

**UNIVERSITY OF SOUTHAMPTON**

**FACULTY OF MEDICINE, HEALTH & LIFE SCIENCES**

School of Psychology

**Why Does Physical Activity Alleviate Depression? Identifying potential mediators  
and understanding the process of change**

by

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ABSTRACT  
FACULTY OF MEDICINE, HEALTH AND LIFE SCIENCES  
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WHY DOES PHYSICAL ACTIVITY ALLEVIATE DEPRESSION? IDENTIFYING  
POTENTIAL MEDIATORS AND UNDERSTANDING THE PROCESS OF  
CHANGE

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Physical activity has been found to alleviate depression, but little is known about why or how it 'works'. Combining quantitative and qualitative research methods, the overall aims of this thesis were to address this gap, identify potential mediators and develop an understanding of the process of change.

Self-esteem, physical self-concept, physical self-efficacy, and the independent mood dimensions of depression, negative affect (NA) and positive affect (PA), were identified from theory as potential mediators. PA and NA have not previously been suggested, and represent a novel explanation. In particular, it was proposed that PA may be a stronger candidate mediator than NA. These factors were examined in an initial, longitudinal study in which individuals with elevated depression scores increased their physical activity over an eight week period. The temporal relation of change suggested that improvement in PA, NA and physical self-efficacy may be stronger candidate mediators than physical self-concept or self-esteem, at least for mediating change in depression in the early stages of increased activity. Larger effects were found for change in PA than NA or any other potential mediator.

A qualitative, grounded theory study offered insight that depressed individuals may experience a sense of pleasurable engagement in life from physical activity. The accounts also suggested the importance of embodied experience and knowledge in the process of change. Direct (bodily) experiences of the physical activity – especially enjoyment – seemed to be related to experiencing benefit, changing motivations and eventually the active use of physical activity to self-control symptoms by some. It was consequently hypothesised that state mood changes (especially an increase in PA – i.e. movement away from anhedonia) may be responsible for initial reductions in depression and that coping self-efficacy may be a mechanism responsible for longer-term effects.

A final, cross-sectional, postal questionnaire study further examined the potential mediators identified from the other studies in a multiple mediation analysis. PA and NA were the only significant direct mediators and statistical comparisons suggested an equal mediating role. However, *post-hoc* analyses suggested that physical self-efficacy may indirectly mediate improvement in depression through improvement in PA but not NA.

From the findings, a new, tentative theoretical model for understanding the process of change is proposed. Distinguishing between PA and NA forms a fundamental basis of the model. It is suggested that embodied experiences of physical activity (e.g. physical self-efficacy) may indirectly mediate higher-level response in depression through PA and / or NA, and that improvement in the mediators may dynamically reinforce future physical activity. The value of distinguishing between PA and NA in understanding mediators of at least initial response in depression to physical activity is discussed.

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## ABBREVIATIONS

BDI(-II)	Beck Depression Inventory(-II)
CBT	Cognitive Behavioural Therapy
CSE	Coping Self-Efficacy Scale
DV	Dependent variable
EFI	Exercise-Induced Feeling Inventory
EFI-A	Exercise-Induced Feeling Inventory (acute version)
EFI-C	Exercise-Induced Feeling Inventory (chronic version)
EXSEM	Exercise and Self-esteem Model
GP(s)	General Practitioner(s)
ICD-10	International Classification of Diseases
IPAQ	International Physical Activity Questionnaire
IV	Independent variable
MASQ	Mood and Anxiety Symptoms Questionnaire
NA	Negative Affect
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
PA	Positive Affect
PD	Psychological Distress scale
PANAS	Positive and Negative Affect Schedule
POMS	Profile of Mood States
PPA	Perceived Physical Ability scale
PSPP	Physical Self-Perception Profile
PSE	Physical Self-Efficacy Scale
PSW	Physical Self-worth
RCT(s)	Randomised Controlled Trial(s)
RSE	Rosenberg's (1965) Global Self-Esteem Scale
SCT	Social Cognitive Theory
SEES	Subjective Exercise Experiences Scale
SEM	Structural equation modelling
SSQ	Social Support Questionnaire
SSQN	Number or Perceived Availability score (social support)
SSQS	Satisfaction score (social support)
SSRIs	Selective Serotonin Reuptake Inhibitors

VO<sub>2max</sub>

Maximal oxygen uptake

WHO

World Health Organisation

# Chapter 1

## Introduction and Thesis Outline

The field of psychosomatic medicine has clearly established the idea that how we think and feel will affect the functioning of the body. What we do with our bodies may also affect how we think and feel, but this somatopsychic approach is less well established. (Mutrie, 2002, p. 412.)

### *1.1 Introduction and aims*

The effect of physical activity on mental health is an area of investigation which has received increasing attention over the past 20 years (Mutrie, 2000). While the importance of physical activity for physical health has long been established, the psychological benefits may be less obvious or well known (Mental Health Foundation, 2005). However, as Mutrie (2002) points out above, what we do with our bodies may indeed affect how we think and feel. Evidence indicates that physical activity may be associated with a number of mental health benefits, including general mood improvement (Arent, Landers, & Etnier, 2000; Berger & Owen, 1983; Cockerill, Lawson, & Nevill, 1995; Pronk, Crouse, & Rohack, 1995), decreased trait anxiety (Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991; Steptoe, Edwards, Moses, & Mathews, 1989), reduced state anxiety (Petruzzello et al.) and lowered stress responses (Hamer, Taylor, & Steptoe, 2006; Rejeski, Thompson, Brubaker, & Miller, 1992). There is also evidence that physical activity may be associated with improved quality of life (Elavsky et al., 2005), self-esteem (Fox, 2000a; McAuley, Blissmer, Katula, Duncan, & Mihalko, 2000; Sonstroem, 1997), and cognitive functioning (Tomporowski, 2003), and decreased risk of developing dementia (Laurin, Verreault, Lindsay, MacPherson, & Rockwood, 2001). In particular, increased physical activity has been found to be consistently associated with reduced levels of depression (Craft & Landers, 1998; Lawlor & Hopker, 2001; Mutrie, 2000). This thesis focuses on furthering our understanding of the relationship between physical activity and depression by exploring 'how' and 'why' physical activity may alleviate depression.

Despite some methodological limitations and a lack of studies to determine the clinical effectiveness of physical activity, the literature indicates that it may be an efficacious intervention for depression (see chapter 2). On the basis of the evidence, in the United Kingdom (UK), structured exercise is now recommended in the guidelines for

managing depression in primary and secondary care as one of the options for the first stage of treatment for mild depression (National Institute for Health and Clinical Excellence [NICE], 2004). In 2004, a report from the Chief Medical Officer (Department of Health, 2004) called for health care providers to give greater consideration to the value of physical activity in treating people with depression.

While physical activity may be an efficacious intervention, little is known about how and why it may alleviate depression. That is, little is known about the potential mechanisms and mediators of change. Suggested mechanisms have mainly been subject to speculation in the literature and have included a range of physiological (e.g. improved cardiovascular fitness), biochemical (e.g. the release of endorphins) and psychological (e.g. self-esteem improvement) explanations (see chapter 3). There are currently few empirical data available to support any explanation. The aim of the research in this thesis was to begin to address this gap. The overall aim was to identify potential psychological mediators and develop an understanding of the process of change.

Next, the background context of this PhD, including the nature of depression, its treatment and the extent to which physical activity is currently used in the treatment of depression, will be outlined. The difference between exercise, physical activity and sport is also defined. Finally, a thesis outline is provided, along with consideration of why it is important to study mechanisms of change.

## *1.2 Background Context*

### *1.2.1 Defining Exercise, Physical Activity and Sport*

The terms ‘exercise’ and ‘physical activity’ are often used inter-changeably, yet they represent distinct classes of activity (Taylor, in press). Although there has been some disagreement regarding definitions (Shephard, 2003), the following definitions provided by Shephard (2003) are used in this thesis:

1. Physical activity - is any kind of muscular movement which increases energy expenditure. This may include exercise, household chores and activity at work.
2. Exercise - is a more structured activity which is performed regularly and with a purpose (e.g. to get healthy or to train for an event).

3. Sport - usually involves competitive activities and these activities do not necessarily always result in a high degree of energy expenditure.

Therefore, 'physical activity' is used as an all-encompassing reference in this thesis and is the dominant term. Occasionally, 'exercise' is used when discussion is clearly limited to structured or leisure time exercise. Of note, most of the depression studies have focused on exercise, rather than other or all forms of physical activity or sport.

### *1.2.2 Depression*

Depression is a mood disorder which is characterised by persistent low mood, loss of pleasure in usual activities, feelings of worthlessness or guilt, poor concentration and attention, and somatic symptoms such as sleep, appetite and psychomotor disturbance (American Psychiatric Association, 1994; World Health Organisation [WHO], 1993). To be diagnosed with depression, according to International Classification of Diseases (ICD-10; WHO, 1993) criteria, an individual must have experienced two of the following symptoms for at least 2 weeks: negative mood unusual for the individual, loss of pleasure, or fatigue or lowered energy. The ICD-10 also provides a classification of different types of depression. Depression may be classified as 'mild' (four symptoms, individual able to continue normal activities), 'moderate' (six symptoms, some difficulty continuing normal activities), or 'severe' (8 symptoms, normal functioning significantly impaired). The NICE (2004) management recommendations are based on the ICD-10 criteria. There are a number of variations of depression, including unipolar (e.g. major depressive disorder, dysthymic disorder) where there is no manic episode or bipolar in which people experience manic episodes (American Psychiatric Association, 1994; Davison & Neale, 1998).

*1.1.2.1 Causes and theories of depression.* Pioneering work by Brown, Bifulco and Harris (1987) highlighted the role of social adversity (i.e. negative life events) in the onset of depression. Negative life events relating to loss or that negatively impact on self-esteem have been found to be particularly associated depression (Farmer & McGuffin, 2003; Brown et al., 1987). While negative life events usually precede the onset of depression (Brown et al., 1987), not everyone who experiences adversity will become depressed (Kessler, 1997). A full discussion of the different theories about what causes and maintains depression is beyond the scope of this PhD. However, psychological theories of depression (e.g. cognitive theories) seek to explain the characteristics of individuals who do become depressed in the face of life difficulties



and provide an understanding of how depression may be maintained (e.g. negative cognitions) (Davison & Neale, 1998).

*1.2.2.2 Prevalence.* At any one time in the UK, around five to six per cent of the population will be experiencing a depressive disorder (Michalak et al., 2002; Ohayon, Priest, Guilleminault, & Caulet, 1999). The prevalence of current depression among patients attending primary care is 16.9% (WHO, 2001). Figures from the United States indicate a lifetime prevalence of depression of 13% (Hasin, Goodwin, Stinson, & Grant, 2005). Women are more likely to experience depression than men (Hasin et al.; Ohayon, et al.; Michalak et al.). People who are unemployed (Michalak et al.), experiencing poor health, disability or chronic conditions (Kaplan, Roberts, Camacho, & Coyne, 1987), and people with less education (Kaplan et al.) are also more likely to be at risk of depression. Financial strain, a low standard of living (Kaplan et al; Weich & Lewis, 1998) and a lack of social support (Kaplan et al.; Michalak et al.) also significantly contribute to depression. Worldwide, depression is one of the leading causes of disability (WHO, 2001) and it has significant economic implications for the individual, the health service and society (Weich, 1997; WHO, 2001). Therefore, the treatment and prevention of depression, including the role of physical activity, should be a pertinent concern.

*1.2.2.3 The treatment of depression.* Despite the prevalence of depression, only a small proportion of people experiencing a depressive disorder are diagnosed or treated (12.5%) (Ohayon, et al., 1999). This may be due to people not seeking help (Olfon & Klerman, 1992, as cited in Ohayon et al., 1999) or due to underdetection by general practitioners (Paykel & Priest, 1992). Depression is more likely to be treated and recognised when people present with more severe depression (Ronalds, Creed, Stone, Webb, & Tomenson, 1997) or in patients with a psychologising symptom attribution style (Kessler, Lloyd, Lewis & Pereira Gray, 1999).

Depression is mainly treated in primary care rather than in more specialised services (Paykel & Priest, 1992; Peveler & Kendrick, 2001) and, in this context, is most commonly treated with antidepressant medication (Hollingshurst, Kessler, Peters, & Gunnell, 2005). In recent times there has been a marked rise in the use of antidepressants (specifically, mostly Selective Serotonin Reuptake Inhibitors; SSRIs), with prescription rates having increased nearly three-fold (Hollingshurst et al.;

Middleton, Gunnell, Whitley, Dorling, & Frankel, 2001). A number of possible explanations have been put forward for this, including increased recognition of depression, greater presentation from patients, and increased prevalence or change in the way that depression is managed (Middleton, et al., 2001). However, recent work indicates that the rise may be due to a small but significant and increasing proportion of patients receiving repeat prescriptions and staying on antidepressants long-term (Kendrick, Yuen, Dunn, Moore, & Mullee, 2007).

Even so, there have been calls for alternative treatments to antidepressants to be given greater consideration (Hollingshurst et al., 2005; Mental Health Foundation, 2005; Moncrieff & Kirsch, 2005). NICE (2004) guidelines for the management of depression only recommend the use of antidepressants for moderate to severe depression, and not as a first line treatment response for mild depression. The only exceptions to this are when other interventions have not been beneficial, the patient has previously presented with severe-moderate depression or the depression is related to a psychosocial or medical condition. The recommended options for mild depression are watchful waiting, guided self-help, brief psychological interventions and exercise. There have been some criticisms of even this recommendation of the use antidepressants in the NICE guidelines, as it has been suggested that the examination of clinically meaningful improvement in the guidelines was flawed and that there needs to be more evidence for the efficacy of antidepressants in the light of the potential adverse effects (Moncrieff & Kirsch, 2005). The call for greater use of alternatives may especially be pertinent in the light of recent concerns about negative side effects of SSRIs such as abnormal abdominal bleeding (Meijer et al., 2004) and the potential increased risk of suicidal behaviour and self-harm (Lenzer, 2004), although there is currently inconclusive evidence regarding the latter risks (Culpepper et al., 2004; Geddes & Cipriani, 2004; Gunnell, Saperia, & Ashby, 2005; Martinez et al., 2005).

Research suggests a number of other reasons to consider alternatives. Many patients do not adhere to their antidepressant prescriptions (Mental Health Foundation, 2005) and two-thirds of patients experience negative side effects and have problems coming off antidepressants (Van Voorhees et al., 2003). Patients often find antidepressants stigmatising and feel they have a negative impact on their sense of identity (Garfield, Smith, & Francis, 2003). Moreover, patients often have a stronger preference for other forms of treatment, such as counselling (Chilvers et al., 2001).

Other options for depression include counselling, cognitive behavioural therapy and other psychological interventions, and physical activity. There is also emerging evidence regarding the beneficial effects of St John's Wort (Szegedi, Kohnen, Dienel, & Kieser, 2005),  $\omega$ -3 polyunsaturated fatty acids such as found in fish (Sontrop & Campbell, 2006), acupuncture (Leo & Ligot, 2006) and animal facilitated therapy (Antonioli & Reveley, 2005). Many of these other treatments have been found to be as effective as antidepressants (Blumenthal et al., 1999; Chilvers et al., 2001; DeRubeis et al., 2005; Szegedi et al., 2005). Economic considerations such as cost and the accessibility of treatments may often be a factor in selection (Hollingshurst et al., 2005). However, there is evidence that the same resources used for antidepressant treatment could be used to purchase cognitive behaviour therapy for a large number of patients (Hollingshurst et al., 2005). Treatments such as physical activity are a lifestyle behaviour which (depending on how it is delivered) can even be relatively cost-free to the health service. Next, the extent to which physical activity is used in the treatment of depression in practice, and patients and health care providers' views of physical activity is considered.

### *1.1.3 Physical Activity and Depression in Practice*

In contrast to antidepressants, physical activity represents a relatively side effect-free treatment, with the only risks being physical injuries and exercise addiction (Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Physical activity also offers a number of coincidental health benefits such as reduced risk of diabetes, coronary heart disease, stroke, cancer and obesity (Department of Health, 2004) and is a healthy lifestyle behaviour which should be encouraged regardless of whether people are depressed or not. Depressed patients often cite physical activity as one of the most helpful aspects of their treatment (Martinsen, 1995). While concern is sometimes expressed that depressed individuals may lack motivation (Scully et al. 1998; Seime and Vickers, 2006), adherence rates to exercise programmes are similar to those of the general population (Mental Health Foundation, 2005). Fifty per cent of people with mental health problems state that exercise played a significant role in their recovery (Mind, 2001, as cited in Mental Health Foundation, 2005) and 85% of people with depression who have been treated with exercise have found it helpful (National Schizophrenic Fellowship, Mind, Manic Depression Fellowship, 2000, as cited in Mental Health Foundation, 2005). Martinsen suggests that patients may prefer exercise as they are

active agents in managing their own problems. As exercise is now recommended as one of the first stages of care in the NICE (2004) guidelines, it should especially be considered by clinicians. Next, the extent physical activity is used in practice and the options available are considered.

In primary care, physical activity interventions primarily take two forms: counselling aimed at changing behaviour delivered within a practice, and exercise referral schemes run by local authority leisure centres in partnership with Primary Care Trusts. Patients with a variety of conditions may be referred, including mental health (Fox, Biddle, Edmunds, Bowler & Killoran, 1997). The schemes offer patients an induction to exercise and are the most common form of physical activity intervention in primary care (Department of Health, 2001; Fox, et al., 1997). Green Gyms offer an opportunity for patients to do physical work outside in the natural environment, such as gardening or maintaining woodland (Mental Health Foundation, 2005).

There are currently few data available to indicate the extent to which physical activity is used by clinicians for depressed patients in practice. Figures from 2002 from the Active Options exercise referral scheme in Southampton showed that 57 of a total 1200 referrals made within the year were for mental health problems. Of these, only 29 patients actually attended the scheme (P. Partington, personal communication, March 17, 2004). This suggests both a low use of the schemes by clinicians for mental health and that, when referrals are made, there may be low patient attendance. A low use of referral schemes by General Practitioners (GPs) for patients with depression was highlighted in 2005 by the Mental Health Foundation (2005). It was found that while 92% of GPs use antidepressants as a first treatment option for mild to moderate depression, only 5% use exercise referral. Similarly, among a sample of psychotherapists only 10% recommended exercise to their clients on a regular basis (Barrow, English, & Pinkerton, 1987, as cited in McEntee & Halgin, 1996). However, no data are available (to the author's knowledge) to indicate the extent to which GPs make physical activity recommendations to their depressed patients during consultation on a more casual basis outside of referral to formal schemes. Nevertheless, the data discussed here would lead to the assumption that, despite the NICE guidelines, there is a low use of physical activity for depression in practice. Possible reasons for this are considered next.

The Mental Health Foundation (2005) found that of the GPs who did not use exercise referral schemes often, 43% did not use them as they did not believe that exercise is an effective treatment for depression. This belief may be attributable to a number of factors, including a lack of dissemination of research findings (Mental Health Foundation, 2005). A qualitative study of clinical psychologists' views of exercise for depression found a lack of awareness of the literature on exercise and mental health (Faulkner & Biddle, 2001). Exercise was also generally not viewed positively as a treatment for depression, as it was regarded to be too simple, not psychologically-based enough and not compatible with clinical psychology. Partly this was due to an apparent attitude among some of a dichotomy between the mind and the body: psychology deals with the mind not the body. In their view, there was no theoretical rationale to consider the role of the body in depression (Faulkner & Biddle, 2001). McEntree and Halgin (1996) similarly found that many psychotherapists do not regard the body as relevant to their work. This perhaps reflects a disembodied view of mental illness in which the body is seen as an objective, material object which is separate from and has nothing to do with the mind (Mutrie, 2002; Mutrie, 2000; Faulkner & Biddle, 2001; Martinsen, 1995). This perception may also come from the established acceptance that physical activity affects physical health and thus its effects are viewed from a physiological stance (Biddle & Fox, 1989). However, a phenomenological view of the body is that all experience is embodied. The body is not merely a biological mass controlled by the mind. The body is actively involved in the world through purposeful activity. Therefore the body dynamically interacts with the environment, social context and people's sense of self (Turner, 1996; Yardley, 1997). From this stance, the body is inseparable from the experience of illness, as it is through the body that we interact with the world (Yardley, 1997). Therefore, there is an argument for consideration of the role of the body in mental illness and for practitioners to consider how, as Mutrie (2002) states above, "what we do with our bodies may ... affect how we think and feel" (p.412).

### *1.3 Why Identify Mechanisms?*

Once a treatment has been found to have an effect, attention may be turned to the mechanisms and process of change (Doss, 2004; Judd & Kenny, 1981; Kazdin, 2001). To examine mechanisms, an intervention must be found to be at least more effective than no intervention at all (Doss, 2004). As discussed in Chapter 2, physical activity has been found to be efficacious and more effective than no treatment for reducing

depression (Lawlor & Hopker, 2001). It is therefore timely to begin to unravel the process of change. We now need to understand *how* and *why* physical activity works. However, even in psychotherapy process research there has been very little attention given to mechanisms - especially the testing of underlying theoretical assumptions (Kazdin, 2001). While it is inarguably useful to investigate whether a treatment works and for whom, it is also important to move away from just description (Judd & Kenny, 1981; Kazdin, 2001) and understand change processes.

An understanding of change mechanisms has a number of implications. First, and perhaps most important, once the factors responsible for response to physical activity are known, interventions may be designed or modified to target the mediators of change (Judd & Kenny, 1981; Steketee & Chambless, 1992). This may contribute towards optimising the effectiveness of physical activity interventions and increase the likelihood of response.

