10.1016/j.amepre.2007.09.025.
- Kinnafick, F., Thogersen-Ntoumani, C., & Duda, J.L. (2014). Physical activity adoption to adherence, lapse and drop out: A self-determination theory perspective. *Qualitative Health Research, 24*(5), 706-718. doi: 10.1177/1049732314528811.
- Kirwan, M., Duncan, M.J., & Vandelanotte, C. (2013). Smartphone apps for physical activity: A systematic review. *Journal of Science and Medicine in Sport, e47*. <http://dx.doi.org/10.1016/j.jsams.2013.10.113>.
- Kirwan, M., Duncan, M.J., Vandelanotte, C., & Mummery, W.K. (2012). Design, development and formative evaluation of a smartphone application for recording and monitoring physical activity levels: The 10,000 steps 'iStepLog'. *Health Education and Behaviour, 40*(2), 140-151. doi: 10.1177/1090198112449460.

- Knowler, W.C., Barrett-Connor, E., Fowler, S.E., Hamman, R.F., Lachin, J.M., Walker, E.A., & Nathan, D.M. (2002). Reduction of the incidence of type 2 diabetes with lifestyle intervention or metformin. *The New England Journal of Medicine*, 346(6), 393-403. Retrieved from: <http://ezproxy.waikato.ac.nz/login?url=http://search.proquest.com/docview/223937844?accountid=17287>.
- Knubben, K., Reischies, F.M., Adli, M., Schlattmann, P., Bauer, M., & Dimeo, F. (2007). A randomised controlled study on the effects of a short-term endurance training programme in patients with major depression. *British Journal of Sports Medicine*, 41, 29-33. doi: 10.1136/bjism.2006.030130.
- Kohl, H.W., Craig, C.L., Lambert, E.V., Inoue, S., Alkandari, J.R., Leetongin, G., & Kahlmeier, S. (2012). The pandemic of physical inactivity: Global action for public health. *Lancet*, 380(9838), 294-305. doi: 10.1016/S0140-6736(12)60898-8.
- Koitan, M. (2009). Mind-body strategies for health. *The Journal of Nurse Practitioners*, 5(5), 374-375. doi:10.1016/j.nurpra.2009.01.012.
- Kokkinos, P., & Myers, J. (2010). Exercise and physical activity: Clinical outcomes and applications. *Circulation*, 122, 1637-1648. doi: 10.1161/CIRCULATIONAHA.110.948349.
- Korkiakangas, E.E., Alahuhta, M.A., Husman, P.M., Keinanen-Kiukaanniemi, S., Taanila, A.M., & Laitinen, J.H. (2011). Motivators and barriers to exercise among adults with a high risk of type 2 diabetes – a qualitative study. *Scandinavian Journal of Caring Sciences*, 25, 62-69. doi:10.1111/j.1471-6712.2010.00791.x.
- Krämer, L.V., Helmes, A.W., Seelig, H., Fuchs, R., & Bengel, J. (2014) Correlates of reduced exercise behaviour in depression: The role of motivational and volitional deficits. *Psychology & Health*, 29(10), 1206-1225. doi: 10.1080/08870446.2014.918978.
- Kroeze, W., Werkman, A., Brug, J. (2006). A systematic review of randomised controlled trials on the effectiveness of computer-tailored education on physical activity and dietary behaviours. *Annals of Behavioural Medicine*, 31(3), 205-223. Retrieved from: http://link.springer.com.ezproxy.waikato.ac.nz/article/10.1207%2Fs15324796abm3103_2.
- Lakka, T., & Laaksonen, D.E. (2007). Physical activity in prevention and treatment of the metabolic syndrome. *Applied Physiology, Nutrition and Metabolism*, 32, 76-88. doi:10.1139/H06-113.
- Leone, L.A., & Ward, D.S. (2013). A mixed methods comparison of perceived benefits and barriers to exercise between obese and non-obese women. *Journal of Physical Activity and Health*, 10, 461-469. Retrieved from: <http://journals.humankinetics.com.ezproxy.waikato.ac.nz/jpah-back-issues/jpah-volume-10-issue-4-may/a-mixed-methods-comparison-of-perceived-benefits-and-barriers-to-exercise-between-obese-and-nonobese-women>.

- Lind, E., Ekkekakis, P., & Vazou, S. (2008). The affective impact of exercise intensity that slightly exceeds the preferred level: 'Pain' for no additional 'gain'. *Journal of Health Psychology, 13*(4) 464–468. doi: 10.1177/1359105308088517.
- Lovibond, S.H., & Lovibond, P.F. (1995). *Manual for the Depression Anxiety Stress Scales (2nd ed.)*. Psychology Foundation Monograph, NSW: Australia.
- Lupton, D. (2014). Apps as artefacts: Towards a critical perspective on mobile health and medical apps. *Societies, 4*, 606-622. doi:10.3390/soc4040606.
- Lutz, R.S., Stults-Kolehmainen, M.A., & Bartholemew, J.B. (2010). Exercise caution when stressed: Stages of change and the stress-exercise participation relationship. *Psychology of Sport and Exercise, 11*, 560-567. doi:10.1016/j.psychsport.2010.06.005.
- Madden, T.J., Ellen, P.S., & Ajzen, I. (1992). A comparison of the theory of planned behaviour and the theory of reasoned action. *Personality and Social Psychology Bulletin, 18*(1), 3-9. doi: 10.1177/0146167292181001.
- Magnusson, A., & Boivin, D. (2003). Seasonal Affective Disorder: An overview. *Chronobiology International, 20*(2), 189-207. doi: 10.1081/CBI-120019310.
- Marshall, S.J., & Biddle, S.J.H. (2001). The Transtheoretical Model of Behaviour Change: A meta-analysis of applications to physical activity and exercise. *Annals of Behavioural Medicine, 23*(4), 229-246. Retrieved from: http://link.springer.com.ezproxy.waikato.ac.nz/article/10.1207%2FS15324796ABM2304_2#.
- McMurdo, M.E.T., Sugden, J., Argo, I., Boyle, P., Johnston, D.W., Sniehotta, F.F., Donnan, P.T. (2010). Do pedometers increase physical activity in sedentary older women? A randomized controlled trial. *Journal of the American Geriatric Society, 58*, 2099–2106. doi: 10.1111/j.1532-5415.2010.03127.x.
- Mehta, N. (2011). Mind-body dualism: A critiques from a health perspective. *Mens Sana Monograph, 9*(1), 202-209. doi: 10.4103/0973-1229.77436.
- Michalak, E.E., Wilkinson, C., Hood, K., & Dorrack, C. (2002). Seasonal and non-seasonal depression: How do they differ? Symptom profile, clinical and family history in a general population sample. *Journal of Affective Disorders, 69*(1), 185-192. doi: 10.1016/S0165-0327(01)00329-9.
- Middelweerd, A., Mollee, J.S., van der Wal, C.N., Brug, J., & te Velde, S.J. (2014). Apps to promote physical activity among adults: A review and content analysis. *International Journal of Behavioral Nutrition and Physical Activity, 11*(97). Retrieved from: <http://search.proquest.com.ezproxy.waikato.ac.nz/docview/1553722894?pg-origsite=summon>.
- Millington, B. (2014). Smartphone apps and the mobile privatisation of health and fitness. *Critical Studies in Media Communication, 31*(5), 479-493. doi: 10.1080/15295036.2014.973429.
- Minsoo, K., Marshall, S. J., Barreira, T. V., Lee, J. (2009). Effect of pedometer-based physical activity interventions: A meta-analysis. *Research Quarterly for*