Second, the identification of mechanisms may also lead to evaluations of whether the effect of physical activity is due to *mode-specific* or *non-specific* factors (Kazdin & Nock, 2003). Non-specific effects are mediators of change that are common to different modes of treatment (e.g. therapeutic alliance) (Hollon, DeRubeis, & Evans, 1987). Mode-specific effects are mediators which are responsible for change in one treatment but not another, and may be unique to the theory behind the treatment (Hollon et al., 1987; Imber et al., 1990). Non-specificity does not mean that a variable is not a causal mediator, as is sometimes presumed in the literature (Hollon et al., 1987). Nor does non-specificity mean that some of the treatment effect may not also be caused by mode-specific mechanisms (Imber et al., 1990). An understanding of specific and non-specific effects may provide insight into the role of physical activity within the overall therapeutic milieu for depression (e.g. when it is used as an adjunctive treatment to, say, psychotherapy or antidepressants). At present it is not understood how physical activity fits into the overall therapeutic milieu for depression (Bouchard, Shephard, & Stephens, 2004).

Third, the identification of mediators may have implications for understanding the factors that may moderate the effect of physical activity. Identification of moderators may help identify which patients may be more likely to experience benefit and the circumstances under which benefit may be optimised (Kazdin & Nock, 2003).

Fourth, the identification of mechanisms is not just pertinent to understanding how physical activity may work, but may also tell us something important about the broader context. An understanding of the mechanisms may offer insight into the factors in other interventions or even everyday life that may play a role in positive mental health (Kazdin, 2001; Kazdin & Nock, 2003). Finally, within the context of psychology, the exploration of mechanisms may lead to theoretical developments.

#### *1.4 Thesis Outline*

Empirical evidence regarding the relationship between physical activity and depression is reviewed in chapter 2. The review shows that physical activity has been found to be consistently associated with lower levels of depression in a number of different populations. Methodological problems with previous research are discussed, but recent well-designed clinical trials which have begun to address some of these problems are also highlighted. It is concluded that while it still may be difficult to establish the clinical effectiveness of physical activity, there is strong evidence for efficacy. It is suggested that it is now appropriate for research to turn towards understanding the mechanisms of change.

Potential mechanisms that may explain the physical activity-depression link are identified in a literature review in chapter 3. Evidence regarding previously speculated mechanisms in addition to a novel explanation proposed in this PhD is reviewed. It is suggested that the difficulty with understanding ‘why’ and ‘how’ physical activity works is that there is no theoretical rationale for it as an intervention. It is important for mechanisms research to take a theoretical approach (Kazdin, 2001). The theoretical frameworks employed in the research in this PhD are presented. Social cognitive theory (Bandura, 1977, 1997), the exercise and self-esteem model (EXSEM; Sonstroem & Morgan, 1989) and the tripartite model of depression and anxiety (Clark & Watson, 1991) were identified as theoretical frameworks from which potential mediators may be understood. From these theories, improvement in self-esteem, physical self-concept, self-efficacy and the independent mood dimensions of depression, positive affect (PA) and negative affect (NA), were proposed as candidate mediators that warranted further examination in the first study of this PhD. Self-efficacy (social cognitive theory) and self-esteem / physical self-concept (EXSEM) have previously been proposed as potential mediators, but the role of PA and NA (as derived from the tripartite model)

has not been previously suggested and represents one of the unique contributions of this thesis. In particular, it is suggested that increased PA may potentially be a stronger candidate mediator than decreased NA. Physical activity may particularly tackle the low PA, anhedonia-related symptom of depression. This explanation has not been previously suggested.

Methodological considerations in delineating change mechanisms and processes are discussed in chapter 4. Both quantitative and qualitative methods were used and the value of using a mixed methods approach is outlined. Quantitative methodological considerations when examining mechanisms are discussed. This consideration informed the design of the first study. In particular, mechanisms research in other therapeutic areas has given little consideration to the temporal precedence criterion and this criterion has also not been considered in the few studies relating to mechanisms of the physical activity-depression link. The first study in this PhD takes this criterion into account and this forms part of the strength of the work presented. Further, mechanisms research benefits from the study of more than one potential mechanism within the same design, as insight may be gained into the relative importance of each mediator. This was also taken into account in the design of the quantitative studies.

Chapter 5 contains a report of a longitudinal pilot study in which individuals with elevated depression scores increased their physical activity over an eight week period. Measures of depression and the potential mediators identified in chapter 3 (physical self-efficacy, self-esteem, physical self-concept, positive affect, negative affect and exercise-induced feelings) were taken at baseline, week 1, week 3 and week 8. The main aims were to explore the temporal relation of change and gain insight into the relative importance of the potential mediators. Change in PA, NA and self-efficacy were concluded to be stronger candidate mechanisms than change in self-esteem or physical self-concept, at least for mediating change in depression in the early stages of increased activity. The effect sizes suggested that an increase in PA may be especially important. This study extends understanding in this area by offering some insight into the temporal relation of change and by exploring a unique combination of potential mediators within the same design.

In chapter 6, a qualitative, grounded theory study is reported. The study explored the experience of physical activity and the process of change from the perspective of



individuals who have experienced depression. A variety of participants were recruited, including both those who did and did not believe that physical activity helped their depression. The participant accounts indicated that physical activity gave them a sense of taking a forward movement into life, which was in direct contrast to the feelings of disengagement and dissociation experienced with depression. Importance was placed on the benefit of *just doing something*. The accounts also suggested the importance of embodied experience and knowledge in the process of change. Direct (bodily) experiences of the physical activity context – especially feelings of enjoyment and mood improvement – were central to perceiving benefit, experiencing a shift from intrinsic to extrinsic motivations over time and eventually the active use of physical activity to self-control symptoms by some. From the qualitative study, it was hypothesised that state mood changes (especially an increase in PA – i.e. movement away from anhedonia) may be responsible for initial reductions in depression and that coping self-efficacy may be a mechanism of change responsible for longer-term effects. The qualitative accounts contributed to an understanding that the process of change may be a fundamentally dynamic and embodied process.

The final study is presented in chapter 7. Although a controlled, longitudinal design would have been ideal to investigate the research questions generated from the previous two studies, an attempt to conduct such a study proved infeasible (see section 4.3.6.2, chapter 4). Therefore, a cross-sectional, postal questionnaire design was used instead. In this study, a multiple mediation analysis was conducted to assess the potential mediating role of coping self-efficacy, physical self-efficacy, exercise-induced feelings, PA and NA. The analysis revealed that PA and NA were the only significant mediators. Statistical comparisons indicated an equal mediating role for PA and NA. However, *post-hoc* analyses suggested that physical self-efficacy may indirectly mediate the effect of exercise on depression through improvement in PA but not NA. It was suggested that even if PA and NA may play an equal mediating role, it may still be beneficial to distinguish between these elements of depression in understanding the process of change, as factors proximal to the physical activity context (i.e. physical self-efficacy) may be differentially associated with each.

The general discussion is presented in chapter 8. The findings from each study are integrated and the overall picture is considered. A new, tentative theoretical model for understanding the process of change, developed from the complementary findings of

the longitudinal, qualitative and cross-sectional studies, is proposed. The distinction between PA and NA forms the fundamental basis of the model. The dynamic, embodied understanding of the process of change derived from the qualitative study also forms a fundamental basis of the model. The proposal of this new theoretical model makes a substantial, novel contribution to this field of knowledge. The implications for future research and clinical practice are discussed.

## Chapter 2

### Review of the Physical Activity and Depression Literature

#### *2.1 Introduction*

To study mechanisms of change, an intervention must first have been found to be efficacious or at least more effective than no treatment at all (Doss, 2004). In this chapter, evidence regarding the physical activity and depression relationship is reviewed. The evidence reviewed suggests that physical activity may be an efficacious intervention for depression and that it may be more effective than no treatment. Therefore, it is appropriate to begin to understand potential mechanisms. It is also useful to have some understanding of the nature and timeline of change in the outcome when studying mechanisms (e.g. dose-response relationship, when initial change may occur) (Doss, 2004). In the second half of this chapter, evidence relating to these issues is also reviewed and was used to inform the design of the studies in this PhD.

#### *2.2 Early Research*

People reporting 'feeling better' from physical activity has been documented for years (Brunner, 1969; Morgan, Roberts, Brand, Feinerman, 1970) and research into the psychological benefit of physical activity can be traced back to the 1960s and beyond (Morgan, 1969b; Scott, 1960). However, research in this area only started to expand in the previous two decades (Mutrie, 2000). Mutrie (2000) cites the work of W.P. Morgan as pioneering in this field. Morgan (1969a, 1969c) found that male (but not female) psychiatric patients scored lower on fitness measures than nondepressed patients. Depressed patients who stayed in hospital long-term were also found to score lower on physical fitness parameters at admission than patients who had a short-term stay (Morgan, 1969a). This suggested that low fitness may form part of the aetiology of depression. Early experimental work including physical activity in the treatment of psychiatric patients evolved from these findings (Mutrie, 2000). Favourable effects were found (i.e. for running) and therapists began to recommend physical activity to their depressed clients (Berger & Owen, 1983). Since, research in this field has grown considerably.

Next, recent epidemiological and intervention research into the effects of physical activity on depression is considered. In line with other reviewers (e.g. Mutrie, 2000;

O'Neal, Dunn, & Martinsen, 2000), the extent to which the evidence supports a causal association is considered. Strength of association, independence of relationship after controlling for other risk factors, consistency of the relationship across different situations and groups, evidence of temporal precedence, a dose-response relationship and experimental evidence are among criteria for inferring causality (O'Neal et al., 2000). Previously highlighted methodological problems with this research and the extent to which recent studies have overcome some of these problems are also considered.

### *2.3 Epidemiological Evidence*

Epidemiological studies have examined cross-sectional and prospective associations between physical activity and depression in large populations. Most of these studies have concentrated on community samples rather than clinical populations.

#### *2.3.1 Cross-sectional Findings*

Cross-sectional studies have found that people who are more physically active are less likely to be depressed. This has been a fairly consistent finding across studies, with the association being found among adult populations in different countries (Brown, Ford, Burton, Marshall, & Dobson, 2005; Hassmén, Koivula, & Uutela, 2000; Weyerer, 1992), the elderly in the community (Kritz-Silverstein, Barrett-Connor, & Corbeau, 2001) and patients with clinical depression (Harris, Cronkite, & Moos, 2006). The relationship remains after covariates such as sociodemographics and physical health status, which may affect both depression and physical activity, have been taken into account (Harris et al., 2006; Kritz-Silverstein et al., 2001; Weyerer, 1992). The association has been found to be consistent across gender and different age groups, including adolescents (De Moor, Beem, Stubbe, Boomsma, & De Geus, 2006).

There has been some indication of a dose-response relationship in the cross-sectional studies. Weyerer (1992) found that adults who reported not being physically active at all were 3.15 times more likely to be depressed than those who reported regular physical activity. However, the participants who reported occasional physical activity were only 1.55 times more likely to be depressed. Hassmén et al. (2000) found that people who were physically active two to three times a week or more were less likely to show concurrent depression than people who did less. Interestingly, the people who reported daily physical activity had a higher depression score than those reporting

being active once or two to three times a week. This is in contrast to other findings that weekly frequency of activity is not related to depression outcomes (Craft and Landers, 1998; Dunn et al., 2005) and that daily exercise may result in a clinical response in some depressed patients (Dimeo, Bauer, Varahram, Proest, & Halter, 2001; Knubben et al., 2007). A dose-response relationship is yet to be established, but Hassmén et al.'s (2000) finding is in accordance with findings presented below indicating that there may be an optimum level of physical activity for mental health benefits.

A limitation of the cross-sectional evidence is that it is not possible to infer a causal relationship between increased physical activity and a lower level of depression. Higher levels of physical activity may lead to reduced depression, but, equally, people who are depressed may be less likely to be active. Prospective evidence can offer some insight into the temporal precedence criteria for inferring causality.

### *2.3.2 Prospective Findings*

Prospective findings regarding the physical activity-depression relationship have been equivocal. At follow-up a few years after baseline, Kritz-Silverstein et al. (2001) did not find any difference in depression scores or change in depression status between those who were and were not physically active at baseline. Weyerer (1992) also found that low physical activity at baseline was not a risk factor for developing depression five years later. However, Brown et al. (2005) found that women who were physically active to some level at baseline were less likely to experience depressive symptoms five years later than the women who were not physically active at all.

There may be a few possible explanations for the inconsistency in findings. First, only Brown et al. (2005) used a measure of physical activity which took into account total energy expenditure (total energy expenditure has recently been found to influence depression outcomes from exercise; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005 – see section 2.11.4.3 below). The measures used in the other studies were based on simple, categorical items developed for the particular study. The measure used by Brown et al. (2005) may have been more sensitive to the actual level of physical activity.

Second, a protective effect may be more likely to be found when there is some level of mood disturbance present at baseline. One study found a protective effect only for the

participants reporting a high level of depression at baseline (Mobily, Rubenstein, Lemke, O'Hara, & Wallace, 1996).

Finally, this pattern of findings could suggest that current physical activity may have stronger implications for mental health than what someone did three, five or ten years ago. Little is known about how long mental health benefits endure after physical activity ceases or whether it may need to be maintained to obtain benefit (see section 2.8 below). Prospective analyses may be confounded by individuals' level of or change in physical activity at follow-up. Kritz-Silverstein et al. (2001) found that regardless of whether or not participants were active at baseline, those who were physically active at follow-up had lower depression scores than both those who were not active at follow-up and those who were not physically active at either time point. Brown et al. (2005) found that the women who increased their physical activity over the five year follow-up period were less likely to experience depressive symptoms than those who did not. This provides some support that it may be current physical activity which has greater implications for mental health.

### *2.3.3 Summary*

Cross-sectional data has shown a consistent association between increased physical activity and decreased depression, but prospective findings have been more equivocal. The studies in which a prospective association has been found provide some support for a causal link (Mutrie, 2000), but the relationship may be complicated by the issue of whether or not current activity is more relevant. Future prospective research could take into account change in physical activity or control for current physical activity.

## *2.4 Intervention Studies*

Attention will now be turned to evidence from studies in which changes in depression or mood have been measured among people taking part in chronic physical activity interventions or acute exercise sessions. First, findings from meta-analyses and narrative reviews are reviewed. Second, studies with nonclinical populations will be briefly considered. Here, the term 'nonclinical' refers to participants who have not been recruited into studies by virtue of a diagnosis of depression or elevated depression scores. Studies addressing the effects of physical activity on depression in clinical populations will then be reviewed. The term 'clinical' refers to participants who were screened for a pre-determined level of depression or who met criteria for a clinical

diagnosis of depression at study entry. Participants drawn from clinical settings, such as psychiatric patients, are included. The definition of depression has varied in studies, but all participants were selected by virtue of the presence of mood disturbance. Following this, studies with different populations, and evidence relating to clinical efficacy and effectiveness will be considered. Studies comparing the effects of physical activity with other interventions and evidence regarding longer-term effects will also be reviewed.

#### *2.4.1 Meta-analyses and Narrative Reviews*

A number of narrative reviews and meta-analyses of the evidence from both clinical and non-clinical samples have been conducted. Study inclusion criteria in meta-analyses and reviews have varied, but this variation provides useful insight into the nature of the effect. Ninety per cent of the studies included in a review by Byrne and Byrne (1993) found a beneficial effect for physical activity on mood. However, the review looked at a mixture of outcomes, including depression, anxiety and mood, and included college students and patients with physical conditions rather than depression as a primary disorder. Greater consistency has been found when reviews have been limited to clinical samples. In terms of clinically defined depression, a review by Mutrie (2000) found that all of the key studies reviewed found some reduction in depression.

While narrative reviews can provide an overview of findings, meta-analyses offer the advantage that overall effect sizes can be summarised from a number of studies. Meta-analyses in this area have all found support for an association between increased physical activity and reduced depression (Craft & Landers, 1998; Lawlor & Hopker, 2001; North, McCullagh, & Tran, 1990). North et al. (1990) found an effect size of -0.53, indicating that by the end of intervention, people in physical activity groups were half of a standard deviation less depressed than those in comparison groups. North et al. (1990), however, included few studies with people with a clinical diagnosis of depression (Mutrie, 2000). Meta-analyses which have only included studies with individuals with clinical levels of depression (e.g. Craft & Landers, 1998; Lawlor & Hopker, 2001) have found larger effects. Craft and Landers (1998) found an effect size of -0.72 for exercise interventions in comparison to no exercise, and Lawlor and Hopker (2001) found an effect size of -1.1 for exercise in comparison to no treatment at all. Indeed, when North et al. (1990) examined a clinical sub-population, they found an

effect size of -0.94 – although the sub-sample included patients with a mixture of disorders rather than pure depression. These findings provide support for a causal link in terms of the strength of the association. The findings also indicate that effects may be stronger among participants with clinical levels of depression (i.e. severer symptoms). This is consistent with findings that people with greater mood disturbance at baseline may experience the greatest mood benefits from physical activity (Craft & Landers, 1998; Gauvin et al., 1996; Reeds & Ones, 2006; Rejeski et al., 1995; Simons & Birkimer, 1988). However, few studies have been conducted with people who are severely depressed (Craft and Landers, 1998), so further research is needed to clarify the relationship between physical activity and severer forms of depression.

*2.4.1.1 Causal association.* There has been some disagreement in the literature regarding whether support for a causal association may be inferred (e.g. O’Neal et al., 2000; Mutrie, 2000; Van de Vliet et al., 2003a). In accordance with Mutrie (2000), the evidence reviewed here suggests that there may be tentative support for a causal association, but more research is needed before firm conclusions may be made (e.g. further work investigating the dose-response relationship).

#### *2.4.2 Studies with Nonclinical Populations*

Studies with nonclinical samples have found mixed mood effects. Some studies have found mood improvement following chronic physical activity (Arent et al., 2000; Cockerill et al., 1995; Simons & Birkimer, 1988) while others have not (Cramer, Nieman, & Lee, 1991; Hughes, Casal, & Leon, 1986; Lennox, Bedell, & Stone, 1990). Findings in relation to acute exercise have been much more consistent (Reed & Ones, 2006), with one review finding mood improvement in 85% of studies (Yeung, 1996). Where a worsening of mood was reported, this was related to high intensity training, competitive activities or uncomfortable conditions (Yeung, 1996). The evidence indicates that although there may be some short-term improvement in mood (i.e. within an acute context), there may not be any enduring benefit among people with normal moods (Lennox et al., 1990). In terms of depression outcomes, in nonclinical populations there is rarely a reduction in depression following intervention (e.g. King, Barr Taylor, & Haskell, 1993; Morgan et al., 1970; Palmer, 1995), although other benefits such as improved self-esteem may be found (Palmer, 1995).



The lack of findings for mood change in ‘normal’ populations has been explained primarily in two ways in the literature. First, physical activity may only result in mood change when disturbed mood is initially present (Mutrie & Biddle, 1995; Palmer, 1995; Lennox et al., 1990). Morgan et al. (1970) found that when participants were divided into sub-groups according to depression status at baseline, those who were classified as depressed showed a significant reduction in depression at the end of the six-week programme while those classified as ‘non-depressed’ did not. Other studies have suggested that people with initially more negative moods may improve the most (e.g. Craft & Landers, 1998; Gauvin, Rejeski, & Norris, 1996; Reeds & Ones, 2006; Rejeski, Gauvin, Hobson, & Norris, 1995; Simons & Birkimer, 1988).

Second, some of the measures used to assess mood in this population may have been insensitive to mood changes (Mutrie & Biddle, 1995; Morgan et al., 1970). Measures of depression may be especially inappropriate, as there is little room for improvement in those who are not depressed. The measurement of mood in relation to physical activity has been a contentious area (see section 3.9.4., chapter 3). Some authors have argued that exercise-specific mood measures may be more sensitive than general mood measures. Measures advocated to be more sensitive to the mood properties of exercise have been developed (Gauvin & Rejeski, 1993; McAuley & Courneya, 1994; Rejeski, Reboussin, Dunn, King, & Sallis, 1999). However, such measures are not without problem (Ekkekakis, 2003; Ekkekakis & Petruzzello, 2004) (see section 3.9.4, chapter 3 for a discussion).

### *2.4.3 Clinical Populations*

Studies with clinical samples have resulted in much more consistent findings, with almost all studies reporting a reduction in depression after physical activity interventions (e.g. Babyak et al., 2000; Blumenthal et al., 1999; Blumenthal et al., 2007; Craft, 2005; Dimeo et al., 2001; Doyne et al., 1987; Dunn et al., 2005; Herman, et al., 2002; Knubben et al., 2007; Mather et al., 2002; Martinsen, Hoffart, & Solberg, 1989; Martisen, Medhus, & Sandvik, 1985; McNeil, LeBlanc, & Joyner, 1991; Singh et al., 2005). While a significant reduction in symptoms is an encouraging finding, one methodological criticism has been that operationalising outcome in terms of the number of people classified as no longer depressed would be a better measure as it is more clinically meaningful (Lawlor & Hopker, 2001). Response rates have been reported in some studies. Using criteria such as a cut-off point on the Beck Depression Inventory

(BDI) (Doynie et al., 1987) or participants no longer meeting criteria for a diagnosis of depression (Blumenthal et al., 1999), studies have found response rates of 60 – 80%. Other studies have followed standards used in other treatment trials by operationalising therapeutic response as a 50% reduction in depressive symptoms. Using this criterion (in addition to a cut-off point on the Hamilton Depression Rating Scale), Dimeo et al. (2001) found that among a sample of 12 patients with refractory depression, five experienced therapeutic response after 10 days of exercise. Other researchers have used less stringent criteria such as a 30% reduction in symptoms (Mather et al., 2002). Using this criterion, Mather et al. (2002) found that 55% of participants in the exercise group in comparison to 33% in a health education control group responded. These studies indicate that not only may physical activity reduce symptoms, but that it may (at least among volunteers) result in a clinically meaningful reduction in depression for some.

#### *2.4.4 Summary*

Intervention studies and meta-analyses show a consistent and strong relationship between increased physical activity and reduced depression. The evidence suggests that the beneficial mood effects may be more consistent and strongest among individuals with higher levels of mood disturbance. This suggests that physical activity may be less relevant when mood is already at an optimum level.