Exercise and Sport, 80(3), 64- 655. Retrieved from:
<http://search.proquest.com.ezproxy.waikato.ac.nz/docview/218506540?pq-origsite=summon>.

- Moreno, J.P., & Johnston, C.A. (2014). Barriers to physical activity in women. *American Journal of Lifestyle Medicine*, 8(3), 164-166. doi: 10.1177/1559827614521954.
- Niuewenhuijsen, E.R., Zemper, E., Miner, K.R., & Epstein, M. (2006). Health behavior change models and theories: Contributions to rehabilitation. *Disability and Rehabilitation*, 28(5), 245-256. doi: 10.1080/09638280500197743.
- Norman, G.J., Zabinski, M.F., Adams, M.A., Rosenberg, D.E., Yaroch, A.L., & Atienza, A.A. (2007). A review of eHealth interventions for physical activity and dietary behaviour change. *American Journal of Preventive Medicine*, 33(4), 336-345. doi:10.1016/j.amepre.2007.05.007.
- Parfitt, G. & Hughes, S. (2009). The exercise-intensity-affect-relationship: Evidence and implications for exercise behaviour. *Journal of Exercise Science and Fitness*, 7(2), 34-41. doi: 10.1016/S1728-869X(09)60021-6.
- Pate, R.R., Pratt, M., Blair, S.M., Haskell, W.L., Macera, C.A., Bouchard, C., Buchner, D., Ettinger, W., Heath, G.W., King, A.C., Kriska, A., Leon, A.S., Marcus, B.H., Morris, J., Paffenberger, R.S., Patrick, K., Pollock, M.L., Rippe, J.M., Sallis, J., & Wilmore, J.H. (1995). Physical activity and public health: A recommendation from the Centres of Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association*, 273, 402-407. Retrieved from:
<http://wonder.cdc.gov/wonder/prevguid/p0000391/p0000391.asp?iframe=true&width=95%&height=95%>.
- Peiser, B.(2009). Seasonal affective disorder and exercise treatment: A review. *Biological Rhythm Research*, 40(1), 85-97. doi: 10.1080/09291010802067171.
- Perri, M.G., Anton, S.D., Durning, P.E., Ketterson, T.U., Sydeman, S.J., Berlant, N.E., Kanasky, W.F., Newton, R.L., Limacher, M.C., & Martin, A.D. (2002). Adherence to exercise prescriptions: Effects of prescribing moderate versus higher levels of intensity and frequency. *Health Psychology*, 21(5), 452-458. Retrieved from:
<http://psycnet.apa.org.ezproxy.waikato.ac.nz/journals/hea/21/5/452.html>.
- Pridgeon, I., & Grogan, S. (2011). Understanding exercise adherence and dropout: An interpretative phenomenological analysis of men and women's accounts of gym attendance and non-attendance. *Qualitative Research in Sport, Exercise and Health*, 4(3), 382-399, doi: 10.1080/2159676X.2012.712984.
- Raedeke, T.D. (2007).The relationship between enjoyment and affective responses to exercise. *Journal of Applied Sport Psychology*, 19(1), 105-115. doi: 10.1080/10413200601113638.
- Rethorst, C.D., Wipfli, B.M., & Landers, D.M. (2009). The Anti-depressive effects of exercise: A meta-analysis of randomised trials. *Sports Medicine*, 39(6), 491-511. Retrieved from:

<http://ezproxy.waikato.ac.nz/login?url=http://search.proquest.com/docview/229630978?accountid=17287>.

- Rogerson, M.C., Murphy, B.M., Bird, S., & Morris, T. (2012). "I don't have the heart": a qualitative study of barriers to and facilitators of physical activity for people with coronary heart disease and depressive symptoms. *International Journal of Behavioral Nutrition and Physical Activity*, 9. Retrieved from: <http://search.proquest.com.ezproxy.waikato.ac.nz/docview/1266765085?pq-origsite=summon>.
- Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. *Clinical Psychology Review*, 21(1), 55-61. doi:10.1016/S0272-7358(99)00032-X.
- Schwarzer, R. (2008). Modelling health behaviour change: How to predict and modify the adoption and maintenance of health behaviours. *Applied Psychology: An International Review*, 57(1), 1-29. doi: 10.1111/j.1464-0597.2007.00325.x.
- Schwarzer, R., & Luszczynska, A. (2008). How to overcome health compromising behaviours: The Health Action Process Approach. *European Psychologist*, 13(2), 141-151. doi: 10.1027/1016-9040.13.2.141.
- Schwarzer, R., Lippke, S., Luszczynska, A. (2011). Mechanisms of health behaviour change in persons with chronic disease or disability: The Health Action Process Approach (HAPA). *Rehabilitation Psychology*, 56(3), 161-170. doi: 10.1037/a0024509.
- Shields, C.A., Brawley, L.R., & Lindover, T.A. (2006). Self-efficacy as a mediator of the relationship between causal attributions and exercise behavior. *Journal of Applied Social Psychology*, 36(11), 2785–2802. doi: 10.1111/j.0021-9029.2006.00128.x.
- Singh, N.P., Kumar, A., & Sarkar, T. (2011). Randomised controlled trials. *Indian Journal of Medical Specialties*, 2(2), 194-199. doi: 10.7713/ijms.2011.0050.
- Slovinec D'Angelo, M.E., Pelletier, L.G., Reid, R.D., & Huta, V. (2014). The roles of self-efficacy and motivation in the prediction of short-and long-term adherence to exercise among patients with coronary heart disease. *Health Psychology*, 33(11), 1344–1353. doi:10.1037/hea0000094.
- Smits, J.A.J., Berry, A.C., Rosenfield, D., Powers, M.B., Behar, E., & Otto, M.W. (2008). Reducing anxiety sensitivity with exercise. *Depression and Anxiety*, 25, 689-699. doi: 101002/da.20411.
- Stanton, R., Reaburn, P., & Happell, B. (2013). Is cardiovascular or resistance exercise better to treat patients with depression: A narrative review. *Issues in Mental Health Nursing*, 34, 531-538. doi: 10.3109/01612840.2013.774077.
- Stanton, R., & Reaburn, P. (2014). Exercise and the treatment of depression: A review of the exercise program variables. *Journal of Science and Medicine and Sport*, 17(2), 177-182. Retrieved from: <http://ezproxy.waikato.ac.nz/login?url=http://search.proquest.com/docview/1514925427?accountid=17287>.