### *2.5 Age, Gender, and Special Populations*

Further supporting evidence for a causal association comes from the consistency of findings across different studies with different groups of people (O’Neal et al., 2000). Age and gender do not appear to moderate the effect of physical activity on depression (Craft & Perna, 2004; North et al., 1990). Most studies have been conducted with adults (Mutrie, 2000), but recent studies have begun to examine the effects among older adults (Babyak et al., 2000; Blumenthal et al., 1999; McNeil et al., 1991; Singh et al., 2005). These studies have found beneficial effects. Fewer studies have been conducted with children or adolescents, but findings indicate that physical activity may also be associated with reduced depression (Larun, Nordheim, Ekeland, Hagen, & Heian, 2007; Motl, Birnbaum, Kubik, & Dishman, 2004; Nabkasorn, et al., 2006) – although studies with those reaching a clinical diagnosis of depression are needed.

Few studies have examined the relationship between physical activity and postnatal depression (Daley, MacArthur, & Winter, 2007). Pregnant women are likely to reduce their level of activity during pregnancy, and changes in activity may be associated with changes in mood while women are pregnant (Poudevigne & O'Connor, 2006). Pram-walking interventions have been found to reduce depressive symptoms among postnatal women (Armstrong & Edwards, 2003, 2004). These results indicate the potential for physical activity as an intervention for postnatal depression, and evidence suggests that the effect may be partly attributable to the physical activity itself rather than the social context in which it takes place (Armstrong & Edwards, 2004). The consistency of the findings for an association in a variety of groups of people provides some support for a causal link, but more research with people with postnatal depression, older adults, and children and adolescents is needed before any conclusions may be made with confidence.

## *2.6 Clinical Efficacy and Effectiveness*

When establishing the effects of an intervention, a distinction needs to be made between clinical efficacy and clinical effectiveness. Efficacy refers to whether an intervention has been found to 'work' under ideal, highly controlled circumstances, usually with a select group of individuals, such as in a RCT. Clinical effectiveness refers to whether an intervention that has been found to be efficacious may 'work' in less ideal circumstances, such as in clinical practice. In these circumstances less control may be exerted, patients may be less likely to adhere, practitioners may be less likely to follow optimal intervention guidelines and a heterogeneous group of individuals may receive the intervention (Haynes, 1999).

### *2.6.1 Evidence for Efficacy*

Commentators have pointed out a number of methodological weaknesses with previous intervention studies, which may compromise inferences about clinical efficacy.

Problems included:

- Lack of studies with individuals who reach standard criteria (e.g. ICD-10) for a clinical diagnosis of depression (Dimeo, et al., 2001; Mutrie, 2000; Martinsen, 1995). Depression defined by preselected cut-off points on self-report measures may be more transitory (Mutrie, 2000).
- Lack of randomisation (Morgan, 1997).

- Inappropriate comparison groups which have not reflected equivalent conditions to the intervention group (Morgan, 1997).
- The need for placebo control, in accordance with efficacy studies of other treatments (Morgan, 1997).
- Lack of blinding of assessors to participants' conditions and the use of self-report measures (Lawlor & Hopker, 2001).
- Small sample sizes, meaning that many studies have been statistically underpowered (Morgan, 1997).

However, recent studies have made efforts to overcome some of these methodological weaknesses. A number of well-designed RCTs have been conducted, which have used randomisation (e.g. Blumenthal et al., 1999; Blumenthal et al., 2007; Dunn et al., 2005; Knubben et al., 2007), blinding of assessors (e.g. Blumenthal et al., 2007; Knubben et al., 2007; Mather et al., 2002; Singh et al., 2005), been adequately statistically powered (Blumenthal et al., 2007) and only included participants who reached a clinical diagnosis of depression (e.g. Blumenthal et al., 1999; Blumenthal et al., 2007; Dunn et al., 2005; Singh et al., 2005). Studies have begun to include appropriate comparison groups, such as social contact (Armstrong & Edwards, 2004; McNeil et al., 1991) and attention control groups (Mather et al., 2002). These studies have found that physical activity may offer benefits over and above the social aspect of group physical activity (Armstrong & Edwards, 2004; McNeil et al., 1991) or attention effects (Mather et al., 2002). Equivalent comparison groups have been used in studies, with efforts being made to keep, for instance, contact time and degree of contact between participants equivalent in groups (Knubben et al., 2007). In all of these better designed studies, positive effects for physical activity on depression have been found.

There may be difficulties in creating a placebo condition for physical activity, but studies have used low intensity stretching and flexibility protocols as placebo (e.g. Dunn et al., 2005; Knubben et al., 2007). In placebo controlled studies, reductions in depression and the proportion of patients showing a clinical response has been found to be superior in the physical activity conditions (e.g. Dunn et al., 2005; Knubben et al., 2007), providing further evidence for efficacy. Evidence for efficacy is particularly convincingly provided by a well-designed, placebo-controlled experimental study by Dunn et al. (2005) in which the effect of exercise was isolated by participants exercising alone in a room in a laboratory. The study found that exercise at an energy expenditure equivalent to the public health recommendations was superior to lower-

intensity exercise or placebo for reducing depression. This experimental study not only provides evidence for efficacy, but also found evidence to support a dose-response relationship (see further discussion of dose-response in section 2.11.4 below), providing further support for a causal association. There is also some evidence that physical activity may be marginally more effective than a placebo pill (Blumenthal et al., 2007). Such well-designed recent studies provide convincing evidence for the clinical efficacy of physical activity.

### *2.6.2 Evidence for Clinical Effectiveness*

One methodological criticism has been that most studies have been conducted with volunteers, many of whom are from the community rather than clinical samples (Lawlor & Hopker, 2001). These individuals may be highly motivated and therefore the effectiveness of physical activity may be overestimated, as in ‘real-life’ clinical situations many depressed patients may not be so willing to exercise. This makes it difficult to determine the clinical effectiveness of exercise (Lawlor & Hopker, 2001). Although studies have been conducted with participants who have met a clinical diagnosis of depression (e.g. Blumenthal et al., 1999; Dunn et al, 2005; Singh et al., 2005), these studies have been within the context of RCTs with volunteers who may not be typical of patients encountered in practice. The effectiveness of physical activity outside of a RCT setting, in clinical practice warrants further investigation. However, due to ethical considerations such as informed consent, it may be difficult to overcome the problem of avoiding a bias towards motivated volunteers.

Intention-to-treat analyses can help provide estimates of effects that may be more likely in practice. A previous criticism of studies is that few included intention-to-treat analyses (Lawlor & Hopker, 2001). The effectiveness of physical activity may have been overestimated as the results were limited to just those who completed the study (Lawlor & Hopker, 2001). However, many recent studies have taken this into consideration (e.g. Blumenthal et al., 1999; Dunn et al., 2005; Knubben et al., 2007) and have performed intention-to-treat analyses. Support for the beneficial effects of physical activity on depression has been found even when such conservative analyses are performed.

### *2.6.3 Summary*

Although most studies have been conducted with adults, there is evidence for consistency of association between increased physical activity and reduced depression across different populations. More research with other groups is needed before definitive conclusions may be made. Consistent positive findings from recent well-designed randomised controlled trials which address some of the previously highlighted methodological problems provide support for efficacy. However, at present it is not possible to establish clinical effectiveness and studies in real-life, clinical settings are needed.

## *2.7 Effects of Physical Activity in Comparison to Other Treatments*

Exercise interventions have been found to be as effective in treating depression as group or individual therapy, behavioural interventions (Craft & Landers, 1998), cognitive therapy (Fremont & Craighead, 1987; Lawlor & Hopker, 2001) and antidepressants (Blumenthal et al., 1999; Blumenthal et al., 2007; Brenes et al., 2007). There is some indication that patients taking medication may initially respond faster (Blumenthal et al., 1999) and that exercise may offer the additional benefit over medication of improved physical function (Brenes et al., 2007). Comparison of the effects of physical activity and medication warrants further investigation, especially as medication is the most commonly used treatment for depression. But these findings suggest that exercise may be a realistic alternative to more expensive and limited forms of treatment (Craft & Landers, 1998).

### *2.7.1 Physical Activity as an Adjunct or Augmentation Treatment*

When physical activity has been used as a concurrent treatment with medication (Blumenthal et al., 1999; Martinsen et al., 1989) or has been added to a programme of treatment (Van de Vliet et al., 2003b), no additional benefit for depression has been observed. Some studies have found, though, that some individuals who have not responded to antidepressant medication have experienced a reduction in depression once physical activity is introduced (Dimeo et al., 2001; Craft, 2005). Physical activity may therefore be a useful augmentation method in some patients when they have not responded to other treatments. Trivedi et al. (2006) are currently investigating this possibility with nonresponders to SSRIs.

### 2.7.2 Summary

Physical activity may be as effective as other treatments for depression, but does not appear to offer additive value. There may only be additive benefit when individuals have not responded to other treatments.

### 2.8 How Long do Effects Last?

Most studies have employed interventions that last between nine and 12 weeks (Craft & Landers, 1998). Within the timescale of interventions, beneficial effects for depression have been found (Craft & Landers, 1998), providing evidence for at least the short-term efficacy of physical activity. However, one methodological criticism has been that few studies have utilised long-term follow-up (Lawlor & Hopker, 2001). Reviews including studies that have used long-term follow up indicate that the effects of physical activity may last between two and 21 months following intervention (Dunn, Trivedi, & O'Neal, 2001; Mutrie, 2000). Lawlor and Hopker (2001) found that effect sizes were lower for studies with long-term follow-up than those without. Due to this finding and the lack of studies, Lawlor & Hopker (2001) suggested that it may only be concluded that physical activity is effective in the short-term.

Even when long-term follow-up has been used, findings have sometimes been difficult to interpret. For instance, Doyne et al. (1987) found that 80% of the participants in a resistance exercise condition and 29% in an aerobic exercise condition remained non-depressed at one year follow-up. There were not any comparison follow-up data with people not allocated to an exercise condition, so it is difficult to interpret these results or why one exercise condition had a better follow-up outcome than the other. A problem with interpreting findings relating to follow-up effects is that few studies have measured or reported participants' level of physical activity during follow-up (Mutrie, 2000). It is not clear whether any prospective or follow-up effects may be due to previous or current physical activity. There is some evidence that physical activity may need to be maintained for continual mood benefit. When regular exercisers stop exercising, within two weeks they can experience an increase in depression, anxiety and somatic symptoms (Berlin, Kop, & Deuster, 2006; Morris, Steinberg, Sykes, & Salmon, 1990). Once exercise is resumed again, these symptoms disappear (Morris et al., 1990). This suggests that recent physical activity may influence current mood more than previous activity, supporting the measurement of physical activity during follow-up. A study by Babyak et al. (2000) is among the few to do this. Babyak et al. (2000)

measured exercise behaviour in all the intervention groups (i.e. exercise, medication and combined) and found that, regardless of group allocation, participants who had exercised more during follow-up were less likely to be depressed. This suggests that follow-up effects may be partly attributable to and complicated by current physical activity (which, of course, may have been inspired by the intervention). Therefore, it may be concluded that physical activity is an efficacious intervention for depression at least in the short-term (i.e. during an increase in activity), but that it may need to be maintained for continual benefit. This possibility could be examined in future research.

### *2.8.1 Summary*

There is strong evidence to support the short-term efficacy of physical activity for reducing depression (i.e. during the period of intervention). There is some evidence to support longer-term effects, but further research is needed. Research is especially needed to establish whether physical activity may need to be maintained for continued benefit.

## *2.9 Summary*

Although further research is needed to provide firmer support for a causal association, it may be concluded that physical activity is an efficacious intervention for depression among people experiencing some degree of mood disturbance, at least in the short-term. It is therefore appropriate to begin to understand the potential mechanisms of change. As longer-term effects are yet to be established, mechanisms research should focus on factors responsible for change during the shorter-term intervention period. Next, the nature of change in depression and how depression may be related to different intervention characteristics is considered to help inform factors that may need to be considered when studying mechanisms of change.

## *2.10 Nature of Change in Depression and Physical Activity Characteristics*

### *2.10.1 Aerobic and Anaerobic*

Physical activity may be classed into three different types: a) flexibility, co-ordination and relaxation, b) aerobic, and c) strength and endurance training (anaerobic) (Martinsen, 1995). A variety of forms of physical activity have been used in interventions studies, but most have used aerobic physical activity (O'Neal et al., 2000). Although classed as a form of physical activity, flexibility, co-ordination and relaxation protocols have tended to be used as placebo controls (e.g. Dunn et al., 2005).



Evidence suggests that aerobic and anaerobic protocols may be equally effective in reducing depression (Craft & Landers, 1998; Doyne et al., 1987; Dunn et al., 2001; Lawlor & Hopker, 2001; Martinsen et al., 1989). There also appears to be no difference in outcome between different forms of physical activity, such as running or walking (Craft & Landers, 1998).

There have been occasional exceptions to these findings. For instance, Penninx et al. (2002) found that while participants in an aerobic exercise condition experienced a reduction in depression, participants in a resistance condition did not. Mutrie (1986) found that aerobic exercise resulted in a faster reduction in depression than resistance training, although there was no difference between groups by the end of the intervention. One possible explanation is that differences may have been due to unequal energy expenditure between groups, so the groups may not have been equivalent comparisons (Dunn et al., 2005). A related explanation is that there may have been different levels of adherence between groups. It has been found that how often people exercise is more important in determining depression outcomes than programme format (King et al., 1993). Indeed, in the Penninx et al. (2002) study, the participants in the resistance training group who were most compliant did experience positive mood effects.

It appears that type of programme may not be important, but level of adherence (and perhaps total energy expenditure) may be important determinants of depression outcomes. This suggests that, in terms of mechanisms research, it may not be important to distinguish between different forms of physical activity when designing studies.

### *2.10.2 Physical Activity Versus Exercise*

Most studies have focused on structured and / or supervised exercise rather than general physical activity. In fact, there has been little mention of the distinction between exercise and physical activity in the literature. There is little data available to determine whether physical activity and exercise may have an equal or superior effect to each other. There are only a couple of studies that may provide some insight. Lin (2003) found that while leisure-time physical activity was associated with depression scores, there was no relationship between occupational, household or total physical activity and depression. Similarly, in a general population study, Stephens (1988)

found that women showed less positive affect when household tasks were included in their total energy expenditure than when it was based on recreation activities only. Stephens (1988) suggests that this may indicate that it is the quality of the experience rather than the activity per se that is important. The distinction between physical activity and exercise warrants further investigation.

### *2.10.3 Environment*

Exercising in a laboratory has been found to have a greater effect on depression than exercising in a hospital setting (Craft & Landers, 1998). This finding may be due to the types of participants used in these studies (i.e. inpatients may not be as highly motivated as other volunteers) or due to the laboratory being a more controlled setting. Otherwise, no difference in depression or mood outcomes have tended to be found whether the physical activity is supervised, conducted in a fitness centre, in a group, at home, on one's own, in the laboratory or in a natural environment (Blumenthal et al., 2007; Craft & Landers, 1998; Kerr et al., 2006; King et al., 1993). To study mechanisms, it may not be important to distinguish between different environments and home-based physical activity may be acceptable, especially when resources cannot support more structured and supervised activities.

### *2.10.4 Dose-response Relationship*

The typical exercise prescription in studies has been 20-60 minutes of moderate intensity physical activity three times a week (Mutrie, 2000), but there has been great variation between studies. Dose has usually been operationalised in terms of three main elements: 1) duration of sessions (duration), 2) number of days per week (frequency), and 3) intensity (i.e. maximal oxygen uptake;  $VO_{2max}$ ) (Dunn et al., 2001). Dunn et al. (2001) have recently suggested that rather than examining the effects of duration, frequency and intensity as separate entities, it may be important to quantify and control dose as total energy expenditure (Dunn et al., 2001). Total energy expenditure takes into account intensity, frequency and duration (Dunn et al., 2001). As few studies have explicitly compared different doses, it is difficult to determine if there is an optimum dose for benefit for depression (Dunn, et al., 2001). Next, findings regarding dose are considered. Evidence indicates that while different intensities, durations and frequencies appear to have little differential impact on depression outcomes, total energy expenditure may be important.

*2.10.4.1 Frequency and duration.* The NICE (2004) guidelines for the management of depression recommend three 45 – 60 minute sessions of exercise per week. However, contrary to the guidelines, current evidence suggests that frequency and duration may not moderate depression outcomes (Craft & Landers, 1998). It may not be important therefore for mechanisms research to prescribe a particular dose of physical activity in terms of frequency and duration. Data regarding intensity is less clear.

*2.10.4.2 Intensity.* The meta-analysis by Craft and Landers (1998) did not find any differences in depression outcome for different intensity protocols (Craft & Landers, 1998). Most studies have focused on aerobic exercise. There has only been one study (to the author's knowledge) which has examined the effect of different intensities of resistance training on depression (Singh et al., 2005). Singh et al. (2005) found a greater response rate in the high intensity than in the lower intensity condition. However, research into general mood outcomes of physical activity indicates that high intensity training may have a negative effect on mood and that moderate intensity activity may have the most optimal effect (Arent, Landers, Matt, & Etnier, 2005; Bouchard et al., 2004; McAuley et al., 2000; Rejeski et al., 1995; Steptoe & Cox, 1988). The beneficial mood effect of high intensity physical activity may be limited to only those who are more trained (Mutrie & Biddle, 1995). So there may be factors, such as the individual's level of training, which modify the relationship. A meta-analysis by Reed & Ones (2006) challenges the notion that moderate intensity activity may be optimal, showing that low intensity activity results in the most consistent and generalisable mood benefits. Further research is needed to clarify whether or not there may be an optimal intensity of physical activity for mood benefit and the factors that may modify the relationship. Given that low intensity physical activity such as walking, even of a short duration, can result in mood improvement (Ekkekakis, Hall, VanLanduyt, & Petruzello, 2000), there may be no need for mechanisms research to focus on a particular intensity of activity.

*2.10.4.3 Total energy expenditure.* While there has been little evidence of a dose-response relationship when duration, frequency and intensity are considered separately, a recent well designed randomised controlled trial (RCT) by Dunn et al. (2005) suggests that total energy expenditure may influence depression outcomes. Of the participants with major depression who were assigned to exercise conditions in which total energy expenditure was consistent with public health guidelines, 47% experienced

a 50% reduction in symptoms in comparison to 30% in lower total energy expenditure dose conditions and 29% in an exercise placebo control condition. Within the public health and low dose conditions, participants were further subdivided into two conditions in which they either exercised three or five times per week (so frequency differed within each total energy expenditure condition). Frequency of exercise was found to have no influence on the depression outcomes in either the public health dose or low dose conditions. These findings suggest that total energy expenditure, rather than frequency, may be important. Future research could seek to replicate this finding and could examine other levels of total energy expenditure. The finding suggests that when designing physical activity and depression studies operationalisation of physical activity as total energy expenditure may need to be considered. This was considered in the cross-sectional study in this PhD (chapter 7), but not the first longitudinal study (chapter 5), as the Dunn et al. (2005) paper was published after the first study had been designed and conducted.

*2.10.4.4 Further comment.* Although studies have often prescribed a particular dose of physical activity, often in the form of structured, supervised exercise sessions, studies have not taken into account other physical activity that participants may have engaged in outside of the prescribed sessions. This may confound attempts to establish a dose-response relationship. Future research and mechanisms research may benefit from quantifying all physical activity participants take part in, not just prescribed levels.

#### *2.10.5 Length of intervention*

Length of intervention has varied between studies. Most of the studies included in the Craft and Landers (1998) meta-analysis used programmes that lasted from nine to twelve weeks. Craft and Landers (1998) found that while programmes of eight weeks or less and programmes of nine to twelve weeks were both effective, the programmes which were nine weeks or over resulted in the greatest reductions in depression. In terms of exploring mechanisms of change within a chronic physical activity setting, this finding would suggest that an eight week physical activity period may be sufficient – at least for studying potential mechanisms responsible for short-term changes.

When investigating mechanisms of change, it is useful to have some understanding of the timeline and nature of change in the outcome (Doss, 2004; Kazdin & Nock, 2003) (see section 4.3.3, chapter 4 for a discussion of the temporal precedence criterion for

inferring change mechanisms). There are currently few data to indicate when initial change in depression may take place during intervention. Daily exercise over a ten day period has been found to result in significant reductions in depression and even a clinical response in some patients (Dimeo, et al., 2001; Knubben et al., 2007). But few studies have employed this kind of daily training. Data from other studies would suggest that initial improvement in depression may be seen by the third or fourth weeks of intervention (Craft, 2005; Doyne et al., 1989; Mutrie, 2000; North et al., 1990). This offers some indication that initial change may occur early and that relatively short programmes may have some effect. To the author's knowledge, there have not been any studies which have measured depression any earlier than the third week.

*2.10.5.1 Accumulation of acute physical activity.* Single sessions of physical activity have been found to improve state mood in people with depression (Bartholomew, Morrison, & Ciccolo, 2005; Bodin & Martinsen, 2004) and improvement may last up to an hour afterwards (Bartholomew et al., 2005). There may be longer-lasting effects, as studies of acute activity with depressed samples have not measured mood beyond one hour post-activity. It has been suggested that the mental health benefits observed with chronic physical activity may be the result of accumulation of benefit from single sessions (Gauvin & Rejeski, 1993). However, it is not yet understood how acute mood changes relate to the changes observed with chronic physical activity (Mutrie & Biddle, 1995).

*2.10.5.2 Further research.* More research is needed to document the time course of change in depression, particularly to ascertain when initial change may occur and when any reductions in depression may level-off or be maintained. This would be particularly informative for developing an understanding of change mechanisms, and would help inform at which points potential mechanisms should be measured during intervention. To understand the potential mechanisms that may be responsible for at least initial change in depression, the data would imply that measurement during the first four weeks may be required.