- Stonerock, G.L., Hoffman, B.M., Smith, P.J., Blumenthal, J.A. (2015). Exercise as treatment for anxiety: Systematic review and analysis. *Annals of Behavioural Medicine*. doi: 10.1007/s12160-014-9685-9.
- Strohle, A. (2009). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission*, 116, 777-784. doi: 10.1007/s00702-008-0092-x.
- Stults-Kolemainen, M.A., & Sinha, R. (2014). The effects of stress on physical activity and exercise. *Sports Medicine*, 44, 81-121. doi: 10.1007/s40279-013-0090-5.
- Tipton, C.M. (2014). The history of "Exercise Is Medicine" in ancient civilizations. *Advances in Physiological Education*, 38, 109- 117. doi:10.1152/advan.00136.2013.
- Tudor-Locke, C., & Lutes, L. (2009). Why do pedometers work? A reflection upon the factors related to successfully increasing physical activity. *Sports Med*, 39(12), 981-993. Retrieved from: <http://link.springer.com.ezproxy.waikato.ac.nz/article/10.2165%2F11319600-000000000-00000>.
- US Department of Health and Human Services (1996). *Physical Activity and Health: A report of the Surgeon General*. Atlanta: GA.
- Vuori, I. (2007). Physical activity and health: Metabolic and cardiovascular issues. *Advances in Physiotherapy*, 9, 50-64. doi: 10.1080/14038190701395887.
- Vuori, I. (2010). Physical activity and cardiovascular disease prevention in Europe: An update. *Kinesiology*, 42(1), 5-15. Retrieved from: <http://web.ebscohost.com.ezproxy.waikato.ac.nz/ehost/detail/detail?sid=c6c930b8-f5e1-46f1-a686-d554b615f67c%40sessionmgr115&vid=0&hid=101&bdata=JnNpdGU9ZWwhvc3QtbGl2ZQ%3d%3d#db=a9h&AN=52950504>.
- Warburton, D.E.R., Nicol, C.W., & Bredin, S.S.D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, 174(6), 801-809. doi:10.1503/cmaj.051351.
- Ware, Kosinski, Dewey & Gandek. (2001). *Quick start guide for SF-8 Health Survey*. Lincoln, RI: QualityMetric Incorporated.
- Weinstein, A.A., Deuster, P.A., Francis, J.L., Beadling, C., & Kop, W.J. (2010). The role of depression in short term mood and fatigue responses to acute exercise. *International Journal of Behavioural Medicine*, 17, 51-57. doi: 10.1007/s12529-009-9046-4.
- Wolff, E., Gaudlitz, K., von Lindenberger, B., Plag, J., Heinz, A., & Strohle, A. (2011). Exercise and physical activity in mental disorders. *European Archives of Psychiatry and Clinical Neuroscience*, 261(2), 186-191. DOI 10.1007/s00406-011-0254-y.

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DO YOU WANT TO START DOING EXERCISE?

ESTABLISHING AN EXERCISE REGIME
COULD HELP TO IMPROVE YOUR MOOD
AND WELLBEING!



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Rebecca Jenkins is a Master's student examining the use of a mobile phone exercise app for establishing an exercise regime as well as the potential effects this could have on mood and wellbeing. If you are between the ages of 18-65 and is someone who has not established a regular exercise regime and want to do so, please contact me! As a participant you will go in the draw to win a \$100 grocery voucher!

Contact details:

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Assessing the effectiveness of an app for establishing exercise: An examination from the Health Action Process Approach

My name is Rebecca Jenkins and I am doing my Master's in psychology at the University of Waikato. This research project is going to examine the effectiveness of a mobile phone exercise app for establishing an exercise regime as well as the effect exercise has on mood and wellbeing.

Requirements:

As a participant you will need to be between the ages of 18 and 60. You will also need to have access to some form of handheld technology such as a smartphone. This could include an Iphone, an android phone an Ipod or something similar. You may own one of these yourself or you could borrow one from someone who has one.

About the app and exercising:

The exercise app programme is cardio based and recommends that you do the 30 minute workouts three times per week for 8 weeks. Please do not feel discouraged if this sounds strenuous! Although it would be great if you could use the app for the full 8 weeks, you do not have to follow the programme rigidly. It can be used as a guide. Do what your body allows. I recommend that you consult with a doctor before starting to exercise, to ensure you are safe to do so.

Questionnaires:

During the time you are using the app, I will be sending you questionnaires to fill out. One of the things I will be examining is changes in mood and wellbeing. Questions regarding mood and wellbeing will be included in the on-line questionnaires that you will be required to fill out before you start using the app, during the time you are using the app (at 4 weeks) and after you have finished using the app (8 weeks). The questions on mood and wellbeing will have statements and questions on how you feel and you will click the response that applies to you.

Questions on using the app, exercise in general and amount of exercise done will also be asked within these questionnaires. Filling out the questionnaires should not take very long, maybe 15 to 20 minutes to complete. Please be as honest as possible when completing the questionnaires, as honest answers will be of the most value to me when conducting the research. Even things that did not go to plan and possible reasons why will still be useful information. I will email you with reminders on when to complete these.

After the trial is complete:

When the 8 weeks are over, the final questionnaire will ask questions that require more in-depth answers. There will be spaces where you can type your answers. Questions will be based around the experiences you have had over the course of the 8 week intervention. These will include questions based around whether or not you found the app effective. After 1 month has gone by after doing this final questionnaire, one more questionnaire will be sent to you. The questions within this questionnaire will be questions you are already familiar with from previous questionnaires.

After analysis of the data, an information sheet explaining the major findings will be made available to you if you wish. Confidentiality will be ensured and your identity will be protected. If you choose to participate in this study you have the right to withdraw at any time, for any reason without penalty or loss. By participating in this research you will go in the draw to win a \$100 grocery voucher!

This research project has been approved by the School of Psychology Research and Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. Any questions about the ethical conduct of this research may be sent to the convenor of the Research and Ethics Committee (Associate Professor John Perrone, phone: 838 4466 ext.8292, e-mail jpnz@waikato.ac.nz).

If you have any questions or queries about this research project please contact me on 027 357 6573 or rebecca_jenkins@hotmail.co.nz. Alternatively you can contact my supervisors. Dr Carrie Barber: cbarber@waikato.ac.nz Dr Jo Thakker: jthakker@waikato.ac.nz

Information and instructions for downloading the app and usage

Instructions for downloading the app:

- On your smartphone or handheld device open the app store
- Tap the 'search' icon
- Tap the search bar and type in 'C25K'
- A few options will come up that match the search. Tap the one that says 'C25K-5k trainer free'
- Tap the square that says 'GET'
- This will then change to a green 'INSTALL' button. Tap this. The app will begin downloading and will be available to use on your device shortly.
- Once the app is ready to use, follow the in-app instructions when you want to work out

About the app:

The Couch to 5k (C25K) running app has designated workouts to do three times a week for 8 weeks. It is designed specifically for people who are new to exercising. The workouts start out at an easy intensity and increase to include running for longer durations. It claims that by following this programme, you will be running 5 kilometres at the end of 8 weeks.

I know that running 5 kilometres sounds like a daunting task, but remember you should not feel pressured to follow the instructions of this exercise app rigidly. It is there to guide you. If you do choose to follow the app, but you feel as though it is progressing too quickly for you, you could choose to repeat weeks or previous workouts until you feel ready to move on. Do what your body allows.

If you feel as though your mood is particularly low or do not feel good about yourself here are a list of services you could get in touch with:

Lifeline telephone counsellors- 0800 543 354

The Psychology Centre- (07) 846 6907

Hauora Maori mental health services- 0800 839 9916

Adult Mental Health- mentalhealth@waikatodhb.health.nz Triage- 0800 50 50 50

If you have any questions or queries, please do not hesitate to contact me.

Mobile- 027 357 6573 Email- rebecca_jenkins@hotmail.co.nz

Alternatively you could contact any of my supervisors. Dr Carrie Barber- cbarber@waikato.ac.nz Dr Jo Thakker- jthakker@waikato.ac.nz

Baseline Questionnaire

Q1 Thank you for agreeing to take part in my Master's project examining the establishment of exercise using an exercise app. This is the first questionnaire you will do and will be used to examine your mood, wellbeing and thoughts about exercise before starting the trial. If there are any questions you are not sure about, just answer the best you can.

Q2 How old are you?

Q3 What ethnic groups do you belong to? (Select all that apply)

- NZ European (1)
- NZ Maori (2)
- Pacific Islander (3)
- Asian (4)
- African (5)
- Middle Eastern (6)
- Other (7) _____

Q4 Are you male or female?

- Male (1)
- Female (2)

Q5 What are your reasons for taking part in the study and wanting to exercise?

- To get fit/healthy (1)
- To lose weight (2)
- To improve mood/wellbeing (3)

Q6 What is your previous experience with exercise?

- Never had a regular exercise programme (1)
- Have done some exercise on and off (2)
- Used to do regular exercise but stopped a year or more ago (3)
- Used to do regular exercise that I stopped less than a year ago (4)

Q7 The following questions examine how you have been feeling lately. Please read each statement and click the response which indicates how much the statement applied to you over the past week. There are no wrong or right answers. Do not spend too much time on any statement.

Q8 I found myself getting upset over quite trivial things

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q9 I was aware of dryness in my mouth

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q10 I couldn't seem to experience any positive feeling at all

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q11 I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q12 I just couldn't seem to get going

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q13 I tended to over-react to situations

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q14 I had a feeling of shakiness (eg, legs going to give way)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q15 I found it difficult to relax

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q16 I found myself in situations that made me so anxious I was most relieved when they ended

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q17 I felt that I had nothing to look forward to

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q18 I found myself getting upset rather easily

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q19 I felt that I was using a lot of nervous energy

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q20 I felt sad and depressed

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q21 I found myself getting impatient when I was delayed in any way (eg, lifts, traffic lights, being kept waiting)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q22 I had a feeling of faintness

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q23 I felt that I had lost interest in just about everything

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q24 I felt I wasn't worth much as a person

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q25 I felt that I was rather touchy

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q26 I perspired noticeably (e.g., hands sweaty) in the absence of high temperatures or physical exertion

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q27 I felt scared without any good reason

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q28 I felt that life wasn't worthwhile

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q29 I found it hard to wind down

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q30 I had difficulty in swallowing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q31 I couldn't seem to get any enjoyment out of the things I did

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q32 I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q33 I felt down-hearted and blue

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q34 I found that I was very irritable

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q35 I felt I was close to panic

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q36 I found it hard to calm down after something upset me

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q37 I feared that I would be "thrown" by some trivial but unfamiliar task

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q38 I was unable to become enthusiastic about anything

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q39 I found it difficult to tolerate interruptions to what I was doing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q40 I was in a state of nervous tension

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q41 I felt I was pretty worthless

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q42 I was intolerant of anything that kept me from getting on with what I was doing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q43 I felt terrified

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q44 I could see nothing in the future to be hopeful about

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q45 I felt that life was meaningless

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q46 I found myself getting agitated

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q47 I was worried about situations in which I might panic and make a fool of myself

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q48 I experienced trembling (e.g., in the hands)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of time (3)
- Applied to me very much, or most of the time (4)

Q49 I found it difficult to work up the initiative to do things

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of time (3)
- Applied to me very much, or most of the time (4)

Q50 These next questions also relate how you have been feeling lately, but are more related to your overall health. Answer every question by selecting the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can

Q51 Overall, how would you rate your health during the past 4 weeks?

- Excellent (1)
- Very Good (2)
- Good (3)
- Fair (4)
- Poor (5)
- Very poor (6)

Q52 During the past 4 weeks, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do physical activities (5)

Q53 During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

- None at all (1)
- A little bit (2)
- Some (3)
- Quite a bit (4)
- Could not do work (5)

Q54 How much bodily pain have you had during the past 4 weeks?