### *2.10.6 Summary*

Physical activity periods of eight weeks duration may be sufficient for studying mechanisms and measurement of mechanisms could be made prior to expected initial change at about four weeks. Although the NICE (2004) guidelines recommend

structured and supervised exercise three times per week for 45 – 60 minutes per session, the evidence reviewed here suggests that contrary to the guidelines there is currently little evidence to support a particular prescription of physical activity dose, type and environment for depression outcomes. Therefore, dose, type and environment may not be important concerns when designing studies to explore mechanisms.

### *2.11 Conclusion*

Given the level of consistency between studies, and recent well-designed RCTs which overcome some of the methodological problems associated with this line of enquiry, it would appear that physical activity may be efficacious in reducing depression, at least in the short-term (Dunn et al., 2005; Lawlor & Hopker, 2001). However, it is not yet understood whether it may be *clinically* effective. Recent good quality experimental studies which isolate the effects of physical activity from other influencing factors (e.g. social contact) and demonstrate a dose-response relationship provide further evidence to support a causal link. The efficacy of physical activity indicates that it is appropriate now to turn attention to the mechanisms of change underlying at least the short-term antidepressant effect.

## Chapter 3

### Theoretical Framework: Potential Mechanisms

#### *3.1 Introduction - If Physical Activity Works, Why Does it Work?*

While there is evidence that physical activity may be an efficacious intervention for depression, less is known about *why* it works (Bouchard et al., 2004; Craft & Perna, 2004; Fox, 1999; Martinsen, 1995; Mutrie, 2002). A number of potential mediators have been proposed in the literature. These include factors derived from biochemical (release of endorphins, increased availability of serotonin), physiological (changes in fitness, improved sleep) and psychological explanations (sense of mastery or self-efficacy, social contact, distraction or time-out, exercise-induced feelings, self-esteem and physical self-perceptions). The role of these factors has mainly been subject to speculation – there is little empirical evidence currently available. Only a few recent studies have used depressed samples to explicitly explore the potential role of some of these mediators (e.g. Bodin & Martinsen, 2004; Craft, 2005). There is a need for further studies which bring our understanding of the potential mediators out of the realm of speculation and into the realm of empirical evidence.

This chapter reviews the evidence for the suggested potential mediators. The review focuses on how existing theories related to psychological outcomes of physical activity and to the aetiology of depression may advance our understanding of potential mediators. It is argued that psychosocial factors associated with the physical activity process may be linked to response rather than physiological adaptations (e.g. improvement in cardiovascular fitness).

#### *3.2 Identifying Potential Mechanisms*

##### *3.2.1 An Atheoretical Treatment*

The study and identification of mechanisms of change requires a theoretical approach (Kazdin, 2001). Potential mechanisms may be identified from existing theory about how a treatment ‘works’ (Kazdin, 2001). The difficulty with understanding how and why physical activity may alleviate depression is that, unlike other interventions for depression, it is not based on any theoretical rationale. For instance, cognitive-behavioural therapy (CBT) is based on theory that negative cognitions cause and maintain depression, and aims to restructure these cognitions (Watkins et al., 1993).

Although attempts to isolate these factors as mediators of change in CBT have not been fruitful (Hollon et al., 1987), there is at least a theoretical basis from which potential mechanisms may be identified and tested. Physical activity, however, is an intervention for depression without a theoretical rationale, which means that there is no explicit theory to draw on about how it works. Research in this area, however, needs to take a theoretical approach (Oweis & Spinks, 2001; Plante, 1993).

### *3.2.2 Applying a Theoretical Framework*

In the absence of a theory about how physical activity ‘works’, research may identify potential mechanisms from other relevant theories and sources. Mechanisms may also be identified from theories about symptomatology or how a condition is maintained (Kazdin & Nock, 2003). Latimer, Martin Ginis, Hicks and McCartney (2004) drew on the relationships described in the Chronic Pain Process Model to understand factors that mediated the effect of exercise on depression among individuals with spinal cord injury. Change in the level of pain experienced was found to mediate the effect of exercise on stress. Change in stress, in turn, mediated the effect of exercise on alleviating depression. Such an approach was successful in identifying potential pathways of action. In this PhD, a theoretical approach was taken in the exploration and identification of potential mediators, including the application of a theory (the tripartite model of anxiety and depression; Clark & Watson, 1991) which has not been previously suggested.

In this chapter, theoretical approaches from which potential mediators may be identified and which form the theoretical frameworks for the quantitative studies in this PhD are reviewed. These include social cognitive theory (Bandura, 1977, 1997), the exercise and self-esteem model (Sonstroem & Morgan, 1989) and the tripartite model of depression and anxiety (Clark & Watson, 1991). From these theories, it is suggested that change in self-esteem, physical self-concept, self-efficacy, and the independent mood dimensions of depression (PA and NA) warrant further investigation as potential mechanisms. While change in self-esteem, self-concept and self-efficacy have been previously suggested as potential mediators, change in PA and NA have not. As physical activity has been found to be more strongly associated with PA than NA (Watson, 1988), it is suggested that physical activity may particularly tackle the low PA, anhedonia-related symptom of depression. An increase in PA may be a stronger candidate mechanism than (just) a decrease in NA. This hypothesis has not been



previously proposed and represents one of the novel contributions of this thesis.

Potential mediators may also be identified from qualitative research with clinicians and patients / clients who have an experience of an intervention (Doss, 2004). The review of the literature identified that few qualitative studies have explored patient or client experiences of physical activity for depression. The studies that have been conducted have been descriptive rather than process-oriented (e.g. Faulkner & Biddle, 2004; Mental Health Foundation, 2005). Grounded theory methods are ideally suited to studying process and generating new hypotheses in areas where there has been little previous research (Charmaz, 2006). Therefore, there is a need for further qualitative work in this area, which takes a grounded theory approach, to explore the *process* of change and to generate further hypothesised mediators outside of established theories.

Before the theoretical frameworks used in this PhD are reviewed, evidence for other suggested biochemical, physiological and psychological mechanisms is reviewed. It should be noted that since this review was conducted and empirical work for this PhD started in 2004, commentators have suggested further theories (e.g. self-determination theory; Ryan & Deci, 2000) from which potential mechanisms may be identified (e.g. Faulkner & Carless, 2006; Stathopoulou, Powers, Berry, Smits, & Otto, 2006). For parsimony, these recently suggested potential mechanisms are not included in this review.

### *3.3 Biochemical Explanations*

#### *3.3.1 Monoamine Hypothesis*

The monoamine hypothesis of depression postulates that depression is caused by deficient activity of the neurotransmitters in the monoaminergic systems (e.g. dopamine, norepinephrine and serotonin). It has been suggested that physical activity may work in a similar way to pharmacological treatments for depression, by increasing the availability of these neurotransmitters (Dunn & Dishman, 1991). Studies that have taken peripheral measurements of monoamine metabolites after physical activity (i.e. from urine or plasma samples) have produced inconsistent findings, with some finding increases in metabolites while others have not (Dunn & Dishman, 1991). Interpretation of the evidence is complicated by uncertainty regarding the extent to which peripheral measures represent related changes at the brain level (Craft & Perna, 2004; de Coverley Veale, 1987). Studies with animals have found increased serotonin and norepinephrine

in some areas of the brain after physical activity (Craft & Perna, 2004). Studies of these systems in humans have not been possible due to the invasive nature of the methodologies. While animal studies may offer some insight, it is difficult to extrapolate findings to human functioning (O'Neal et al., 2000). It is also unclear whether increased monoamine activity actually is related to mood improvement (Fox, 1999; Oweis & Spinks, 2001). The monoamine hypothesis may be a plausible explanation, but it remains largely speculative.

### *3.3.2 Endorphin hypothesis*

It has been speculated that physical activity may prompt the release of endorphins which leads to mood improvement (Craft & Perna, 2004). Similar to the monoamine hypothesis, some studies have found evidence of increased peripheral levels of endorphins after physical activity (Hatfield, Goldfarb, Sforzo, & Flynn, 1987; Yeung, 1996), while others have not (e.g. Kraemer, Dziewaltowski, Blair, Rinehardt, & Castracane, 1990; McGowan et al., 1993). Even when increases in endorphins have been found, corresponding changes in mood have not (Hatfield et al., 1987). Conversely, improvement in mood has been found in the absence of an increase in endorphins (Kraemer et al., 1990).

There may be a few explanations for the lack of a correlation between increased endorphins and mood improvement. First, the mood of participants may have been within a normal range prior to physical activity, which means that there may have been little room for improvement (Hatfield et al., 1987). Studies with clinical samples may result in different findings – there is a need for studies with clinical samples (Stathopoulou et al., 2006). Second, endorphins may only be released at higher intensities of physical activity (e.g. 60% of  $VO_{2max}$ ) (Goldfarb & Jamurtas, 1997; Kraemer et al., 1993). Endorphins may therefore explain mood changes at higher-intensities, but not those observed with lower intensity protocols. Given that high-intensity physical activity may result in negative mood effects in some (McAuley et al., 2000; Rejeski et al., 1995; Steptoe & Cox, 1988), this explanation may not be plausible or the relationship may be modified by other factors. Finally, beta-endorphins may be a mechanism of change for some aspects of mood, but not others. For instance, Janal, Colt, Crawford Clark and Glusman (1984) found that the administration of the opiate receptor blocker naloxone weakened some mood responses following physical activity (i.e. feelings of joy and euphoria), but not others.

Current findings provide only limited evidence to support the endorphin hypothesis. Findings suggest that even if a link were found, other factors may also explain mood improvement from physical activity (i.e. following lower intensity protocols, or change in elements of mood not found to be linked to endorphins).

### *3.4 Physiological explanations*

#### *3.4.1 Cardiovascular fitness hypothesis*

Improvement in cardiovascular fitness has been proposed as a potential mechanism of change. This hypothesis evolved from early work suggesting that lowered physical fitness may form part of the aetiology of depression (Morgan, 1969a, 1969b, 1969c). Early research found that fitness improvement accompanied improvement in depression following exercise intervention with psychiatric inpatients and that those who evidenced the greatest improvements in fitness showed the greatest reduction in depression (Martinsen, Medhus, & Sandvik, 1985), providing support for the hypothesis.

Further research has suggested that the cardiovascular fitness hypothesis may be a less plausible explanation. Martinsen et al. (1989) discounted the hypothesis on the basis of a more extensive investigation using a larger number of participants. Participants in both an aerobic exercise condition and a nonaerobic condition showed similar reductions in depression, despite an increase in fitness only being observed in the aerobic group. The correlation between increased physical fitness and reduction in depression was also low and not statistically significant. Other investigations (e.g. Doyne et al., 1987) and meta-analyses (e.g. Craft & Landers, 1998) have found that aerobic and nonaerobic physical activity may be equally effective. These findings suggest that change in fitness levels may not be necessary for a response in depression. Notably, a lack of correlation with improved fitness has also been found among studies looking at other psychological outcomes from physical activity, such as improvement in mood, anxiety, perceived coping ability (Steptoe et al., 1989), perception of physical appearance (King, Barr Taylor, Haskell, & DeBusk, 1989), self-concept (Ossip-Klein et al., 1989) and symptoms of chronic fatigue syndrome (Moss-Morris, Sharon, Tobin, & Baldi, 2005). Improvement in depression and other psychological changes from physical activity may be relatively independent of changes in fitness. Even when correlations have been significant they have represented small effect sizes (e.g.

Blumenthal et al, 1999). This suggests that even if changes in fitness may play some role, additional mechanisms may also account for the effects.

One possibility is that changes in cardiovascular fitness may mediate longer-term changes in depression rather than initial improvement (Craft and Landers, 1998). Programmes of 15 - 20 weeks may be necessary to achieve cardiovascular fitness gains (Craft & Landers, 1998). Many physical activity and depression studies have been of a shorter duration and this may explain why change in fitness has not been observed (Craft & Landers, 1998). Although programmes of eight-weeks or less have been found to be effective, programmes of a longer duration have been found to be more effective (Craft & Landers, 1998). This may be because longer programmes may be more likely to improve fitness (Craft & Landers, 1998). Indeed, among the elderly, studies in which a cardiovascular fitness gain was reported resulted in better mood improvement than studies in which fitness gains were not observed (Arent et al., 2000). This is plausible, but as Fox (1999) points out, “increased fitness may not be a trigger for change although it may eventually accompany it” (p. 415).

Given the complexity of factors that may be associated depression (e.g. low self-esteem, low self-efficacy, lack of social support), the cardiovascular fitness hypothesis may potentially be an overly simplified explanation of why and how physical activity may alleviate depression. Certainly short term changes in depression do not appear to be dependent upon fitness gains, as studies of even a short duration have noted significant effects in the absence of fitness improvement. This suggests that other factors may mediate initial response in depression.

#### *3.4.2 Other Physiological Mechanisms*

Among other suggested physiological mechanisms are changes in core body temperature (the thermogenic hypothesis) and sleep improvement. Increases in temperature in the brainstem as the result of exercise have been proposed to be associated with reduced muscle tension and feelings of relaxation (Craft & Perna, 2004). Evidence regarding the hypothesis has been inconsistent (Fox, 1999). One study concluded that an increase in body temperature was not necessary for a reduction in anxiety (Petruzzello, Landers, & Salazar, 1993), and other studies have found that higher temperature levels during exercise may be related to more negative affect (Yeung, 1996). Improvement in sleep may be a more promising potential mechanism.

Physical activity has been found to improve sleep cycles (Driver & Taylor, 2000, as cited in Stathopoulou et al., 2006). Among a depressed sample, Singh et al. (2005) found improvement in sleep quality in the exercise condition and found that improvements in sleep were associated with reduced depression. This hypothesis warrants further exploration.

### *3.5 Summary*

The literature reviewed suggests that there is currently little evidence available to support most physiological and biochemical explanations, although improvement in sleep may be a promising hypothesis. The cardiovascular fitness hypothesis may especially present a weak explanation, at least of initial response in depression. Although biological and physiological mechanisms cannot be dismissed as potential explanations, the lack of current supporting evidence suggests that some of the effect may potentially be explained by psychosocial factors. Other commentators have suggested that research should focus on the cognitive and behavioural factors associated with the physical activity process itself and that these may ultimately be important in determining response (Doyle et al., 1987; Fox, 1999). This review now examines how a psychological, theoretically-based approach may potentially lead to a deeper understanding of how psychosocial factors grounded in the physical activity context itself may determine response. Before the theoretical frameworks used in this PhD are reviewed, other suggested psychological mechanisms are briefly reviewed.

### *3.6 Psychosocial mechanisms*

#### *3.6.1 Social contact and distraction*

The studies in this PhD explore the role of self-efficacy, self-esteem and change in PA and NA as potential mechanisms. However, other psychological mechanisms have been suggested including social contact and distraction. Although there has been some indication that social contact may partly explain the effect (McNeil et al., 1991), most studies indicate that social contact may not be primarily responsible for improvements in depression. When physical activity has been home-based or conducted in isolation, improvement in depression has still been found (Babyak et al., 2000; King, Barr Taylor, & Haskell, 1993; Dunn et al., 2005). Other studies suggest that physical activity offers greater benefit than social contact alone (e.g. Armstrong & Edwards, 2004). Distraction or time out from worries also presents a weaker psychological explanation. Craft (2005) found the increased coping self-efficacy was a stronger

candidate mediator than distraction. At the end of the exercise programme, there was no difference in distraction between participants in the exercise and control conditions and changes in distraction did not correlate with improvement in depression. As with all potential mediators, due to the current limited evidence base these explanations cannot be dismissed, but the findings suggest that other psychological factors may be stronger candidate mediators. Therefore, the initial work in this PhD focused on change in self-efficacy, self-esteem and the mood dimensions of depression as potential psychological mediators.

### *3.7 Social Cognitive Theory: Self-efficacy*

An increase in self-efficacy has been one of the most frequently proposed potential mediators. According to social cognitive theory (SCT), self-efficacy is defined as one's confidence in one's ability to perform particular behaviours to produce desired outcomes (Bandura, 1977). Self-efficacy does not relate to measurable, objective skills, but relates to an individual's own *belief* and *perception* about what they are capable of doing and the degree to which they can exert control over their situation. Self-efficacy beliefs can influence behaviour, thought processes, motivation and mood states, including depression (Bandura, 1997). Individuals with higher levels of self-efficacy tend to have better mental health than those low in self-efficacy (see section 3.7.2 below).

Physical activity presents a context in which depressed individuals may experience an increase in self-efficacy (i.e. via experiences of mastery). In addition to potentially being a direct mediator of improvement in depression, an increase in self-efficacy may also be an indirect mediator. Conceptually, it may partly mediate self-esteem improvement (Sonstroem, Harlow, & Josephs, 1994) and mood outcomes such as PA and NA from physical activity (Ekkekakis, 2003) which, in turn, may mediate improvement in depression. The ways in which physical activity may affect self-efficacy and how this may relate to depression is discussed further below. First, SCT is briefly outlined, then the relationship between self-efficacy and mental health is discussed, and, finally, the evidence supporting self-efficacy as a potential mediator is considered.

#### *3.7.1 Social Cognitive Theory*

Social cognitive theory characterises individuals as self-regulative and self-reflective

beings. People make evaluations of themselves based on what they believe they can do and this affects their thoughts, feelings, motivations and behaviours (Bandura, 1997). Self-efficacy beliefs are formed from a cognitive appraisal of four main sources of information: experiences of mastery from successful performance, vicarious experience, verbal persuasion, and physiological and affective states (Bandura, 1977, 1997). Mastery experiences have the strongest influence on perceptions of self-efficacy (Bandura, 1977, 1997).

According to SCT, individuals will have many specific self-efficacy beliefs relating to different domains of action, rather than just a general sense of self-efficacy. However, efficacy beliefs may generalise between different situations. Generalisations may occur when situations require similar skills, when self-regulatory skills learnt in one area may be applied to another, and through an increased sense of confidence in one's ability to learn new skills as the result of other skills being mastered. Generalisation may also occur through an increased sense of personal agency to effect control over one's life, rather than through skill development *per se* (Bandura, 1997).

### *3.7.2 Self-efficacy and Depression*

According to SCT, a lack of self-efficacy is a contributing factor to depression. It mediates cognitive, behavioural and environmental factors that lead to depression. Efficacious individuals have a strong sense of resilience and believe that they can exert some degree of control over challenging situations. Individuals with a low sense of self-efficacy lack this sense of control and believe that they cannot bring about positive outcomes in their lives, and, thus, are more vulnerable to stress and depression (Bandura, 1997). This low sense of self-efficacy affects how depressed people evaluate and think about themselves and can lead to negative ways of thinking and rumination. This contributes to the maintenance of depression. A reciprocal relationship between efficacy beliefs and mood is proposed. Feelings of inefficacy may result in depression, but despondency can lead to feelings of inefficacy while positive mood can enhance perceived self-efficacy (Bandura, 1997).

Other theories of depression share the perspective that depressed people lack perceived control over their lives. Hopelessness theory (Abramson, Metalsky, & Alloy, 1989) - the revised, more recent version of Miller and Seligman's (1975) original learned helplessness theory of depression - suggests that depressed individuals attribute

negative events to global, unchangeable internal and external factors. The resulting sense of helplessness can lead to depressed affect.

Empirical evidence supports a link between low self-efficacy and depression in adult, adolescent and older adult populations (Davis-Berman, 1990; Kanfer & Zeiss, 1983; Luszczynska, Gutierrez-Dona, & Schwarzer, 2005; Muris, 2002). General self-efficacy has been found to be negatively associated with depression and anxiety, and is positively associated with optimism, self-regulation and self-esteem in adults (Luszczynska et al., 2005). In terms of domain-specific self-efficacy, depressed individuals have been found to exhibit lower social, emotional, academic and physical self-efficacy than nondepressed individuals (Davis-Berman, 1990; Kanfer & Zeiss, 1983; Muris, 2002).

Depressed individuals often believe that they cannot actively control the symptoms of their depression (Bandura, 1997). Bandura (1997) proposes that self-efficacy is a key mechanism in the self-regulation of mood states such as depression. Self-efficacy can aid individuals in taking pathways of action that can help exert control over their environment, thought processes and emotional reactions.

The relationship between general and domain-specific self-efficacies and depression suggests that treatments which enhance areas of self-efficacy and help depressed individuals see to themselves as masterful and able to exert control over their situations and symptoms may alleviate depression.

### *3.7.3 Self-efficacy as a Mechanism*

Bandura (1977; 1997) suggests that regardless of theoretical background, an increase in self-efficacy is a mechanism of change common to many treatments for depression (and other conditions). Engagement in active or behavioural treatments provides opportunities for increases in self-efficacy, as individuals experience mastery and a sense of enablement from their own efforts. For instance, treatments that aim to change negative thought patterns involve individuals in active assignments where they learn skills to self-control thoughts. Response in depression to cognitive therapy has been found to be partly predicted by increased self-efficacy to control negative thought patterns (Kavanagh & Wilson, 1989). Treatments may target different areas of competency, but all seek to enhance a person's capabilities to take control of their



situation, thoughts and moods (Bandura, 1997).