- None (1)
- Very mild (2)
- Mild (3)
- Moderate (4)
- Severe (5)
- Very severe (6)

Q55 During the past 4 weeks, how much energy did you have?

- Very much (1)
- Quite a lot (2)
- Some (3)
- A little (4)
- None (5)

Q56 During the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do social activities (5)

Q57 During the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

- Not at all (1)
- Slightly (2)
- Moderately (3)
- Quite a lot (4)
- Extremely (5)

Q58 During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do daily activities (5)

Q59 The following questions are related to your thoughts around exercising and your readiness to exercise. There are no wrong or right answers, so just answer them as openly as possible.

Q60 I am sure that I can change to a physically active lifestyle

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q61 I am sure that I can be physically active once a week

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q62 I am sure that I can be physically active at least three times a week

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q63 I am sure I can start being physically active immediately even if I initially have to reconsider my views on physical activity

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q64 I am sure I can start being physically active immediately even if the planning for this is very laborious

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q65 I am sure I can start being physically active immediately even if I have to force myself

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q66 I am sure I can start being physically active immediately even if I have to push myself

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q67 These next questions relate to your thoughts around planning exercise. Again, there are no right or wrong answers. Please answer them as openly as possible.

Q68 I have made detailed plans on which days I will do exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q69 I have made detailed plans on where I am going to do exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q70 I have made detailed plans regarding what exercise I will do

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q71 I have already planned what to do if something interferes with my original exercise plan

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q72 I have already planned what to do in difficult situations to stick to my intentions

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q73 I have already planned what to do when faced with possible setback

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q74 The following questions relate to the amount of exercise you have done over the past two weeks. Please answer them as honestly as possible. If you did not do any exercise, or exercise that relates to the question, just say you did not do any. Please only state the physical activities that are not part of your job or household duties.

Q75 During the past two weeks, how many times per week did you engage in vigorous physical activity? Vigorous physical activity means it was intense exercise which resulted in heavy puffing and sweating. This can include intensive swimming, running or cycling, as well as other things that may have required a lot of effort.

Q76 What was the average duration of each vigorous exercise session in minutes over the past two weeks? (If you said you did not do any vigorous exercise previously just put a zero on the box).

Q77 During the past two weeks, how many times per week did you engage in mild or moderate physical activity? Mild or moderate physical activity means the intensity of the exercise is far less than vigorous exercise, which may result in slightly increased breathing and minor sweating. This could include activities such as swift walking or slow cycling.

Q78 What was the average duration of each mild or moderate exercise session in minutes over the past two weeks? (If you said you did not do any mild or moderate exercise previously, just put a zero in the box).

Q79 Was this amount of exercise you reported from the past 4 questions a typical amount for you?

- Yes (1)
- No (2)

Mid-intervention questionnaire

Q1 You have now been involved with the study for four weeks. Keep it up! The following questions relate to your views on maintaining exercise. There are no right or wrong answers, so please answer them as openly as possible.

Q2 I am sure I can keep being physically active regularly even if it takes me a long time to make it a habit

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q3 I am sure I can keep being physically active regularly even if I am worried and troubled

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q4 I am sure I can keep being physically active regularly even if I don't see success at once

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q5 I am sure I can keep being physically active regularly even if I am tired

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q6 I am sure I can keep being physically active regularly even if I am stressed out

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q7 I am sure I can keep being physically active regularly even if I feel tense

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q8 I am sure I can keep being physically active regularly even if I won't get social support for my first attempts

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q9 I am sure I can keep being physically active regularly even if I have to start all over again several times until I succeed

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q10 I am sure I can keep being physically active regularly even if my partner/family isn't physically active

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q11 In spite of good intentions, smaller or larger relapses may occur. Imagine you stopped exercising for some time. How confident are you about restarting exercise?

Q12 I am sure I can be physically active again even if I postpone my plans several times

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q13 I am sure I can be physically active again even if I am not able to pull myself together sometimes

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q14 I am sure I can be physically active again even if I have already paused for several weeks

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q15 Keep in mind the exercise you have done over the past four weeks and answer these questions. Again, there are no right or wrong answers. Please answer them as openly as possible.

Q16 I have constantly monitored if I do enough exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q17 I have carefully observed that I have trained at least 30 minutes with the suggested intensity per occasion

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q18 I am always aware of my plans of doing exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q19 I have always been aware of my prescribed training programme

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q20 I have really tried to do exercise regularly

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q21 I have tried my best to train as much as I intended to

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q22 The following questions relate to the amount of exercise you have done over the past two weeks. Please answer them as honestly as possible. If you did not do any exercise, or exercise that relates to the question, just say you did not do any. Please only state the physical activities that are not part of your job or household duties.

Q23 During the past two weeks, how many times per week did you engage in vigorous physical activity? Vigorous physical activity means it was intense exercise which resulted in heavy puffing and sweating. This can include intensive swimming, running or cycling, as well as other things that may have required a lot of effort.

Q24 What was the average duration of each vigorous exercise session in minutes over the past two weeks? (If you said you did not do any vigorous exercise previously just put a zero on the box).

Q25 During the past two weeks, how many times per week did you engage in mild or moderate physical activity? Mild or moderate physical activity means the intensity of the exercise is far less than vigorous exercise, which may result in slightly increased

breathing and minor sweating. This could include activities such as swift walking or slow cycling.

Q26 What was the average duration of each mild or moderate exercise session in minutes over the past two weeks? (If you said you did not do any mild or moderate exercise previously, just put a zero in the box).

Q27 Was this amount of exercise you reported from the past 4 questions a typical amount for you?

- Yes (1)
- No (2)

Post-intervention questionnaire

Q1 You have been involved with the study for 8 weeks now and have come to the end of the period for using the app. Thank you very much for your participation! The first questions are about how you have been feeling lately and are the same as what you did right at the very start as the study. Again, there are no right or wrong answers, so please answer them as openly as possible.

Q2 The following questions examine how you have been feeling lately. Please read each statement and click the response which indicates how much the statement applied to you over the past week. There are no wrong or right answers. Do not spend too much time on any statement.