From an SCT perspective, as other commentators have proposed, an increase in self-efficacy may mediate response in depression to physical activity. While self-efficacy has been proposed as a potential mediator, with the exception of Craft (2005), few commentators have considered *why* or in *what way* an increase in self-efficacy may mediate. There are a few possibilities. First, the physical activity context may offer scope for depressed individuals to encounter sources of self-efficacy and this may lead to change in perceptions of self-efficacy. For instance, individuals may experience mastery from learning a new skill, from engaging in a physical activity task or from successfully self-regulating physical activity behaviours. They may also experience positive physiological and affective sensations or outcomes which influence perceived abilities and feelings of self-efficacy. Feeling more efficacious may in itself reduce feelings of depression (Bandura, 1997). Second, experiences of self-efficacy relating to the physical activity context may potentially generalise to other areas and depressed individuals may experience an increased sense that they can exert control over their lives. Third, although physical activity is not explicitly aimed at giving depressed individuals a greater sense of control over their moods, perceived improvements in affective state (i.e. affective feedback) may give people a sense that they can do something about their symptoms and improve perceived ability to cope with symptoms. In this sense, physical activity may potentially be an empowering treatment for depression, as it may offer people a way that they can actively self-regulate symptoms. Improvements in depression will occur during a treatment alongside increases in perceived ability to control mood (Bandura, 1997). Fourth, Bandura (1997) states that skills for increasing pleasurable activity are important for terminating depressed moods. Physical activity could be considered to be a pleasurable activity, and thus a mood-relevant task. An increase in confidence to perform this task (i.e. self-efficacy for engaging in pleasurable activity) from experiences of mastery may mediate improvement in depression. Finally, an increase in self-efficacy may indirectly mediate change, as it may conceptually partly mediate improvement in other potential mediators (i.e. PA, NA and self-esteem) which, in turn, may mediate improvement in depression. For instance, an increase in physical self-efficacy within the physical activity context may partly determine whether positive mood changes are experienced (Bodin & Martinsen, 2004). Further, an increase in physical self-efficacy from the physical activity context may generalise to improvement in self-concept and global self-esteem

(Sonstroem et al., 2004). Next, the empirical evidence available to support self-efficacy as a potential mediator is considered.

#### *3.7.4 Physical Activity and Self-efficacy*

A number of studies have shown that physical activity may enhance feelings of self-efficacy among non-depressed samples, within the context of both chronic (Annesi, 2004; Li, McAuley, Harmer, Duncan, & Chaumeton, 2001; Rejeski et al., 2001) and acute (McAuley, Talbot and Martinez, 1999) physical activity. Changes in self-efficacy during chronic physical activity interventions have been shown to be related to mood improvement (Annesi, 2004), reductions in stress (Anderson, King, Stewart, Camacho, & Rejeski, 2005) and improvements in subjective wellbeing (Rejeski et al., 2001). While initial levels of self-efficacy may moderate mood responses to physical activity (Bozoian, Rejeski and McAuley, 1994; McAuley, Shaffer, & Rudolph, 1995), there is evidence to suggest that change in self-efficacy may be more important in determining mood responses (McAuley et al., 1999). These findings demonstrate that not only may physical activity increase self-efficacy, but also that such changes in self-efficacy may play a role in mood outcomes from both acute and chronic physical activity.

There have only been a few studies examining the relationship between self-efficacy, mood and physical activity among depressed individuals (Bodin & Martinsen, 2004; Brown, Welsh, Labbe, Vitulli, & Kulkarni, 1992; Craft, 2005; Singh et al., 2005; Tsang, Fung, Chan, Lee, & Chan, 2006). All but one (Brown et al., 1992) of these was published after an initial review of the literature and the first study for this PhD was designed. Similar to the research with nondepressed groups, these studies have looked at self-efficacy within the context of both acute (Bodin & Martinsen, 2004) and chronic physical activity (Brown et al., 1992; Craft, 2005; Singh et al., 2005; Tsang et al., 2006).

Brown et al. (1992) found that a group of adolescent psychiatric inpatients taking part in structured exercise sessions experienced an increase in self-efficacy 4.5 weeks into the programme. Depression also changed at 4.5 weeks, and prior to change in physical fitness. The findings provide some support for self-efficacy as a potential mechanism, and the temporal relation of change offers additional support that initial change in depression may be mediated by psychosocial factors such as self-efficacy rather than

physiological mechanisms. While the findings are encouraging, the final sample size in the study was small ( $n = 11$ ) and the authors did not carry out analyses in which changes in self-efficacy were correlated with or used to predict change in depression, so it is unclear whether change in self-efficacy was related to change in depression.

Other studies, including those that have performed correlational analyses, have resulted in more equivocal findings. Using a general measure of self-efficacy, Singh et al. (2005) found that while self-efficacy increased over the exercise intervention period among older adults, there was no difference in change between the exercise conditions and the GP usual care condition. Further, changes in self-efficacy did not predict depression response. Also using a general self-efficacy measure, Tsang et al. (2006) found among older adults that those in a physical activity group showed higher levels of self-efficacy than those in a non-physical activity comparison group mid-way during a 16-week intervention, and at follow-up at four and eight weeks after the programme. However, the authors did not use correlational analyses to examine how change correlated with or predicted change in depression. These equivocal findings may be the result of the scales used to measure self-efficacy. Bandura (1997) emphasises that the measurement of self-efficacy should be specific to the domain of interest and that measures of general self-efficacy should be avoided. The identification of the form of efficacy to measure requires a clear theory of the factors involved in the particular domain. The employment of general self-efficacy measures is therefore inappropriate and reflects a lack of consideration, as stated above, about *in what way* an increase in self-efficacy may play a role as a mediator. From the consideration presented above about the *way* in which self-efficacy may potentially mediate, it would appear that physical/exercise self-efficacy and depression coping self-efficacy or self-efficacy to self-regulate mood and thoughts might be appropriate forms of self-efficacy to measure in this domain. A. Bandura (personal communication, November 27, 2006) has confirmed this. Two recent studies have given greater consideration to the measurement of self-efficacy and have measured exercise task-specific self-efficacy (Bodin & Martinsen, 2004) and depression coping self-efficacy (Craft, 2005).

In a study of clinically depressed women engaged in a nine-week exercise programme, Craft (2005) explored the role of depression coping self-efficacy as a potential mechanism. The women in the exercise group showed an increase in coping self-efficacy at three weeks along with improvement in depression with no further change

by the end of the intervention, whereas the women in the no-exercise control group showed no improvement in depression and decreases in coping self-efficacy across time. Using partial correlation analyses, controlling for baseline values of depression and coping self-efficacy, it was found that coping self-efficacy and depression were highly negatively correlated at week three and week nine. These results suggest that exercise may enhance perceived ability to cope with one's depression.

Bodin and Martinsen (2004) examined the influence of exercise task-specific self-efficacy on state PA, NA and anxiety among clinically depressed participants within a single session of exercise. Participants were assigned to either a martial arts class or a stationary bike exercise. The martial arts class was anticipated to be an initially low self-efficacy task in comparison to the stationary bike exercise and that the martial arts condition would result in an increase in self-efficacy, whereas self-efficacy in the stationary bike exercise would remain stable. Self-efficacy did increase in the martial arts condition but not in the stationary bike condition. The martial arts condition also resulted in increased PA and reduced state anxiety, whereas the stationary bike exercise produced no changes in mood. There was not an effect for NA. The findings of the study provide support that mood outcomes of physical activity, such as an increase in PA, may be partly dependent upon whether an increase in self-efficacy for the exercise task is experienced.

These recent studies employing domain specific measures of self-efficacy provide support for the role of self-efficacy as a potential mediator of change. The findings support two *ways* in which self-efficacy may potentially mediate: 1) through an increase in confidence to cope with symptoms, and 2) through mood responses being partly determined by whether or not a change in self-efficacy for the physical activity task is experienced. However, while the considered use of specific measures of self-efficacy represents a methodological improvement, Craft (2005) used a measure of depression coping self-efficacy that was designed specifically to measure self-efficacy for completing homework tasks in cognitive behavioural therapy (the Depression Coping Self-Efficacy Scale; Perraud, 2000) and it may not have been an appropriate measure to use in this area. Other measures of coping self-efficacy or negative mood regulation self-efficacy might be considered in future research.

### 3.7.5 Summary

Change in self-efficacy is a theoretically plausible potential mechanism and there is some empirical data to support its role. More studies are needed which examine changes in self-efficacy and depression over time among depressed individuals engaged in physical activity. Studies are particularly needed which examine areas of self-efficacy relevant to this domain (i.e. physical activity related self-efficacy or depression coping or mood self-regulation self-efficacy), which will help build a picture of *in what way* an increase in self-efficacy may potentially mediate. Also, self-efficacy may be either a direct and / or indirect mediator of change and further research is needed to establish by which of these pathways self-efficacy may mediate.

The following sections of this chapter detail two further ways in which physical activity may alleviate depression: through changes in self-esteem/self-concept and through change in the mood dimensions of depression. Conceptually, self-efficacy may play a contributing underlying role in each of these processes.

### 3.8 Exercise and Self-Esteem Model: Self-esteem and Physical Self-concept

Self-esteem refers to an individual's attitude towards themselves in terms of evaluations of their own worth and whether they view themselves in a positive or negative way (Rosenberg, 1965). Positive self-esteem is strongly related to good mental health (Fox, 2000). Depressed individuals often have a poor self-concept and experience feelings of low self-esteem (American Psychiatric Association, 1994; Beck, Brown, Steer, Kuyken, & Grisham, 2001). Indeed, low self-esteem and feelings of worthlessness form part of the etiology of and diagnostic criteria for depression (American Psychiatric Association, 1994) and may be a causal factor in the development of depression (Beck et al., 2001; Wilson & Krane, 1980). It has been suggested that physical activity may alleviate depression through self-esteem improvement and the development of more positive perceptions of the self.

#### 3.8.1 Physical Activity and Self-esteem

Research has shown that physical activity participation is positively associated with self-esteem and that physical activity interventions may result in improved self-esteem (Fox, 2000; Spence, McGannon, & Poon, 2005). The strongest effects have been found for specific elements of the physical self, such as body image, rather than for global self-esteem. Findings relating to global self-esteem have been mixed and one review

found only a small effect size for change (Spence, et al., 2005). One explanation for these findings is that global self-esteem in healthy individuals may be a fairly stable trait and unlikely to change due to ceiling effects (Fox, 2000). Therefore, measures of specific aspects of the physical self may be more appropriate for use in these groups, as change be more likely (Fox, 2000). It is also possible that physical activity may have more of an impact of self-esteem and self-concept when it is initially lower, such as among people experiencing depression.

There have been fewer studies of the effects of physical activity on self-esteem among individuals suffering from mental health conditions, but those that have been conducted have been more consistent in showing positive results (Fox, 2000). Intervention studies have found positive changes in self-concept (Ossip-Klein et al., 1989; Tsang et al., 2006) and improvements in self-esteem (Blumenthal et al., 1999) alongside improvement in depression among clinically depressed individuals. Therefore, change in self-esteem might mediate change in depression, but more research – and especially research that takes a theoretical approach – is needed with depressed samples engaged in physical activity.

Research has largely focused on examining whether physical activity may increase self-esteem in various groups. In these studies, little consideration has been given to self-concept theory and little attempt has been made to understand mechanisms of change (Sonstroem, 1997). Employing a theoretical approach may not only enhance validity, but may also elaborate change processes. Based on contemporary theorising about the structure of self-esteem, Sonstroem and Morgan (1989) proposed a theoretical model of self-esteem change in the context of physical activity. The model provides a theoretical framework that could potentially be applied to understanding pathways of change that may explain the physical activity-depression link. The model may potentially explain how depressed individuals' direct experiences of the physical activity context (e.g. increased self-efficacy) may influence higher-order changes in self-concept and self-esteem and, consequently, depression (Biddle & Mutrie, 1991; Van de Vliet et al., 2002a),

### *3.8.2 Exercise and Self-Esteem Model (EXSEM)*

Contemporary theory about the structure of the self proposes that self-esteem is multidimensional and hierarchically organised, rather than being unidimensional.

Global self-esteem represents the highest, most general level of the hierarchy. It is subsumed and influenced by second level self-concepts relating to particular domains, including academic, social and physical self-concepts. These self-concepts are formed from evaluation of the self in more specific sub-areas relating to the domain (e.g. physical self-concept will be based on self-evaluation in subareas such as physical appearance and physical ability). Evaluations of the sub-areas are in turn influenced by more specific self-evaluations of behaviour experienced directly in the relevant environment (i.e. self-efficacy perceptions). This represents the most specific level of the hierarchy and is the most amenable to change. Global self-esteem is a more general self-evaluation and thus is more stable. Self-esteem change comes about through change in self-evaluations at the lower levels of the hierarchy generalising to the upper levels (Fox, 1990; Sonstroem & Morgan, 1989).

Based on this theory, Sonstroem and Morgan (1989) proposed a model to explain self-esteem change from physical activity (the EXSEM). The model was proposed as a working model open to development. Subsequently, the model was expanded to incorporate Fox and Corbin's (1989) Physical Self-Perception Profile (PSPP). The PSPP was developed in response to a lack of appropriate instruments available to measure aspects of the physical self and is also based on the multidimensional, hierarchical theoretical structure of self-esteem. The profile measures five factors; physical self-worth (PSW), sports competence, physical condition, body attractiveness and physical strength (Fox, 1990). The expanded model is used in the present PhD research. Behaviours and experiences in the exercise context are proposed to influence perceptions of physical self-efficacy. Change in self-efficacy can lead to higher level change in four subdomain perceptions of the physical self, which may then generalise to improvement in an overall sense of physical self-worth. Change in physical self-worth may then generalise to global self-esteem change at the top of the hierarchy (Sonstroem et al., 1994)

The model emphasises the importance of competency development (rather than change in physiological parameters such as cardiovascular fitness) in self-esteem change and it draws on SCT by placing physical self-efficacy expectations at the base of the model. The model is based on the assumption that perceptions of competence (i.e. self-efficacy) develop from interaction with the exercise context, and that change in perceptions of competence may generalise and result in improved self-esteem. Change

in self-efficacy, therefore, is more amenable to change and should theoretically precede change in the other constructs.

It is important to note that the domain level self-perception physical self-worth is not the summed result of the four underlying subdomains, but that it is a generalised result. The multidimensional, hierarchical theory does not characterise self-esteem as the sum of perceptions of the self in different domains, but as an increasing level of generality resulting from more specific perceptions. This takes into account the complex nature of self-esteem, the relationships between more specific self-perceptions and the weighting of importance that is given to them (Fox, 1990). The degree of importance an individual places on each area of self-evaluation will influence the strength of association between the lower and the higher elements of the model (Sonstroem and Morgan, 1989).

The structure of the model has been validated, including the role of physical self-worth as a mediator between the subdomains and global self-esteem (Sonstroem et al., 1994; Van de Vliet et al., 2002b). Among a group of female aerobic dancers the model accounted for a 32.8% of the variance in self-esteem (Sonstroem et al., 1994), which, as the authors point out, is quite notable given that the physical self is only one domain among a number that contribute to self-esteem. It is possible that the finding may have been due to such participants placing high importance on the physical self in their overall sense of self-worth. However, other studies have also found high correlations between physical self-worth and global self-esteem (Fox, 2000), suggesting that the physical self may be important in overall feelings of self-worth. As Fox (2000) points out, “elements of physical self are particularly significant as the body functions as the *public interface* of the self with the social world” (p. 94). Physical activity interventions and experiences that result in improved physical self-esteem may therefore have strong implications for improving overall self-esteem.

Despite its theoretical coherence, the EXSEM has been employed in very few studies (Carless & Fox, 2003; McAuley, Mihalko, & Bane, 1997). The model aims to account for change over time (Sonstroem & Morgan, 1989), yet little research has examined the model longitudinally (McAuley et al., 1997). While the model may be tested cross-sectionally, the best test of the model is one that looks at the relationships over time within the context of physical activity (Sonstroem & Morgan, 1989).



The structure of the model has generally been supported in the few longitudinal studies that have examined the model in healthy individuals involved in physical activity interventions (McAuley et al., 1997; McAuley, Elvsky, Motl, Konopack, Hu, & Marquez, 2005), including aerobic and anaerobic physical activity (McAuley et al., 2000). Studies have suggested that revision to the relationships proposed at the lower level of the model may be necessary. Findings suggest that self-efficacy may not be influenced by physical measures such as changes in fitness, change in body fat and frequency of physical activity participation, as was originally proposed in the model. Instead, these factors may operate in parallel with self-efficacy in directly mediating responses at the subdomain level (McAuley et al., 2000; McAuley et al., 2005). This suggests that other factors within the physical activity context may influence evaluations of self-efficacy and that physical measures may have additional direct effects on the subdomain level. The inclusion of measures of global self-esteem has also been questioned, as little change has been found at this level in comparison to physical self-concept (McAuley et al., 1997). However, tests of the model in other populations where baseline values of self-esteem may be lower (i.e. the depressed) may find larger effects for global self-esteem, so it may be premature to dismiss the use of global measures.

The application of the model to understanding the potential mediating pathways of the physical activity-depression link is supported by available data. The physical self has been shown to be related to a number of indicators of mental health, including life adjustment, PA, NA and depression (Sonstroem & Potts, 1996). Additionally, psychiatric inpatients hold more negative perceptions of the physical self than do adults from the general population (Van de Vliet et al., 2002a). It has been suggested that the physical self may be an important area of intervention in depression (Van de Vliet et al., 2003a). Whether associations between the physical self and mental health are direct or mediated through self-esteem as the EXSEM model would imply has been subject to debate (Sonstroem & Potts, 1996; Van de Vliet et al., 2002b). Sonstroem & Potts (1996) found that physical self-perceptions significantly predicted some mental health factors independent of the influence of global self-esteem. However, Van de Vliet et al. (2002b) found that although physical self-perceptions explained a significant amount of variance in depression, when global self-esteem was added to the model, direct pathways were no longer significant (except for body attractiveness in

women), suggesting that self-esteem may be a necessary mediator. The relations may be moderated by gender. Ryan (2008) found a direct effect of physical self-esteem on depression among females, but not males. However, among males, the relationship between physical self-esteem and depression was mediated through global self-esteem. Further research is needed to determine whether global self-esteem is a necessary mediator of mental health relationships, or whether the physical self may have a direct effect. For the moment, studies employing the EXSEM should evaluate all aspects of the model.

These studies indicate the relevance of the EXSEM for understanding the exercise-depression link. However, all of these studies were cross-sectional and, as stated earlier, a more comprehensive test of the model will look at associations longitudinally, within the context of physical activity. To the author's knowledge, only three longitudinal studies have been conducted that have tested elements of the model in relation to depression outcomes and / or with mental health samples. Two were conducted with psychiatric inpatients (Knapen et al., 2003; Van de Vliet et al., 2003a) and one was conducted with non-depressed, healthy older adults (Motl et al., 2005).

Motl et al. (2005) found that change in physical self-esteem mediated change in depression from a physical activity intervention, providing some supporting evidence for physical self-concept as a potential mediator. However, participants were not screened for depression symptoms before being entered into the study, so findings may be different in a sample with elevated depression scores. Motl et al. (2005) also only measured physical self-esteem and not any other element of the EXSEM model, which means that the study offers little insight into the longitudinal relations proposed in the model. Van de Vliet et al. (2003a) looked at changes over time in depression, anxiety, physical self-perceptions and global self-esteem among female, depressed psychiatric patients engaged in a multi-faceted treatment programme including psychomotor therapy. At the end of the three-month intervention, depression, anxiety, global self-esteem, physical self-worth and the subdomain of bodily attractiveness all showed significant change in a positive direction. None of the other subdomains showed significant change. Correlational analyses showed that changes in physical self-worth were significantly associated with changes in global self-esteem, depression and anxiety in the expected direction, providing some longitudinal support for self-esteem and physical self-worth as potential mediators. A similar study by Knapen et al. (2003)

in which psychiatric patients engaged in psychomotor therapy also found improvements in physical self-concepts at the end of the intervention. However, the association of physical self-concept change with response in depression cannot be determined as depression was not measured and the patients were suffering from a mixture of psychiatric disorders.

These studies indicate that factors from the EXSEM do show significant change longitudinally over the course of interventions involving physical activity, supporting the potential value of the EXSEM for understanding mediating pathways within the context of depression. However, the research has been limited. Van de Vliet et al. (2003a) examined changes on the measures within the context of a multi-faceted treatment rather than a pure physical activity intervention and no control group was employed. It is difficult to determine whether the changes were a function of the physical activity element or another element of the treatment or resulted from natural improvement over time. Studies are needed that examine change over time in elements of the model within the context of a physical activity with participants not receiving any other form of treatment. Studies with depressed individuals outside of a psychiatric inpatient setting are also needed – especially studies with individuals screened for a pre-determined level of depression prior to study entry. The EXSEM model as a whole, including physical self-efficacy, has not been tested longitudinally in a mental health sample. This means that there is currently little evidence to offer insight into the relative changes between each element of the model, and depression, over time or the theoretical associations proposed. This includes a lack of work assessing the temporal relation of change.

### *3.8.3 Summary*

There are some data to support change in self-esteem and self-concept as potential mediators. The EXSEM provides an appropriate theoretical framework to guide research examining mediators in this area, especially as the model elucidates how direct experiences of the physical activity context may lead to higher order change. In accordance with the model and findings that perceptions of the physical self are associated with depression, studies might measure self-concept as physical self-concept in this context. This may also be important as there may be a direct rather than indirect mediation relationship between physical self-worth and depression, and more specific measures may be more sensitive to change than global self-esteem. There is a need for

further studies which examine the model as a whole, including change in self-efficacy, longitudinally with depressed populations engaged in physical activity and who are not receiving any other form of treatment.

### *3.9 Tripartite Model of Anxiety and Depression: Mood Dimensions of Depression*

The same potential mediators of the physical-activity depression link tend to be speculatively repeated in the literature (e.g. self-esteem, endorphins, self-efficacy). With the exception of Stathopoulou et al. (2006) and Faulkner and Carless (2006), there have been few attempts to consider other theoretical frameworks that may help identify new, previously unconsidered hypothesised mechanisms. Drawing on the tripartite model of anxiety and depression (Clark & Watson, 1991), this thesis presents a novel explanation. It is proposed that physical activity may also potentially alleviate depression through the impact that it has on the independent mood dimensions of depression, PA and NA. Physical activity may particularly alleviate depression through an increase in PA. That is, physical activity may help tackle the symptoms of loss of pleasure and energy, and help move depressed individuals away from feelings of anhedonia. From a positive psychology perspective (Seligman & Csikszentmihalyi, 2000), the distinction between the PA and NA elements of depression may be an important one. Psychology has historically focused on understanding the factors that contribute to mental *illness* rather than *good mental health* (Seligman & Csikszentmihalyi, 2000). It may be important in the treatment of depression to focus on more than just the removal of negative affect – it may also be important for treatments to increase positive affect. Physical activity may potentially ‘work’ through both these mechanisms, and, theoretically, an increase in PA may be a more dominant mediator of change than a decrease in NA. Next, the tripartite model of depression and anxiety, the theoretical justification for these new proposed potential mediators and supporting empirical evidence is presented.