Q3 I found myself getting upset over quite trivial things

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q4 I was aware of dryness in my mouth

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q5 I couldn't seem to experience any positive feeling at all

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
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- Applied to me very much, or most of the time (4)

Q6 I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q7 I just couldn't seem to get going

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
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Q8 I tended to over-react to situations

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
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Q9 I had a feeling of shakiness (eg, legs going to give way)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q10 I found it difficult to relax

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q11 I found myself in situations that made me so anxious I was most relieved when they ended

- Did not apply to me at all (1)
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Q12 I felt that I had nothing to look forward to

- Did not apply to me at all (1)
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- Applied to me to a considerable degree, or a good part of the time (3)
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Q13 I found myself getting upset rather easily

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Q15 I felt sad and depressed

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
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Q16 I found myself getting impatient when I was delayed in any way (eg, lifts, traffic lights, being kept waiting)

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Q17 I had a feeling of faintness

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- Applied to me to some degree, or some of the time (2)
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- Applied to me to some degree, or some of the time (2)
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- Did not apply to me at all (1)
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Q22 I felt scared without any good reason

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q23 I felt that life wasn't worthwhile

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q24 I found it hard to wind down

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q25 I had difficulty in swallowing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q26 I couldn't seem to get any enjoyment out of the things I did

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q27 I was aware of the action of my heart in the absence of physical exertion (eg.,sense of heart rate increase, heart missing a beat)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q28 I felt down-hearted and blue

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q29 I found that I was very irritable

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q30 I felt I was close to panic

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q31 I found it hard to calm down after something upset me

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q32 I feared that I would be "thrown" by some trivial but unfamiliar task

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q33 I was unable to become enthusiastic about anything

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q34 I found it difficult to tolerate interruptions to what I was doing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q35 I was in a state of nervous tension

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q36 I felt I was pretty worthless

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q37 I was intolerant of anything that kept me from getting on with what I was doing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q38 I felt terrified

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q39 I could see nothing in the future to be hopeful about

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q40 I felt that life was meaningless

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q41 I found myself getting agitated

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q42 I was worried about situations in which I might panic and make a fool of myself

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q43 I experienced trembling (e.g., in the hands)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of time (3)
- Applied to me very much, or most of the time (4)

Q44 I found it difficult to work up the initiative to do things

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of time (3)
- Applied to me very much, or most of the time (4)

Q45 These next questions also relate how you have been feeling lately, but are more related to your overall health. Answer every question by selecting the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can

Q46 Overall, how would you rate your health during the past 4 weeks?

- Excellent (1)
- Very Good (2)
- Good (3)
- Fair (4)
- Poor (5)
- Very poor (6)

Q47 During the past 4 weeks, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do physical activities (5)

Q48 During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

- None at all (1)
- A little bit (2)
- Some (3)
- Quite a bit (4)
- Could not do work (5)

Q49 How much bodily pain have you had during the past 4 weeks?

- None (1)
- Very mild (2)
- Mild (3)
- Moderate (4)
- Severe (5)
- Very severe (6)

Q50 During the past 4 weeks, how much energy did you have?

- Very much (1)
- Quite a lot (2)
- Some (3)
- A little (4)
- None (5)

Q51 During the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do social activities (5)

Q52 During the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

- Not at all (1)
- Slightly (2)
- Moderately (3)
- Quite a lot (4)
- Extremely (5)

Q53 During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do daily activities (5)

Q54 The following questions relate to exercising and are the same questions from the very start of the study and the four week mark. Please answer them as openly as possible. There are no wrong or right answers.

Q55 I am sure I can keep being physically active regularly even if it takes me a long time to make it a habit

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q56 I am sure I can keep being physically active regularly even if I am worried and troubled

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q57 I am sure I can keep being physically active regularly even if I don't see success at once

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q58 I am sure I can keep being physically active regularly even if I am tired

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q59 I am sure I can keep being physically active regularly even if I am stressed out

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q60 I am sure I can keep being physically active regularly even if I feel tense

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q61 I am sure I can keep being physically active regularly even if I won't get social support for my first attempts

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q62 I am sure I can keep being physically active regularly even if I have to start all over again several times until I succeed

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q63 I am sure I can keep being physically active regularly even if my partner/family isn't physically active

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q64 In spite of good intentions, smaller or larger relapses may occur. Imagine you stopped exercising for some time. How confident are you about restarting exercise?

Q65 I am sure I can be physically active again even if I postpone my plans several times

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q66 I am sure I can be physically active again even if I am not able to pull myself together sometimes

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q67 I am sure I can be physically active again even if I have already paused for several weeks

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q68 Keep in mind the exercise you have done over the past 8 weeks and answer these questions. Again, there are no right or wrong answers. Please answer them as openly as possible.

Q69 I have constantly monitored if I do enough exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q70 I have carefully observed that I have trained at least 30 minutes with the suggested intensity per occasion

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q71 I am always aware of my plans of doing exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q72 I have always been aware of my prescribed training programme

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q73 I have really tried to do exercise regularly

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q74 I have tried my best to train as much as I intended to

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q75 The following questions relate to the amount of exercise you have done over the past two weeks. Please answer them as honestly as possible. If you did not do any exercise, or exercise that relates to the question, just say you did not do any. Please only state the physical activities that are not part of your job or household duties.

Q76 During the past two weeks, how many times per week did you engage in vigorous physical activity? Vigorous physical activity means it was intense exercise which resulted

in heavy puffing and sweating. This can include intensive swimming, running or cycling, as well as other things that may have required a lot of effort.

Q77 What was the average duration of each vigorous exercise session in minutes over the past two weeks? (If you said you did not do any vigorous exercise previously just put a zero on the box).

Q78 During the past two weeks, how many times per week did you engage in mild or moderate physical activity? Mild or moderate physical activity means the intensity of the exercise is far less than vigorous exercise, which may result in slightly increased breathing and minor sweating. This could include activities such as swift walking or slow cycling.

Q79 What was the average duration of each mild or moderate exercise session in minutes over the past two weeks? (If you said you did not do any mild or moderate exercise previously, just put a zero in the box).

Q80 Was this amount of exercise you reported from the past 4 questions a typical amount for you?

- Yes (1)
- No (2)

Q81 The following questions are about the overall experience of using the Couch to 5k app and exercise in general. We are interested in your experience and your feedback on the Couch to 5k app and what you felt helped, and didn't help for starting exercise. This.

will be most helpful if you tell us what worked and didn't work, and if you didn't exercise, what stood in your way. We really appreciate your honesty.

Q82 If you used the Couch to 5k app, how long did you use it for?

- I didn't use it (5)
- One week or less (1)
- Two-four weeks (2)
- Four-six weeks (3)
- The whole 8 weeks (4)

Q83 Here you can explain how using the app went for you:

Q84 What were some things you liked about the app?

Q85 What were some things you did not like about the app?