#### *3.9.1 Theories of Mood*

Mood may be conceptualised and measured either as a categorical or dimensional entity, and various measures of mood reflect one or other of these approaches (Ekkekakis, 2003). Dimensional models encapsulate a greater amount of the variance of affective space and capture what has been termed *basic affect*, while categorical models measure more specific emotions and, thus, a more limited part of affective space (Ekkekakis & Petruzello, 2002). Dimensional models commonly characterise

affect in terms of two dimensions: perceived activation (i.e. high arousal-low arousal) and affective valence (i.e. pleasant-unpleasant) (Ekkekakis & Petruzzello, 2002).

Various specific affective states are located within these rotated and unrotated dimensions, essentially falling around the edges of a conceptual circle formed by the dimensions – this is known as the Circumplex Model of Affect (Ekkekakis & Petruzzello, 2002; Russell, Weiss, & Mendelsohn, 1989). A number of dimensional theories have been proposed to account for the structure of mood (e.g. Russell et al., 1989; Thayer, 1978; Watson & Tellegen, 1985). Although different terminology may be used, these theories are compatible with, rather than compete with, each other, and reflect dimensions of the Circumplex Model (Ekkekakis & Petruzzello, 2002).

Differences between models depend upon whether the dimensions are considered to be bipolar (unrotated factors) or orthogonal (rotated factors) (Ekkekakis & Petruzzello, 2002; Tellegen, Watson, & Clark, 1999). Bipolar models, for instance, characterise *happiness* and *sadness* as opposite emotions on the pleasant-unpleasant (valence) dimension, and *active* and *quiet* as opposite emotions on the high arousal-low arousal (activation) dimension. From this point of view, positive and negative affect correlate (Green, Goldman, & Salovey, 1993). When the dimensions are rotated 45 degrees, the resulting two dimensions each include states of both activation and valence: “one dimension extends from high-activation pleasant to low-activation unpleasant affect and the other extends from high-activation unpleasant to low activation pleasant affect” (Ekkekakis & Petruzzello, 2002, p.39). The dimensional structure of mood proposed by Watson and Tellegen (1985) is based on this orthogonal model and forms the theoretical basis of the tripartite model of depression and anxiety.

### 3.9.2 Dimensional Theories

Watson and Tellegen (1985) propose that mood consists of two independent dimensions known as positive affect (PA) and negative affect (NA). High PA is a pleasurable state of energy, activation and engagement, whereas low PA reflects a lethargic and sad state. High NA represents feelings of distress and tension, whereas low NA is a peaceful and calm state (Watson, Clark, & Tellegen, 1988). PA and NA are proposed to be relatively independent dimensions; so, for instance, a high level of NA does not correspond to a low level of PA. Theoretically, it is possible to experience a high level of NA and a high level of PA at the same time. However, the independence assumption has often been challenged (Green et al., 1993), as there have been frequent findings of a correlation between the two scales (e.g. Crawford & Henry,

2004). The relationship between the two may in fact be time dependent. Greater independence is found when the scales are measured in accordance with how people have felt generally over long timescales (i.e. weeks, a year) than when measured in accordance with how people have felt over shorter periods (i.e. at the moment, over days) (Diener & Emmons, 1984).

The proposed independence of PA and NA is an important theoretical proposition, though, as each has distinct correlates and may be influenced by different factors (Watson, 1988). NA is more influenced by daily life events than PA. PA tends to follow a diurnal pattern, whereas NA does not (Clark & Watson, 1989). Perceived stress is related to NA but not to PA, while social activity and physical activity are related to PA but not to NA (Watson, 1988). It is this latter finding which forms a fundamental part of the novel hypothesis presented in this thesis - that physical activity may partly mediate improved depression through an increase in PA.

### *3.9.3 Tripartite model*

Not only may PA and NA have distinct daily correlates, but these independent mood dimensions have been shown to be related to the differential diagnosis of depression and anxiety (Watson & Tellegen, 1985) and may help discriminate the two conditions (Watson et al., 1988a). NA correlates with both depression and anxiety, while PA only correlates with depression. These findings led Clark and Watson (1991) to propose the tripartite model of anxiety and depression, which proposes that depression and anxiety share a common high distress factor (high NA). However, anhedonia (low PA) is specific to depression, while physiological hyperarousal is specific to anxiety.

The three factors proposed in the tripartite model have been confirmed in student, adult, patient populations (Gençöz, 2002; Joiner, 1996; Watson et al., 1995), and children (Kiernan, Laurent, Joiner, Catanzaro, & MacLachlan, 2001), providing support for the model. Some tests of the model also suggested that low PA may be a more dominant symptom of depression than high NA (Gençöz, 2002). This suggests, as Gençöz (2002) states, that in the treatment of depression “the primary focus should be on increasing PA rather than on decreasing NA” (p.998). If low PA forms a more dominant aspect of depression, then treatments or activities (i.e. physical activity) that may be associated with increased PA may be particularly important.

In this PhD, it is proposed that the tripartite model may represent a useful, new theoretical framework to apply to understanding potential mediators of the physical activity-depression link. This has not been previously suggested, although the model has been applied to understanding mechanisms of change of different antidepressants (e.g. Dichter, Tomarken, Fried, Addington, Shelton, 2005; Tomarken, Dichter, Fried, Addington, & Shelton, 2004). Based on the model and empirical evidence relating to mood change from physical activity, it is proposed that both increased PA and reduced NA may mediate the alleviation of depression. Although Watson (1988) suggests that physical activity may not be related to NA, studies have found that physical activity may both reduce NA and increase PA (Arent et al., 2000; Reed & Ones, 2006; Yeung, 1996). There is some evidence to suggest, however, that an increase in PA may be a stronger candidate mechanism of change than a decrease in NA. Larger effect sizes have been found for change in PA than in NA from physical activity (Gauvin et al., 1996). Gauvin, Rejeski and Reboussin (2000) found that physical activity explained variation in PA when diurnal patterns were taken into account, but that while participants showed more NA on the days that they did little or no physical activity, the relationship was not significant when the influence of daily life events was controlled, suggesting that physical activity is more strongly associated with PA than NA when other factors are taken into account. Therefore, it is proposed that physical activity may 'work' by the effect that it has on these independent affective dimensions of depression (i.e. by relieving distress and tension, and by increasing feelings of energy, engagement and pleasant activation), but that an increase in PA (i.e. movement away from anhedonia) may be a stronger candidate mechanism than a decrease in NA.

The distinction between the PA and NA symptoms of depression may be important for a number of other reasons. First, an increase in PA may be a benefit that is offered by physical activity, but not by other activities or treatments. Bartholomew et al. (2005), for instance, found that while both a single session of exercise and a period of quiet rest decreased negative mood states in patients with major depressive disorder, it was only the exercise session that resulted in improvements in positive mood states. Different antidepressants have also been found to be differentially associated with PA and NA. For instance, serotonergic antidepressants may be more related to NA than PA, suggesting that while they may decrease NA, they may not increase PA (Nutt et al., 2006). Second, some findings suggest that change in self-efficacy from exercise may be related to change in PA but not NA in both healthy (Bartholomew & Miller, 2002)

and depressed individuals (Bodin & Martinsen, 2004). This suggests that distinction between these two elements of depression may offer insight into the potential indirect mediational role of self-efficacy in the physical activity-depression link (i.e. change in self-efficacy may indirectly mediate change in depression through increased PA but not decreased NA). Third, Nutt et al. (2006) point out that PA is a neglected concept in depression research and, as stated above, from a positive psychology perspective (Seligman & Csikszentmihalyi, 2000) mental health is about more than just the removal of negative affect. As Arent et al. (2000) state, “although it may seem to be a semantic issue, exercise might be more appealing to the elderly if they were told it could make them ‘feel good’ rather than simply ‘less poorly’”.

#### *3.9.4 Mood measurement*

A focus on negative affect has also been a problem that has plagued mood measurement in exercise psychology (Arent et al., 2000; Yeung, 1996). This may be due to the most commonly used scales, such as the Profile of Mood States (POMS) and the State-Trait Anxiety Inventory, having a negative bias. The use of such scales has been especially criticised as PA may be more strongly associated with physical activity than NA (Gauvin et al., 1996; Gauvin et al., 2000, Watson, 1988) and recent conceptualisations of mood place equal emphasis on both PA and NA (Gauvin & Brawley, 1993). Yet research into physical activity and affect has largely been atheoretical (Gauvin & Brawley, 1993). Research needs to employ measures that reflect an appropriate theoretical basis (Gauvin & Brawley, 1993; Ekkekakis, 2003). Ekkekakis (2003) advocates a dimensional rather than categorical approach. Based on the use of the tripartite model as a theoretical framework, this was the approach primarily taken in the present research. The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988b) was used to measure PA and NA, as this measure is conceptually related to the tripartite model.

The tripartite model provides a clear theoretical rationale for why a dimensional approach to measurement should be used when looking at affect as mediators in the present research. However, the best way to theoretically conceptualise and measure mood in relation to physical activity is currently an area of contention (Gauvin & Rejeski, 2001; Ekkekakis & Pretruzzello, 2004). Gauvin and Rejeski (1993) have suggested that the use of global measures such as the PANAS may not be appropriate, as they are not specific to what people tend to feel during and after physical activity. In



response to this, Gauvin and Rejeski (1993) developed the Exercise-Induced Feeling Inventory (EFI) to measure mood in relation to acute physical activity. The measure was developed from a 'conceptual' point of view that physical activity can stimulate specific feeling states – although, a critical review of the development of the scale suggests that a conceptual or theoretical basis was lacking (Ekkekakis & Petruzzello, 2004). The scale measures four feeling states associated with physical activity: feelings of revitalisation, tranquillity, positive engagement, and physical exhaustion. These states are suggested to reflect the phenomenology of mood in relation to physical activity. Gauvin and Rejeski (1993, 2001) argue that the EFI may be more sensitive to mood change in relation to physical activity than the PANAS – although they do not provide any empirical evidence to support this claim. Further, Gauvin and Rejeski (1993, 2001) claim that the feeling states measured by the EFI in relation to acute physical activity “represent important outcomes in their own right that may mediate or moderate other psychological benefits previously linked to physical activity (e.g., a reduction in depressed affect)” (Gauvin & Rejeski, 2001, pp. 74 - 75). In particular, they propose that feelings of positive engagement and revitalisation may account for changes in depression, and that feelings of tranquillity may be related to changes in anxiety (Gauvin & Rejeski, 1993). Again, empirical support is not provided to support these conjectures. Also, unlike the proposal of the tripartite model which clearly specifies how PA and NA (as measured by the PANAS) are related to depression, a theoretical basis is not used to support the mediational relationships proposed by Gauvin and Rejeski (1993, 2001).

The EFI represents a categorical measure of affect and Ekkekakis and Petruzzello (2002) provides a convincing rationale that a dimensional approach may be more appropriate. Ekkekakis and Petruzzello (2002) point out that there are no theoretical reasons at this time to suppose that physical activity results in particular mood effects that justify the limiting of measurement to a few affective states. Dimensional measures may be more appropriate as they measure a wider range of affective space and thus may be more likely to capture change from physical activity. Dimensional models also take into account negative aspects of mood which are not measured by the EFI. Even if physical activity may be more strongly associated with PA, experiences of physical activity may not be uniformly positive. However, Ekkekakis (2003) suggests that categorical measures are not incompatible with dimensional conceptualisations: categorical measures may be useful for identifying particular

cognitive antecedents of change at a more specific level that account for change at the dimensional level. Indeed, Tellegen et al. (1999) suggest a hierarchical conceptualisation of mood whereby categorical states represent the most specific level of affect and underlie dimensional states, which in turn subsume global, bipolar affect (i.e. happiness vs. sadness). From a hierarchical perspective, specific feeling states experienced in relation to physical activity, as measured by the EFI, may mediate change in higher level affective states such as PA and NA, and / or depression. At present it is not understood how the mood effects of acute physical activity may relate to longer-term changes such as improvement in depression (Mutrie & Biddle, 1995), and the EFI may provide a framework for investigating this. If particular feeling states from acute physical activity mediate change in depression this may be useful for understanding the process of change, as there has been much research in exercise psychology looking at factors within the physical activity context that may moderate acute mood outcomes of physical activity. For instance, utilising the EFI, Rejeski et al. (1995) found that while there were no differences in feelings of revitalisation and positive-engagement experienced post-exercise in relation to 10, 25 and 40 minute exercise conditions, tranquillity only showed a significant increase in the 25 minute condition. This suggests that specific feeling states from physical activity may be differentially influenced by duration. Other potential moderators include in-task feeling states (Rejeski et al., 1995), self-efficacy (Bozoian et al., 1994), preferred exercise mode (Daley & Maynard, 2003; Parfitt & Gledhill, 2004), cognitions during physical activity (Blanchard, Rodgers, & Gauvin, 2004) and environment (Gauvin et al., 1996). Although the development of the EFI and conjectured mediational role of the feeling states lacked a conceptual basis, from a hierarchical mood perspective (Tellegen et al., 1999) the EFI may be useful for investigating how mood experiences grounded within the physical activity context may mediate response in higher level mental health constructs such as depression. Therefore, it may be useful to employ both the PANAS and the 'physical activity specific' EFI to measure affective mediators of the physical activity-depression link.

### 3.9.5 Summary

The application of the tripartite model of anxiety and depression represents a new theoretical framework from which potential mediators may be identified and studied. Based on the model and literature relating to the mood effects of physical activity, it is proposed that change in the *independent* mood dimensions of depression, PA and NA,

may partly mediate depression outcomes. As physical activity may be more strongly associated with PA than NA, it is further proposed that improvement in depression may particularly be mediated by an increase in PA – physical activity may particularly ‘work’ by moving people away from feelings of anhedonia. Based on the model, a dimensional approach to mood measurement employing the PANAS is the most suitable. Measurement of mood employing the EFI may also be useful, as this may offer a framework for establishing how acute mood outcomes may mediate chronic changes in depression and it may also be more sensitive to the mood effects of physical activity than the PANAS. However, the proposed application of the EFI to this area (Gauvin & Rejeski, 1993) is not as conceptually well-grounded as the proposal of the tripartite model.

### *3.10 Conclusions and directions for research*

The present review suggests that psychosocial factors associated with the process of physical activity rather than biochemical or physiological factors may mediate change in depression, at least in the initial stages of increased physical activity. However, few studies have directly examined any of the potential psychosocial mediators either individually or concurrently among depressed people engaged in physical activity. Therefore, further research is needed in this area.

Research needs to take a theoretical approach and the development of the field may benefit from researchers identifying new, appropriate theories from which potential mediators may be identified. Social cognitive theory, the EXSEM and the model of exercise-induced feelings have all been previously proposed as useful frameworks from which potential psychosocial mediators may be identified and tested. The proposal of the tripartite model of anxiety and depression (and especially the potential role of increased PA) has not been previously suggested and represents a unique contribution of this thesis.

Based on the identified theories and supporting literature, self-efficacy, self-esteem, physical self-concept, PA, NA and exercise-induced feelings warrant further investigation as potential mediators. In terms of addressing gaps in the current literature, longitudinal research is needed in which the potential mediating role of these factors is directly tested among depressed individuals involved in physical activity. In particular, studies which concurrently examine a number of potential mediators are

needed – only Craft (2005) has looked at more than one potential mediator in the same design. This may be beneficial as the different theories may be tested and insight may be gained into whether some potential mediators may be stronger candidates than others (Kazdin & Nock, 2003). Also, little consideration has been given to temporal precedence in the design of the longitudinal studies that have been conducted. There is a need for longitudinal studies which measure the potential mediators at multiple time points prior to expected change in depression so that insight may be gained into potential causal relations.

Potential mechanisms may also be identified from qualitative studies of individuals' experiences of an intervention (Doss, 2004) and this may be especially useful for identifying other potential mediators outside of established theory. There have been few qualitative studies of depressed individuals' experiences of physical activity and those that have been conducted have been descriptive rather than process-oriented. Process-oriented, qualitative research is needed to explore and elucidate the process of change and identify further potential mediators.

## Chapter 4

### Methodology

This chapter discusses and explains the methodological approaches used in the empirical studies in this PhD. The methodological issues involved in identifying mechanisms of change in process research will be discussed. As there has been only limited discussion in the physical activity and mental health literature about identifying and testing mechanisms of change (e.g. Jamieson & Flood, 1993), the methodological approach in this PhD was partly informed by the literature on psychotherapy process research. In this PhD, both quantitative and qualitative research methods were used, and this chapter explains why it was appropriate to use a mixed methods approach.

#### *4.1 Overview of Studies*

In chapter 3, a number of potential mediators of the physical activity-depression link were identified from theory for empirical examination in this thesis (self-efficacy, self-esteem, physical self-concept, PA, NA and exercise-induced feelings). A need for longitudinal studies which explore potential mediators within a multiple mediation design that takes into account temporal precedence was identified. A need for process-oriented qualitative research to elucidate the process of change and identify potential mediators outside of established theory was also identified. Based on the review, two initial studies for this PhD were designed to address these gaps:

1. a pilot, quantitative longitudinal study exploring change over time in all the potential mediators and depression among a group of individuals with elevated depression scores who increased their physical activity over an eight week period. The main aim was to explore the temporal relation of change. Additional aims were to assess the feasibility of longitudinal research and inform the design of a later, controlled longitudinal study.
2. a qualitative grounded theory study which aimed to elucidate the process of change and identify additional hypothesised mechanisms for testing in further quantitative research.

The findings of these two studies informed the design of a final, quantitative study which built on the previous findings. The study was originally designed to be a controlled, longitudinal study which aimed to explore the temporal precedence issue further. However, due to practical difficulties when the study was conducted (see

below), the study had to be abandoned and a cross-sectional, questionnaire study was conducted instead.

#### *4.2 Delineating mechanisms*

As discussed in chapter 3, in process research, potential mechanisms may be identified from a number of sources, including existing theory and qualitative research (Doss, 2004; Judd & Kenny, 1981; Kazdin, 2001; Kazdin & Nock, 2003). Once potential mechanisms have been identified for empirical examination, determination of an actual mechanism will come from multiple sources of evidence rather than just one study (Kazdin & Nock, 2003). Kazdin and Nock (2003) present a number of criteria that strengthen the case for a mechanism of change:

1. The potential mechanism shows a strong association with both the intervention and the outcome.
2. The potential mechanism is consistently found to account for change while other plausible mechanisms are discounted.
3. Evidence of a dose-response relationship between the mechanism and the outcome (although this will not necessarily be linear).
4. Evidence of a temporal relation in which change in the mechanism is shown to precede change in the outcome.
5. Consistency – replication of findings in other populations and under different circumstances.
6. Plausibility - the proposed mediator should be theoretically plausible.
7. Evidence of causality obtained by the direct manipulation of the potential mediator in an experiment.

Different studies will address different elements of the above criteria and the accumulation of evidence strengthens the case for a particular mechanism (Kazdin & Nock, 2003). As there has been little research into the mechanisms involved in the physical activity-depression relationship, this thesis represents an early starting point in identifying potential mechanisms. The aim of the studies in this thesis was to contribute some evidence in relation to some of these criteria and begin to identify potential mechanisms that may be subject to further examination in future research. The quantitative studies in the present thesis were designed to address the following criteria: the strength of association between the potential mechanisms, physical activity

and depression; whether some of the potential mechanisms were stronger candidate mediators than others; and the temporal relation of change.

### *4.3 Quantitative Methodology*

This section discusses the methodology used in the quantitative studies, including methodological issues relating to the study of mechanisms of change. The distinction between mediators and moderators; appropriate study designs for inferring causality (temporal precedence); the testing of more than one mechanism within the same study; the selection of measures; and statistical analyses of mediation, are discussed.

#### *4.3.1 Defining Mediators and Moderators*

When looking at processes of change, it is important to distinguish between *moderators* and *mediators* (Kazdin, 2001). This distinction is often overlooked and the two terms are frequently confused (Baron & Kenny, 1986). A moderator is a variable that influences the strength of the association between two or more other variables, while a mediator is a process variable through which an independent variable affects a dependent variable (Baron & Kenny, 1986; Kazdin, 2001). In process research, the identification of moderators answers the questions of for whom and under which circumstances an intervention is most effective (Kazdin, 2001). The identification of mediators, however, is concerned with explaining how and why a treatment works (Judd & Kenny, 1981; Kazdin, 2001). The present thesis is concerned with identifying mediators, rather than moderators. The distinction is important as it has implications for research methodology, particularly statistical analysis (Baron & Kenny, 1986).

#### *4.3.2 Statistical Tests of Mediation*

Statistical tests of mediation were employed in the analysis of data from the cross-sectional study (chapter 7). There are a number of different methods for analysing mediation, including structural equation modelling (SEM), but the seminal Baron and Kenny (1986) approach is outlined here to introduce the basic premises behind testing and establishing mediation.

Baron & Kenny (1986) outline a series of steps for statistically testing mediation using multiple regression procedures. Although variables should ideally be measured in a way that allows causal inference (Judd & Kenny, 1981; Kazdin & Nock, 2003), these statistical analyses may be applied to non-experimental / observational data if there is a

sound theoretical rationale behind the proposed mediation effects (Shrout & Bolger, 2002). However, any inferences about causality will be limited, as significant effects will reflect only *statistical association* (Shrout & Bolger, 2002). Statistical tests cannot provide evidence about causality, only appropriate methodological designs can (see further discussion below). The pathways that need to be statistically tested to establish mediation according to the Baron and Kenny (1986) approach are illustrated in Figure 1.

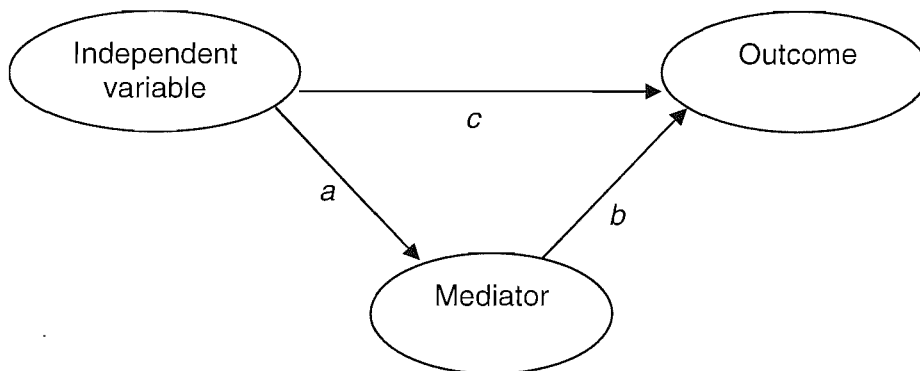


Figure 1. A basic mediation model.

To carry out a mediational analysis, there must first be evidence of a relationship between the independent variable (IV) and the dependent variable (DV) (path  $c$ ). Following this, a variable is considered to be a mediator if these conditions are met:

1. The IV is significantly related to the mediator (path  $a$ ).
2. The mediator is significantly related to the DV (path  $b$ ).
3. When paths  $a$  and  $b$  are controlled, there is no longer a significant relationship between the IV and the DV (path  $c'$ ).

Full mediation occurs when the effect of the IV on the DV is zero when the mediator is included in the model. However, in social science full mediation rarely occurs, so a reduction in path  $c$  shows partial mediation and that other factors may also account for the relationship (Baron & Kenny, 1986).

#### 4.3.3 Temporal Precedence

While correlational, observational data may offer some insight into the role of a variable as a potential mediator, stronger evidence may be obtained from longitudinal studies that demonstrate temporal precedence. Establishing the timeline of change is crucial in mechanisms research (Kazdin & Nock, 2003). To infer causality, change in the potential mechanism(s) should be shown to temporally precede change in the



outcome (Doss, 2004; Judd & Kenny, 1981; Kazdin & Nock, 2003). This means that potential mechanism(s) should be measured at least once mid-point during intervention, and, ideally, the outcome should also be measured at the same time point (Kazdin & Nock, 2003). Yet this criterion has often not been considered in the design of psychotherapy process research, with pre- to post-intervention measurement points often just being used (Doss, 2004; Feeley, DeRubeis, & Gelfand, 1999; Kazdin & Nock, 2003). Although pre- to post-change may offer insight into whether or not a potential mechanism shows concurrent change with the outcome (thus providing some support for its potential role as a mediator), such designs offer little insight into causality (Doss, 2004; Kazdin & Nock, 2003). Improvement in the outcome may have caused improvement in the purported mediator.

The timing of mid-point measurements should be based on an understanding of the timeline of change in the outcome (Doss, 2004). Specifically, to understand mediators of initial change in an outcome, measurements should be taken prior to expected initial change (Doss, 2004; Kazdin & Nock, 2003). Yet even when mid-point measures have been taken in psychotherapy process research, little consideration has been given to the timing of measurement to capture change before expected change in the outcome (Doss, 2004; Ilardi & Craighead, 1994; Wilson, 1999). In terms of the evidence relating to the potential mechanisms that may explain the physical activity-depression link that are of interest in this thesis, the few studies available have only shown concurrent change in depression and the potential mechanisms (Van de Vliet et al., 2003a) – even when mid-point measures have been taken (Brown et al., 1992; Craft, 2005). Apart from Brown et al. (1992) who aimed to examine the temporal relation of change in physical fitness and depression, there have not been any studies which have explicitly considered the temporal precedence criterion or explored the temporal relation of change. The review in chapter 2 highlighted that programmes of eight weeks may be effective and that, in terms of the timeline of change, initial change in depression may occur as early as four weeks into intervention (Doyno et al., 1989; Mutrie, 2000; North et al., 1990). Previous studies have not attempted to measure the potential mediators prior to this time point. Therefore, in the present research a pilot longitudinal study was designed in which the temporal relation of change in depression and all the potential mediators was explored over an eight week physical activity period among ‘sedentary’, depressed individuals. Based on the methodological consideration presented here, interim measurement of the potential mechanisms and the depression

were taken at the end of week one and the end of week three prior to expected initial change in depression at week four.

While the temporal precedence criterion may be important, it should be noted that not all mechanisms of change involved in therapeutic outcomes will be apparent before change in the outcome. There may be a difference between the mechanisms responsible for initial response and those responsible for longer-term effects, such as relapse prevention (Wilson, 1999). Mediators that may explain the short-term efficacy of physical activity (i.e. that may account for the effects observed with eight week programmes) were of initial interest in the present research.

#### *4.3.4 Multiple mediators*

Mechanisms research may benefit from the measurement of more than one hypothesised mechanism within the same study (Kazdin, 2001). This allows for comparison of effect sizes and assessment of whether some factors may be stronger candidate mediators than others (Kazdin & Nock, 2003). This means that the application of different (competing) theories of change may also be assessed (Kazdin, 2001). The application of only one theory assumes that only one set of mediators may account for all change, whereas numerous mechanisms may be at work (Kazdin, 2001). Based on this methodological consideration, in the present PhD research a multiple mediation approach was taken in the two quantitative studies, allowing assessment at this exploratory stage of which factors may be stronger candidate mediators than others. Few previous studies have assessed more than one potential mediator or theory. Taking this approach in this PhD also represents a novel contribution as the application of the tripartite model of anxiety and depression (Clark & Watson, 1991) could be compared to the other, previously suggested, theoretical frameworks.

#### *4.3.5 Selecting Measures*

It is important to give careful consideration to the selection of measures of purported mechanisms (Doss, 2004). First, valid and reliable measures which adequately reflect the theoretical basis of the construct of interest should be used. Second, the measures should be sensitive to change during the intervention. Finally, the measures of the mechanisms and the outcome should be measures of separate constructs to avoid confounding (Doss, 2004). These issues were taken into consideration when selecting the measures in the quantitative studies in this thesis.

#### *4.3.6 Quantitative Studies*

*4.3.6.1 Pilot longitudinal study.* Based on the theoretical frameworks identified in chapter 3 and the methodological considerations discussed above, a pilot longitudinal study was designed. In the study, individuals with elevated depression scores were encouraged to increase their physical activity. This study examined all the potential mechanisms identified from the theoretical frameworks in chapter 3, rather than just focusing on one theory and used early mid-point measures to explore temporal precedence (see sections 4.3.3 and 4.3.4).

Exploration of the temporal relation of change demanded a repeated-measures, longitudinal design with depressed individuals who had low baseline levels of physical activity. An observational approach was taken in which participants (screened against inclusion criteria) were encouraged to increase their physical activity in their own time. Given the resources available for this PhD, this naturalistic, observational approach was considered to be the most practical and feasible method of collecting data in the absence of resources for a formal intervention. Although less controlled than an experimental approach employing a prescriptive intervention (i.e. an RCT), an observational approach can offer a useful starting point for evaluating potential mechanisms when there has been little previous research (Jamieson & Flood, 1993). Observational methods also offer advantage over experimental approaches in which a potential mediator is manipulated, as a number of potential mediators may be studied simultaneously (Jamieson & Flood, 1993), which is also beneficial when research is in its infancy. Observational methods may help identify potential mediators that can be subject to experimental manipulation in future research (Jamieson & Flood, 1993). The disadvantage of observational methods is that cause and effect can be difficult to determine as not all confounding factors may be controlled (Jamieson & Flood, 1993). Observational methods do, however, offer a greater degree of ecological validity than experiments (Jamieson & Flood, 1993).

In the pilot study, a control group was not used. One of the original purposes of the study was to inform the design of a later, controlled longitudinal study and assess the feasibility of conducting longitudinal research for this PhD (e.g. whether participants would increase their physical activity in the absence of a formal intervention). For

these reasons, when the study was designed, it was not considered necessary to include a control arm.

*4.3.6.2 Controlled longitudinal study.* As the pilot work found that most of the change in depression occurred by the end of week 3 (see chapter 5), a further, controlled longitudinal study employing only a three week physical activity period was planned as the final study for the PhD. The study aimed to build on the pilot work by intensively exploring the temporal relation of change within a controlled design. Depressed participants recruited from the community were randomised to either an ‘increased exercise’ condition or a ‘usual exercise’ control condition. To explore the temporal relation of change further, weekly measures of the outcome and the mechanisms were planned (including two baseline assessment periods), plus daily assessments in the second baseline week and the first week. However, this study proved to be unfeasible and had to be abandoned. Recruitment efforts over a six week period resulted in only eight potential participants being screened, of whom only two met the inclusion criteria and were entered into the study. Of these, only one participant returned completed data.

*4.3.6.3 Cross-sectional study.* Due to these practical difficulties, a cross-sectional questionnaire study was employed instead. The aim of this study was to examine the strength of association between the proposed mechanisms, physical activity and depression among a larger sample of individuals currently experiencing symptoms of depression. The use of a larger sample meant that statistical tests of mediation could be employed. Although a cross-sectional design cannot offer any insight into cause and effect, it is one way of addressing the strength of association criterion and establishing whether some potential mediators may be more plausible than others.

#### *4.4 Mixing Quantitative and Qualitative methods*

Quantitative and qualitative methods are sometimes viewed to be distinct paradigms of research as the two methods are seen to be based on different ontological and epistemological stances (Hammersley, 1996). Ontology refers to assumptions about the nature of reality and epistemology refers to different perspectives regarding the nature of knowledge about reality. Quantitative methods tend to be deductive (Krantz, 1995) and tend to be based on a positivist epistemology, with the underlying ontological assumption is that a ‘true’, objective reality may be accessed (Sale,

Lohfeld, & Brazil, 2002). Qualitative methods tend to be based on an interpretivist or constructivist epistemology, which is based on the ontological perspective that a number of different realities may exist and ‘reality’ depends on the perspectives and interactions of individuals (Sale et al., 2002). Qualitative methods tend to be inductive (Krantz, 1995). An alternative view is that the methods are complementary and may be combined (Hammersley, 1996).

Hammersley (1996) regards the viewpoint that quantitative and qualitative methodologies have distinct philosophical bases as erroneous, as different techniques within both paradigms reflect both inductive and deductive approaches. Hammersley advocates a shedding of philosophical perspective and that choice of methodology should be based on the research question to be answered. A less dismissive stance about the philosophical assumptions underlying each method is taken by other authors who also advocate the combination of quantitative and qualitative methods (e.g. Foss & Ellefsen, 2002; Sale et al., 2002). From this point of view, the different understandings of the nature of knowledge behind each method is acknowledged and considered advantageous as it allows for a deeper understanding of different elements of a phenomenon (Foss & Ellefsen, 2002; Sale et al., 2002). As Foss and Ellefsen (2002) state, “within a complex and differentiated reality we need different and various types of knowledge” (p. 244). This may be considered an epistemological stance in its own right. It is one that acknowledges that reality is complex and that we need various ways to study it. This is the stance that I take in this thesis.

There are a number of ways in which quantitative and qualitative methods may be used in mixed designs:

1. As a means of triangulation with the aim of confirmation (Foss & Ellefsen, 2002; Hammersley, 1996) or completeness (Foss & Ellefsen, 2002).
2. The use of qualitative methods to generate hypotheses for testing in future quantitative research (Foss & Ellefsen, 2002; Hammersley, 1996) or the identification of questionnaire items (Hammersley, 1996).
3. Qualitative methods may be used to further explore findings or issues which have emerged from quantitative work (Foss & Ellefsen, 2002; Hammersley, 1996).

4. For complementary purposes – for instance, experiments can result in generalisable findings and insight into causal processes, while qualitative methods can provide in-depth insights into how those processes may work in the natural context (Hammersley, 1996).

In the present PhD research, a mixed methods approach was used for the purposes of completeness, hypothesis generation and complementarity. Next, attention will be turned to the advantages of combining quantitative and qualitative approaches in process and mechanisms research.

#### *4.4.1 Advantages*

Exclusive use of quantitative methods may constrain research progress, as they tend to be limited to the testing of hypotheses based on pre-existing theories. An advantage of qualitative methods is that they may generate new theories and hypotheses (Foss & Ellefsen, 2002). As only a limited number of theories have so far been identified to guide research into the mechanisms of change of the physical-activity link (see chapter 3), inductive qualitative methods such as grounded theory may be useful for generating new theory and identifying factors outside of identified theoretical frameworks which may explain the process of change. This may lead to the generation of hypotheses for testing in future research and may also offer complementary understanding of quantitative findings.

Quantitative approaches to studying change processes also force participants to present their experience within a restricted, pre-determined format. There may be many other aspects of the change process which are important and may not be accessed by quantitative methodology (Gallegos, 2005; Klein & Elliott, 2006). Quantitative methods may not elaborate more subtle, individual experiences that may affect outcome nor identify the *meaning* of change for an individual's life (Faulkner & Biddle, 2004; Levitt, Butler, Hill, 2006). Qualitative methods enable access to meanings and the lived experience of a phenomenon, whereas quantitative findings present a more decontextualised, disembodied understanding (Massé, 2000). Clinical trials cannot elucidate the individual experience of physical activity (Faulkner & Biddle, 2004) nor all the factors that may be encountered within the physical activity context itself or participants' greater lives that may impact on whether benefit is experienced, whereas qualitative methods enable a focus on the story of the individual

which is embodied and contextualised. Findings from quantitative studies also tend to be based on motivated volunteers (Biddle, Fox, Boutcher, & Faulkner, 2000), whereas an understanding of the process of change may benefit from accessing more negative experiences of physical activity. Qualitative methods are a way of accessing and exploring these experiences. Dynamic and variable experiences of an intervention over time may also be more accessible through qualitative methods (Klein & Elliott, 2006). Qualitative findings may complement quantitative findings by contributing to a fuller, richer, contextualised understanding of the process of change.

#### 4.5 *Qualitative Methodology*

##### 4.5.1 *Grounded Theory*

4.5.1.1 *Overview and historical context.* The qualitative approach used in the second study of this PhD was grounded theory (Glaser & Strauss, 1967). The aim is to inductively develop theory or a set of categories relating to the phenomenon of interest that is grounded within the context of participants' lives (Charmaz, 1995). Grounded theory methodology was chosen as it is centred around understanding *processes* and thus was considered an appropriate method for exploring the process of change.

Grounded theory developed from its originators', Glaser and Strauss' (1967), qualitative investigation of dying in hospitals. In reaction to the predominantly deductive sociology of the time, it was conceived as a way of generating data-driven theory from the in-depth analysis of a substantive area (Glaser & Strauss, 1967). Following its original conception, Glaser and Strauss eventually disagreed on the nature of the approach (Walker & Myrick, 2006). Glaser took a positivistic approach which was concerned with understanding the *realities* of the social structures which people are subject to. Strauss took a symbolic interactionist approach that humans are active agents and that reality is a perception constructed through human interaction (Charmaz, 2006). Strauss was interested in understanding action and process (Strauss & Corbin, 1990) rather than structure. More contemporary versions of grounded theory evolved from the more interpretivist, constructionist epistemology taken by Strauss (e.g. Charmaz, 1995, 2006; Henwood & Pidgeon, 1995, 2003). Given this historical context, grounded theory may be applied from a realist or constructionist / contextualist approach (Mays & Pope, 1995). It is most suited to the constructionist position and contemporary versions are consistent with this (Madill, Jordan, & Shirley, 2000).

*4.5.1.2 Constructivist grounded theory.* The grounded theory approach taken in this thesis was conducted from the interpretivist, constructionist epistemological perspective. This perspective is concerned with understanding subjective experience and rejects the idea that underlying realities may be accessed (Charmaz, 1995). ‘Reality’, from this point of view, is constructed by language and interactions between persons (Madill et al., 2000). A researcher cannot approach the data as a *tabula rasa* (as the original conception of grounded theory advocated), but will come to the research with some particular interests, preconceived concepts and theoretical sensitivities (Charmaz, 1995; Henwood & Pidgeon, 1995, 2003). From this point of view, grounded data analysis involves the researcher ‘flip flopping’ between the data and their own interpretation (Henwood & Pidgeon, 1995).

This choice of epistemological perspective was appropriate as it reflects my belief that an underlying ‘truth’ about reality may never be accessed and that multiple perspectives of reality exist. I believe that ‘reality’ is a subjective perception of the individual and that research may never be truly objective or value-free. In line with the constructionist approach, I believe that researchers cannot separate themselves from the research process and may impact on the data, and thus the reflection of ‘reality’, that they produce. As the research was conducted from a constructionist perspective, data analysis was guided by the procedures outlined by authors within the constructionist methodological approach – primarily Henwood and Pidgeon (1995, 2003) and Charmaz (1995, 2006).

*4.5.1.3 Outline of approach.* Grounded theory involves the systematic coding of instances in the data that leads to the generation of categories, properties of categories and the eventual identification of a core concern (Charmaz, 1995, 2006). The aim is to fully explore categories and properties by identifying similarities and diversities in the data (Henwood, 1996). The method of *constant comparison* is central to this: instances, codes and categories are constantly compared within and across participants and to each other. In this way, categories are refined and verification sought (Charmaz, 1995). This method helps the researcher stay close to the data and inductively develop the analysis (Rennie, Phillips, & Quartaro, 1998). Once categories develop, the aim is to move towards a higher-level conceptualisation and the construction of a theory that explains the phenomenon under study (Charmaz, 2006; Henwood & Pidgeon, 2003). However, grounded theory studies do not always have to move towards this higher



level of theorising. Henwood & Pidgeon (1995) point out that a whole grounded theory may be overly ambitious, especially for an undergraduate or postgraduate project. Grounded theory may be used partially: that is, elements of its procedures may be used. For instance, the researcher may focus on just developing a set of categories and fully exploring these. Grounded theory is an iterative process, so although there are 'stages' of data analysis, movement through these will not be a linear process (Charmaz, 1995, 2006; Henwood & Pidgeon, 2003).

In grounded theory, sampling is inherently tied up with data analysis and later sampling needs will be determined by the ongoing analysis (Pidgeon & Henwood, 1996). This is called *theoretical sampling*. Initially, participants are chosen who reflect the broad area of interest so that the elements of the phenomenon under study will develop clearly. With ongoing analysis, the focus of the research becomes more apparent as the researcher identifies core elements of the phenomenon. Further participants are selected on the basis of a theoretical need to explore developing categories as fully as possible by sampling all of the variations within it (Rennie et al., 1988). Theoretical sampling prevents the researcher from collecting the same data over and over again and develops the analysis (Glaser, 1998), aiding *saturation* (reaching the point where no new data may be obtained and categories have been fully explored) (Mays & Pope, 1995).

#### 4.5.2 *Trustworthiness*

As with quantitative research, qualitative work needs to be assessed for its rigour, quality and credibility ('trustworthiness'). Assessing the quality of qualitative research has become a growing concern in recent times. There is some debate about whether the criteria used to assess quantitative work may be transferred to the assessment of qualitative research. Some view qualitative research as a distinct paradigm with a different philosophy of knowledge which means the methods used in the quantitative approach may be inappropriate (Johnson, 1999; Mays & Pope, 1995). Johnson (1999) suggests that the "concepts of credibility, dependability and transferability" (p. 186) are more appropriate than validity, reliability, and generalisability. Other commentators (Smith, 1996; Yardley, 2000) retain the term 'validity'. There have been no universal criteria agreed among qualitative researchers for the assessment of trustworthiness (Smith, 1996). However, recently some guidelines detailing general quality criteria

against which qualitative research may be assessed have been published (e.g. Elliott, Fischer, & Rennie, 1999; Meyrick, 2006; Yardley, 2000).

There are a number of methods that can be employed to assess the trustworthiness of qualitative research, including triangulation, reflexivity, member checking (respondent validation), internal coherence, deviant case analysis, transparency of the research process, clarity of the write up, the use of theoretical sampling and reader evaluation (Elliott, Fischer, & Rennie, 1999; Madill, 2000; Mays & Pope, 1995; Yardley, 2000). The choice of methods to use should take a considered approach which is based on the epistemological position of the research (Madill et al., 2000). For instance, triangulation from a realist perspective is about seeking confirmation of findings, whereas from the constructionist perspective triangulation aids completeness (Madill et al., 2000). Among trustworthiness measures suited to the constructionist approach are reflexivity, reader evaluation, internal coherence and the use of theoretical sampling. These are the methods that were used in the present research.

*4.5.2.1 Reflexivity.* Reflexivity enhances the trustworthiness of qualitative research by making the researcher's own pre-conceptions and biases apparent and prompting the researcher to consider how these may have shaped the research process (Johnson, 1999). Reflexivity not only encompasses an awareness of one's intellectual bias, but also how the self may interact with the research process. The researcher's own personal history, values and feelings, as well as their relationship and interaction with the participants, may all impact on the outcomes of qualitative work (King, 1996). Reflexivity involves a record of the researcher's thoughts, feelings and pre-conceptions being kept during the research process – this is often in the form of a reflexive diary. From a realist perspective, the function of reflexivity is to aid the researcher to put aside their biases. However, a constructionist perspective acknowledges that the researcher will bring pre-conceptions to the analysis and, therefore, the role of reflexivity is for the researcher to make plain the position from which they approached their analysis. This may then be used to aid reader evaluation of the interpretation offered by the researcher (Madill et al., 2000).

*4.5.2.2 Reader evaluation.* Any report of the research should include a clear outline of the methods used, including the way in which the data were collected and the analysis was carried out. In this way, a reader can interpret the analysis and clearly see how the

analysis evolved over time (Mays & Pope, 1995). Many qualitative studies do not provide sufficient information about the way in which the research was actually carried out (Mays & Pope, 1995). By being more explicit about the process of the research, transparency is enhanced (Yardley, 2000), which contributes towards ensuring the trustworthiness of the analysis. Enough raw data in the form of quotes should be provided in the report so that the reader may determine for themselves how the analysis fits with the data (Yardley, 2000). Reader evaluation is a quality criterion that sits comfortably within a constructionist framework (Madill et al., 2000).