Q86 Did the Couch to 5k app help you with planning out exercise? (E.g. how often to do exercise and for how long each time?)

- Yes, very much (1)
- It somewhat helped (3)
- It was somewhat unhelpful (4)
- No, not at all (6)

Q87 Please explain why the app was helpful or unhelpful for planning exercise:

Q88 Did you do any other forms of exercise, or another method for exercise other than using the app during this 8 week period? Please explain what you did. Did this form of exercise or alternative method work better or worse for you than using the app?

Q89 Do you have any suggestions on what could have helped you more for starting exercise? (E.g. social support)

Q90 What were some things you found hard about exercising or seemed to prevent you from exercising? (You can select multiple options)

- Didn't want to/didn't feel like it (1)
- Too tired (2)
- Not enough time (3)
- Sickness/poor health/pain (4)
- Previously unpleasant exercise experience (5)
- I did not find anything hard about exercising/nothing prevented me (6)
- Other (7) _____

Q91 On a scale of 1-5, how effective did you find the Couch to 5k app for exercising?

- Very Ineffective (1)
- Ineffective (2)
- Neither Effective nor Ineffective (3)
- Effective (4)
- Very Effective (5)

Q92 Please make further comments on the overall effectiveness of the app:

Follow-up questionnaire

Q1 It has now been a month since completing the 8 week period of using the Couch to 5k exercise app. This questionnaire has been given to you to see how you are going 1 month after using the app. Just as the previous times, there are no right or wrong answers and you should answer the questions as openly as possible.

Q2 The following questions examine how you have been feeling lately. Please read each statement and click the response which indicates how much the statement applied to you over the past week. There are no wrong or right answers. Do not spend too much time on any statement.

Q3 I found myself getting upset over quite trivial things

- Did not apply to me at all (1)
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Q5 I couldn't seem to experience any positive feeling at all

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- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q7 I just couldn't seem to get going

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q8 I tended to over-react to situations

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q9 I had a feeling of shakiness (eg, legs going to give way)

- Did not apply to me at all (1)
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- Applied to me to a considerable degree, or a good part of the time (3)
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Q16 I found myself getting impatient when I was delayed in any way (eg, lifts, traffic lights, being kept waiting)

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- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q22 I felt scared without any good reason

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q23 I felt that life wasn't worthwhile

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q24 I found it hard to wind down

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q25 I had difficulty in swallowing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q26 I couldn't seem to get any enjoyment out of the things I did

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q27 I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q28 I felt down-hearted and blue

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q29 I found that I was very irritable

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q30 I felt I was close to panic

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q31 I found it hard to calm down after something upset me

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q32 I feared that I would be "thrown" by some trivial but unfamiliar task

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q33 I was unable to become enthusiastic about anything

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q34 I found it difficult to tolerate interruptions to what I was doing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q35 I was in a state of nervous tension

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q36 I felt I was pretty worthless

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q37 I was intolerant of anything that kept me from getting on with what I was doing

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q38 I felt terrified

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q39 I could see nothing in the future to be hopeful about

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q40 I felt that life was meaningless

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q41 I found myself getting agitated

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q42 I was worried about situations in which I might panic and make a fool of myself

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q43 I experienced trembling (e.g., in the hands)

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of time (3)
- Applied to me very much, or most of the time (4)

Q44 I found it difficult to work up the initiative to do things

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of time (3)
- Applied to me very much, or most of the time (4)

Q45 These next questions also relate how you have been feeling lately, but are more related to your overall health. Answer every question by selecting the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can

Q46 Overall, how would you rate your health during the past 4 weeks?

- Excellent (1)
- Very Good (2)
- Good (3)
- Fair (4)
- Poor (5)
- Very poor (6)

Q47 During the past 4 weeks, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do physical activities (5)

Q48 During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

- None at all (1)
- A little bit (2)
- Some (3)
- Quite a bit (4)
- Could not do work (5)

Q49 How much bodily pain have you had during the past 4 weeks?

- None (1)
- Very mild (2)
- Mild (3)
- Moderate (4)
- Severe (5)
- Very severe (6)

Q50 During the past 4 weeks, how much energy did you have?

- Very much (1)
- Quite a lot (2)
- Some (3)
- A little (4)
- None (5)

Q51 During the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do social activities (5)

Q52 During the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

- Not at all (1)
- Slightly (2)
- Moderately (3)
- Quite a lot (4)
- Extremely (5)

Q53 During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?

- Not at all (1)
- Very little (2)
- Somewhat (3)
- Quite a lot (4)
- Could not do daily activities (5)

Q54 These next questions are related to exercising and your perceived ability to exercise. They are the same questions that have been presented in all the other questionnaires you have already done. Please answer them as openly as possible. Remember that there are no right or wrong answers.

Q55 I am sure I can keep being physically active regularly even if it takes me a long time to make it a habit

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q56 I am sure I can keep being physically active regularly even if I am worried and troubled

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q57 I am sure I can keep being physically active regularly even if I don't see success at once

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q58 I am sure I can keep being physically active regularly even if I am tired

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q59 I am sure I can keep being physically active regularly even if I am stressed out

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q60 I am sure I can keep being physically active regularly even if I feel tense

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q61 I am sure I can keep being physically active regularly even if I won't get social support for my first attempts

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q62 I am sure I can keep being physically active regularly even if I have to start all over again several times until I succeed

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q63 I am sure I can keep being physically active regularly even if my partner/family isn't physically active

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q64 In spite of good intentions, smaller or larger relapses may occur. Imagine you stopped exercising for some time. How confident are you about restarting exercise?

Q65 I am sure I can be physically active again even if I postpone my plans several times

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q66 I am sure I can be physically active again even if I am not able to pull myself together sometimes

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q67 I am sure I can be physically active again even if I have already paused for several weeks

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q68 Keep in mind the exercise you have done over the past month after finishing the period of using the app and answer these questions. Again, there are no right or wrong answers. Please answer them as openly as possible.

Q69 I have constantly monitored if I do enough exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q70 I have carefully observed that I have trained at least 30 minutes with the suggested intensity per occasion

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q71 I am always aware of my plans of doing exercise

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q72 I have always been aware of my prescribed training programme

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q73 I have really tried to do exercise regularly

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q74 I have tried my best to train as much as I intended to

- Not true at all (1)
- Barely true (2)
- Mostly true (3)
- Exactly true (4)

Q75 The following questions relate to the amount of exercise you have done over the past two weeks. Please answer them as honestly as possible. If you did not do any exercise, or exercise that relates to the question, just say you did not do any. Please only state the physical activities that are not part of your job or household duties.

Q76 During the past two weeks, how many times per week did you engage in vigorous physical activity? Vigorous physical activity means it was intense exercise which resulted in heavy puffing and sweating. This can include intensive swimming, running or cycling, as well as other things that may have required a lot of effort.

Q77 What was the average duration of each vigorous exercise session in minutes over the past two weeks? (If you said you did not do any vigorous exercise previously just put a zero on the box).

Q78 During the past two weeks, how many times per week did you engage in mild or moderate physical activity? Mild or moderate physical activity means the intensity of the exercise is far less than vigorous exercise, which may result in slightly increased breathing and minor sweating. This could include activities such as swift walking or slow cycling.

Q79 What was the average duration of each mild or moderate exercise session in minutes over the past two weeks? (If you said you did not do any mild or moderate exercise previously, just put a zero in the box).

Q80 Was this amount of exercise you reported from the past 4 questions a typical amount for you?

- Yes (1)
- No (2)

Q81 Since finishing using the app, have you continued to exercise?

- Yes, all the time (1)
- Somewhat, but not as much as I would have liked to (2)
- Not really (3)
- No, not at all (4)

Q82 Please make some comments on your continuation or discontinuation of exercising since doing the 8 week trial (You may like to comment on what exercise you have been doing since completing the 8 week period of using the app, whether or not you

continued using the app, or if you have not exercised since then, why you have perhaps found it difficult to keep exercising).

Exercise app study: Research results

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Background:

It is well known that we should engage in plenty of exercise to get healthy and stay healthy. It has also become more well-known in recent years that exercise is beneficial for mood, primarily depressive symptoms. Although exercising is good for us it is recognised by many exercise psychologists and health behaviour change theorists that exercise can be difficult to begin and then maintain. Statistics show that as many as 50% of people who begin an exercise regime stop exercising within the next 6 months. Many barriers such as lack of time and energy, as well as exercising often feeling unpleasant contribute to people feeling reluctant to begin an exercise regime and then stick to it. However, it has been recognised by researchers that factors such as self-monitoring of exercise behaviour as well as planning are helpful for beginning and then maintaining an exercise programme. Self-regulation and monitoring involves examining one's own exercise behaviour. This could include, looking back on a work out just completed and assessing whether it was performed at an appropriate intensity, pace or length of time or even looking back over the previous week and assessing whether you engaged in enough exercise. Planning can involve scheduling in when exercise can be performed around commitments as well as assessing what should occur if something gets in the way of one's original exercise plan such as poor weather. Many of these components are incorporated (or can easily be incorporated) in mobile software applications, more commonly known as 'apps'. Exercise apps are a promising mode for beginning and maintaining exercise on a wide scale because so many people in the Western world own a smartphone. They are also capable of encompassing techniques that are known to be beneficial for helping people to exercise such as aids for self-regulation and monitoring. However, due to smartphone apps being a relatively recent phenomenon, more research needs to be done to assess whether they are effective.

A total of 17 participants who were eager to begin exercising were given the Couch to 5k running guide app to use to use over a two month-period. Participants were examined throughout this time by filling out questionnaires at various time points. The Couch to 5k app was used for this research due to it being especially designed for beginners as well as it being simple, easy to use and accessible.

Results:

Overall, amount of exercise by participants increased over time. Changes in number of times per week and average duration of vigorous exercise produced a great enough result that the changes were detected by statistical tests. Changes in mild or moderate exercise did not produce a large result, however this was expected due to the Couch to 5k app encouraging vigorous intensity exercise. Most people stopped using the app at some point during the study but continued to exercise without using the app. App usage was not particularly high as 17.6% of participants did not use the app at all, 17.6% of participants used the app for one week or less, 41.2% of participants used the app for two-four weeks, 17.6% of participants used it for four-six weeks and 5.8% of participants used it for the whole 8 weeks. However, the app seemed to be more a tool to get people started as most people who discontinued using the app began doing their own exercise without it. Some participants even commented that the app helped them gauge what was recommended for cardio exercise and subsequently felt confident enough to do exercise at an appropriate level on their own.

A strong relationship between self-regulation and monitoring and exercise was found at all time points of the study. This shows that the app may have been helping participants with self-examination of exercise. However, it was also mentioned by some participants that they would have liked to have seen more alerts and reminders within the app. These features would have likely aided self-regulation and monitoring of exercise more by keeping exercise goals at the forefront of the user's mind. It was also appeared that the app wasn't using as many features as it could have been capable of such as GPS tracking, steps taken and distance travelled that could have aided self-regulation and monitoring further.

Planning was also examined. The relationship between planning and exercise was found to be moderate at the beginning of the study; however it was not very strong at later stages. This suggested that planning may take on a stronger and more important role at the beginning of a new exercise programme and other factors such as self-regulation and monitoring may become more important once exercise has been somewhat established.

Many participants also mentioned the way the running guide of the Couch to 5k progressed. Participants who had stopped exercising less than a year before signing up to the study said that the guide progressed too slowly. Many of the people in this situation said that they felt they were not getting pushed and as a result gave up on the guide. As these people were familiar with exercise in the past, confidence in their ability to begin exercise at a higher intensity may have played a role. However, many more participants said that the guide progressed too quickly and became difficult. As a result, many gave up using the app. This is an important point to raise as a lot of research states that exercise that is performed at an intensity that is too high is more likely to result in discontinuation of the exercise programme. Therefore, for the app to be more successful at producing long-term exercisers, it may be more helpful to spread the guide over 10-12 weeks with much more gradual changes in intensity.

Summary:

- Exercise increased throughout the exercise trial
- The app was considered more as a starting point for people as app usage was not particularly high as well as most participants discontinuing use at some point. However, most participants went on to do their own exercise plan
- There was a strong relationship between self-regulation and monitoring and exercise. This shows that the app may have helped with self-regulation and monitoring
- More features such as alerts, reminders, GPS tracking, steps taken and distance travelled could be included in the app to make it more successful
- Planning seemed to take on a more important role at the beginning of the study than the end suggesting that other factors such as self-regulation and monitoring become more useful for maintaining an exercise programme once started
- Progression of the app's running guide needs to be examined so that users are not exerting themselves too much and therefore stop exercising all together

Thank you!

Thank you all so much for participating in this research-it could not have been possible without your willingness to give the trial a go! I hope you all continue to exercise and make positive changes in your lives! If you are interested in reading the full thesis please contact me via email so I can send it through to you.