*4.5.2.3 Internal coherence.* Internal coherence is a quality criterion that appears to have achieved consensus among qualitative researchers (Smith, 1996). An analysis should make sense and not contradict itself (Madill et al., 2000). The researcher may actively look for challenges to the developing theory in the form of a deviant case analysis. The theory may be checked by seeing whether it can account for cases that appear to contradict it. A good analysis should be able to explain the majority of cases (Mays & Pope, 1995).

#### *4.5.2.4 Theoretical sampling*

The use of theoretical sampling aids the researcher in ensuring that the phenomenon has been fully explored. If theoretical sampling is not used, the degree of transferability, rigour and depth of the research may be questionable (Morse, 1995).

### *4.6 Conclusions*

Establishing temporal precedence and concurrently studying more than one potential mediator may be important considerations in mechanisms research. Therefore, taking these into account, the main aim of the pilot longitudinal work was to concurrently explore the temporal relation of change in depression and all the mediators identified from the theoretical frameworks presented in chapter 3 to gain insight into which factors may be stronger candidate mediators than others. Mechanisms and process research may also benefit from a mixed methods approach, as qualitative research may complement quantitative findings by providing a richer, contextualised understanding, and may also generate new hypothesised mechanisms or change processes for examination in future quantitative work. Grounded theory methods are ideally suited to studying process, so this method was selected as the qualitative approach in this PhD. The pilot longitudinal study is presented in chapter 5 and the qualitative study is

presented in chapter 6. The final, cross-sectional study, developed from the findings of the first two studies, is presented in chapter 7. The overall aim of the research in this thesis was to gain further understanding of the process of change and answer the research question: “Which psychological factors may mediate the relationship between physical activity and decreased depression?”

## Chapter 5

### Longitudinal Study – Exploring the Temporal Relation of Change

#### *5.1 Introduction*

As chapter 3 highlighted, very little is currently known about the process of change in physical activity for depression. Only a few studies have directly tested potential mechanisms among depressed individuals involved in physical activity and there is a need for further longitudinal work. There is particularly a need for studies which examine more than one potential mechanism concurrently, as insight may be gained into whether some factors may be stronger candidate mediators than others. This chapter reports on a prospective, pilot study which concurrently explored the role of changes in self-esteem, physical self-concept, self-efficacy, PA, NA and exercise-induced feelings as potential mechanisms among a group of individuals with elevated depression scores who increased their physical activity over an eight-week period.

Research in this area needs to take a theoretical approach (Oweis & Spinks, 2001; Plante, 1993). As discussed in chapter 3, the potential change mechanisms examined in the present research were drawn from social cognitive theory (Bandura, 1977, 1997), the EXSEM (Sonstroem et al., 1994), the tripartite model of anxiety and depression (Clark & Watson, 1991), and a model of exercise-induced feelings (Gauvin & Rejeski, 1993). The tripartite model has not been previously applied to this area, yet the review in chapter 3 presents the case for consideration of change in the affective dimensions of depression (and especially an increase in positive affect) as potential mechanisms. Also, while elements of the EXSEM have been explored longitudinally with mental health samples, there have not been any studies which have examined the model as a whole, including self-efficacy, longitudinally among depressed individuals engaged in physical activity. All elements of the model were measured in the present study. The aim of the present study was to concurrently explore the utility of these theories directly within the physical activity and depression context.

The design of the present study particularly builds on previous research by not only examining a number of potential mediators within the same design, but also by exploring the temporal relation of change. There have not been any previous studies which have taken into account the temporal precedence criterion when identifying potential mechanisms. There is a need for longitudinal studies that include early,

multiple measurement points of the potential mediators and depression. In the present study, in addition to taking measures of the potential mechanisms and depression at baseline and the end of the study, interim measures were also taken at the end of the first and third weeks prior to expected change in depression.

The specific aims of the present study were: (a) to assess whether depression, self-esteem, physical self-concept, self-efficacy, PA and NA changed over time among a group of depressed individuals who increased their physical activity; (b) to assess the temporal relation of change in the potential mechanisms and depression; and (c) to assess whether any early change in the potential mechanisms predicted overall change in depression.

This study was also intended to be a pilot study to assess the longer-term feasibility of and inform the design of further longitudinal research for this PhD. This included participant recruitment, participant retention, whether participants would increase their physical activity in their own time in the absence of a formal intervention, whether under such circumstances a reduction in depression would occur and other issues, such as the nature of change in depression and the potential mediators over time.

## *5.2 Method*

### *5.2.1 Ethical issues*

Ethical approval to conduct the study was obtained from the School of Psychology, University of Southampton, Ethical Committee (Ref: PG/03/38).

### *5.2.2 Design*

This was a repeated measures within-subjects, single group design (a control condition was not used for reasons outlined in chapter 4, section 4.3.6). Individuals with elevated depression scores were encouraged to increase their physical activity in their own time over an eight week period. Measures of depression and the potential mediators were taken at baseline and at the end of weeks 1, 3 and 8.

### *5.2.3 Participants*

*5.2.3.1 Recruitment procedure.* Participants (n = 47) were recruited via advertisements about the study at the University of Southampton between August 2004 and January 2005. Advertisements stated that we were seeking individuals who were currently

experiencing low mood or depression to take part in a study of the psychological effects of exercise and that participants would be reimbursed up to £50 for any exercise costs incurred due to taking part in the study (see appendices A and B). The advertisements resulted in 216 enquiries about the study. After receiving more information (including inclusion and exclusion criteria), 47 individuals attended an initial meeting with the researcher during which they completed informed consent and screening measures. All 47 consented to take part.

*5.2.3.2 Inclusion criteria.* Participants were entered into the study if they: (a) had a score of  $\geq 10$  on the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) (i.e. elevated depression scores, but not necessarily meeting criteria for mild depression); (b) were typically physically active once a week or less, for at least 30 minutes per session; (c) were not currently receiving any form of treatment for depression; (d) showed no evidence of medical contraindications to exercise, as assessed by two questions provided by a general practitioner; and, (e) anticipated that they would be able to make the time commitment to be physically active two to three times per week for 30 minutes a session over the following eight weeks. At screening assessment, eight individuals failed to meet these criteria and were excluded from the study, resulting in a sample of 39 individuals.

*5.2.3.3 Participant characteristics.* The participants were 32 women (82.1%) and seven men (17.9%), with an age range of 18 – 45 years (median age = 21). Most were undergraduate ( $n = 28$ ; 71.8%) or postgraduate ( $n = 9$ ; 23.1%) students, plus one member of staff and a member of the general public. At screening, 14 (35.9%) reported that they were typically physically active once a week, 18 (46.2%) reported that they were physically active less than once a week and seven (17.9%) stated that they were never physically active.

## *5.2.4 Measures*

*5.2.4.1 Demographics.* Age, gender and occupation data were taken from all participants at entry to the study.

*5.2.4.2 Depression.* Depression was measured by the BDI-II (Beck et al. 1996). The questionnaire lists 21 symptoms of depression (i.e. feelings of sadness, loss of pleasure, self-criticalness) and respondents select statements scored from 0 – 3 that best reflect

their experience of the severity of each symptom. Total scores can range from 0 – 63, with a higher score indicating a greater level of depression. The BDI-II is a reliable test, showing good internal consistency with a reported Cronbach alpha of .93 among college students (Beck et al., 1996). Cronbach alpha values for the reliability of this measure and the other measures used with the present sample are not reported, as the sample size was too small to calculate these.

*5.2.4.3 PA and NA.* The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) was used to measure state mood (appendix C). The scale measures two dimensions of mood: PA and NA. The scale consists of 20 adjectives relating to feelings and emotions. Respondents are asked to rate the extent to which they have experienced each of the feelings over a particular period of time. In the present study, the ‘past few days’ time scale was used, as the aim was to assess state mood (which is more likely to be sensitive to change) rather than trait mood. Over this timescale, it has been found that NA has a correlation of .56 and PA has a correlation of -.35 with the BDI. These correlations are low enough to suggest that PA and NA are conceptually distinct from the depression measure (Watson et al., 1988). Responses are made according to a five-point scale. Total scores for PA and NA can range from a 10 to 50, with a higher score indicating a greater amount of that affective component. The scale shows good internal consistency, with reported Cronbach alphas of .88 for PA and .85 for NA.

Previous tests of the tripartite model of have used versions of the PANAS to measure the positive affect and negative affect elements (e.g. Cook, Orvaschel, Simco, Hersen, & Joiner, 2004; Gençöz, 2002; Kiernan et al., 2001). On the basis of the tripartite model, Watson et al. (1995) did develop the Mood and Anxiety Symptoms Questionnaire (MASQ) to aid discrimination between anxiety and depression. The PANAS was the selected as the measure to be used in the present study, as it is briefer than the MASQ and the physiological hyperarousal element of the model was not being tested. The structure of the PANAS, using a state mood time scale, has been shown to be consistent with the posits of the tripartite model (Crawford & Henry, 2004).

*5.2.4.4 Exercise-Induced Feelings.* Acute affective responses to physical activity were measured with the EFI (Gauvin & Rejeski, 1993). The scale measures four feeling states (*revitalisation, tranquillity, positive engagement* and *physical exhaustion*), each



assessed by three words describing feelings associated with physical activity (e.g. 'refreshed', 'calm'). Respondents rate the intensity with which they are experiencing each feeling from 0 (*do not feel*) to 4 (*feel very strongly*). Total scores for each feeling state can range from 0 to 12. The scales are reliable, with Cronbach alphas of .78, .80, .72 and .74 for revitalisation, physical exhaustion, tranquillity and positive engagement respectively, when administered after physical activity.

The EFI was developed to measure feeling states in relation to acute physical activity. However, it was anticipated that it would be methodologically difficult to obtain ratings of affect immediately post-physical activity. Therefore, the instructions and wording were changed to reflect a retrospective recall of how the participants had felt immediately after physical activity over the past few days (see Appendix D). Research has shown that the retrospective recall of emotions within a time frame of a few weeks draws on episodic knowledge specifying emotions in relation to the time and place they occurred, while retrospective recall over periods longer than a few weeks draws on semantic knowledge of beliefs about how one generally feels (Robinson & Clore, 2002). Therefore, the retrospective recall of feelings post-physical activity was anticipated to be a relatively accurate reflection of those experienced in relation to recent physical activity experiences.

As the EFI only measures positive affective responses and feelings of fatigue, the *psychological distress (PD)* scale from the Subjective Exercise Experiences Scale (SEES; McAuley & Courneya, 1994) was used to measure negative feelings post-physical activity. This scale consists of four single word items (i.e. 'awful', 'discouraged'). For ease of administration and consistency, the words for this scale were incorporated into the EFI format and the EFI response options were used (see Appendix D). The PD scale shows high reliability in terms of internal consistency:  $\alpha = .85$  (McAuley & Courneya, 1994).

*5.2.4.5 Global self-esteem.* Rosenberg's (1965) Global Self-Esteem Scale (RSE) was used to measure self-esteem (see Appendix E). The scale consists of 10 statements relating to feelings of self-worth, and these were rated on a 5-point scale from 1 = 'strongly disagree' to 5 = 'strongly agree'. The total score on this measure is the sum of the responses to all ten items, with scores ranging from 10 to 50. A higher score indicates a higher level of self-esteem.

*5.2.4.6 Physical self-concept.* The Physical Self-Perception Profile (PSPP; Fox, 1990) was used to measure physical self-concept (see appendix F). The scale comprises five subscales, sports competence (*Sport*), physical condition (*Condition*), body attractiveness (*Body*) and physical strength (*Strength*) and physical self-worth (*PSW*). A forced-choice response format is presented which entails the participant to decide between two contrasting statements for each item and rate whether the statement is 'really true for me' or 'sort of true for me'. Total scores for each subscale can range from 6 to 24, with a higher score indicating a more positive self-perception. The scale shows good reliability, with coefficient alphas for the subscales ranging from .80 to .92. This measure of the physical self was used as the expanded EXSEM (Sonstroem et al., 1994) directly evolved from this conceptualisation of physical self-concept.

*5.2.4.7 Physical self-efficacy.* The Perceived Physical Ability (PPA) subscale of the Physical Self-Efficacy Scale (PSE; Ryckmann, Robbins, Thornton, & Cantrell, 1982) was used to assess physical self-efficacy (see appendix G). The scale measures respondents' perceived physical abilities with ten statements, such as 'I can't run fast'. Total scores on the scale can range from 10 - 60. A higher score represents a higher degree of self-efficacy. The PPA subscale has been used as a measure of physical self-efficacy in other tests of the EXSEM model (i.e. McAuley, Mihalko, & Bane, 1997). The PPA shows good internal consistency, with a coefficient alpha of .84.

*5.2.4.8 Physical activity.* Participants completed structured weekly diaries of their physical activity at baseline (see appendix H) and during each week of the study (see appendix I). Weekly diaries were completed in the participants' own time and were included in the questionnaire booklets given to participants to measure depression and the potential mediators. The weekly diaries were posted back to the researcher in the booklets along with the measures of depression and the potential mediators at the end of weeks one, three and eight (see section 5.2.5). Participants recorded the days of the week they had been physically active (including walking and cycling as transport), the type of activity they did, and the length of each session in minutes. For the purposes of statistical analyses, physical activity was operationalised as the weekly total number of minutes.

### 5.2.5 Procedure

Participants attended an initial meeting with the researcher at which they completed informed consent (see appendix J) and then screening measures, including the BDI-II, to assess whether they matched the inclusion criteria for the study (see appendix K, but note that the BDI-II is not included as it is copyrighted and individual record forms were purchased for its use during this study). Participants who met the inclusion criteria were given further information about the study. Participants were instructed to increase their level of physical activity during their own time, for a period of eight weeks. The meta-analysis by Craft and Landers (1998) suggested that eight week physical activity periods are effective and mediators of this short-term response in depression were of interest in the present research. Participants were guided to be physically active two to three days a week for 30 minutes a session. The meta-analysis by Craft & Landers (1998) suggested that number of days of physical activity per week and session duration did not significantly influence depression outcomes. Therefore, this was intended as a *guideline* only to increase activity, rather than as a stringent requirement, as the aim was to increase activity from usual levels. The aim was also not to present participants with off-putting, unrealistic targets as it was anticipated that this may have had a negative impact on adherence and participant retention. To ease the participants into increasing their physical activity, they were guided to do 15 – 20 minutes per session in the first week of the study, 20 – 30 minutes per session in the second week and then 30 minutes per session for the remaining six weeks. As there is no indication in the literature that a particular mode of physical activity may be any more effective than another (see chapter 2), participants were told that they could take part in any type of physical activity. The researcher discussed with each participant the type of activity that might suit them, health and safety considerations and provided practical information (e.g., how to join the university gym). The aim of the latter was to support participants in beginning to increase their physical activity. The participants were instructed to start increasing their physical activity at the beginning of the following week.

Each participant was given an information pack which contained the physical activity guidelines, health and safety information (appendix L), a list of local exercise resources (appendix M), a list of support sources for depression (appendix N), booklets containing all the questionnaire measures and physical activity diaries for the duration of the study, and stamped addressed envelopes for return. To encourage adherence,

participants were also provided with a blank timetable in the physical activity guidelines sheet to help them plan physical activity sessions into their week. Research has shown that people are more likely to adhere to exercise if they plan it (Lippke, Ziegelmann, & Schwarzer, 2004). Attention was drawn to the grid during the initial meeting. At the end of the meeting, each participant completed a questionnaire containing the baseline (week 0) measures of all the potential mediators (except exercise-induced feelings) and a diary of how much physical activity they had engaged in over the previous seven days. Exercise-induced feelings were not measured at baseline, as this measure was only relevant once the participants began to increase their physical activity (i.e. at the end of the first week onwards). Administration of the BDI-II at the screening assessment was used as the baseline measure of depression. The participants then completed further measures of depression and all the potential mediators at the end of weeks one (week 1), three (week 3) and eight (week 8) of the increased physical activity period. Physical activity was recorded every week in the diaries provided.

To enhance adherence and continued participation in the study, participants were invited to attend two further meetings with the researcher during the study – one mid-study and one at the end of the study – to discuss the study and how they were finding increasing their physical activity. Only 14 participants attended the mid-study meeting and eight attended the end-of-study meeting. However, all participants received e-mail contact at these intervals from the researcher to arrange the meetings and to remind them to return questionnaires.

#### *5.2.6 Statistical analyses*

Data were screened for missing values, outliers and normality. Where individual items were missing on scales, the within-individual mean response calculated from the completed items on the scale was inserted (Shrive, Stuart, Quan, & Ghali, 2006). Where the majority or all of the items from a scale were missing, the case was removed from any analyses involving the missing variable. Univariate outliers were identified by inspection of standardised scores ( $z$  scores). Cases were defined as outliers if they had standardised scores greater than  $\pm 3.29$  on a variable (Tabachnick & Fidell, 1996). The influence of two univariate outliers on baseline physical activity and Week 1 PD was reduced by changing the scores so that they were one unit greater than the next extreme score (Tabachnick & Fidell, 1996). The case with the extreme score on week 0

physical activity reported 560 minutes of physical activity, yet had indicated on the screening form that they typically exercised once a week for 30 minutes. As the baseline measure of physical activity was not the measure used to determine inclusion or exclusion to the study, the case was retained for statistical analyses.

Normality was assessed using the  $z$  distribution and using a criterion of  $z > 3.29$ ,  $p < .001$  to identify non-normality. Three of the variables showed both significant skew and kurtosis: week 0 physical activity, week 0 Strength, and week 3 PD. Age demonstrated skew but not kurtosis. Where appropriate, nonparametric tests were used for analyses involving these variables.

Fisher's exact tests, independent samples  $t$ -tests and Mann-Whitney  $U$  tests were used to assess whether there were any differences between those who completed the study and those who did not. Wilcoxon matched-pairs, signed rank tests were conducted to assess whether the physical activity engaged in during week 1 and across all weeks of the study represented a statistically significant increase from baseline levels. For this purpose, a new variable was created (average weekly minutes) which represented each participant's mean weekly number of physical activity minutes (an aggregate of all minutes recorded for weeks 1 to 8, divided by eight).

A series of univariate repeated measures analysis of variance (ANOVA) analyses were performed to assess change over time in depression and the potential mechanisms. 'Time' represented the within-subject factor with four levels (weeks 0, 1, 3 and 8) – except for the exercise-induced feelings analyses which had three levels (weeks 1, 3 and 8). When main effects for time were significant, comparisons were conducted to examine specific time effects.

To address whether any earlier change in the potential mechanisms between week 0 and week 3 predicted overall change in depression between week 0 and week 8, a series of hierarchical, multiple regression analyses were conducted. In these models, week 8 depression was entered as the dependent variable, week 0 depression was entered in the first step as a predictor variable, followed by the week 0 value of the potential mechanism in the second step and the week 3 value of the potential mechanism in the third step. Thus, residualised change in depression and the potential mechanisms was assessed by controlling for baseline scores (Steketee & Chambless, 1992). This is a

more desirable way of assessing change than the use of simple raw change scores, as initial differences between participants and measurement error from repeated administration of a measure may be controlled (Steketee & Chambless, 1992). For the analysis of the exercise-induced feelings, week 3 values were used to predict overall change in depression between weeks 0 and 8.

A statistical significance level of  $p < .05$  was used in all analyses. Although a large number of analyses were conducted, Bonferroni correction of the alpha level was not applied as it is of limited use when sample sizes are small and may result in important findings being discarded due to a lack of power (Type II error; Steketee & Chambless, 1992). Effect sizes rather than  $p$ -values per se were used to interpret the findings, as the size of the effect is more informative than just significance level (Wright, 2003) and in mechanisms research with small samples (which may be under-powered), the effect size may also be more informative (Doss, 2004).

### 5.3 Results

#### 5.3.1 Attrition

Of the 39 participants who entered the study, nine dropped out of the study before the end of week 1, a further four dropped out by the end of week 3, and two did not return questionnaires for week 8. The complete dataset consisted of 24 participants who had returned questionnaires at each stage. This represented a 61.5% participant retention rate.

#### 5.3.2 Differences between completers and noncompleters

Analyses of baseline and demographic data were conducted to examine whether there were any differences at study entry between those who completed the study ( $n = 24$ ) and those who did not ( $n = 15$ ). There were no differences in gender ( $\chi^2(1, N = 39) = .35, p = .69$ ) or occupation ( $\chi^2(1, N = 39) = 2.39, p = .65$ ). Table 1 shows the results for the continuous variables. The only significant difference was that those who completed the study had engaged in more physical activity during the seven days prior to entering the study than those who did not.

#### 5.3.3 Change in Physical Activity

Figure 2 shows the median number of minutes of physical activity reported by the participants at baseline and during each week of the study. At a median level, the

Table 1

*Comparison of the Baseline Characteristics of the Completers and Non-completers*

Variable	Completers	Non-completers	<i>t</i> or <i>z</i>	<i>p</i>
Age ( <i>Mdn</i> , range) <sup>a</sup>	21 (18–39)	24 (18–45)	<i>z</i> = -0.72	.48
Depression ( <i>M</i> , <i>SD</i> )	28.21 (9.08)	28.33 (8.67)	<i>t</i> = -0.04	.97
Positive affect ( <i>M</i> , <i>SD</i> )	19.25 (6.73)	19.80 (6.25)	<i>t</i> = -0.26	.80
Negative affect ( <i>M</i> , <i>SD</i> )	27.71 (7.33)	30.00 (7.51)	<i>t</i> = -0.94	.35
Self-esteem ( <i>M</i> , <i>SD</i> )	25.50 (8.04)	25.00 (5.99)	<i>t</i> = 0.21	.84
Physical self-worth ( <i>M</i> , <i>SD</i> )	10.67 (4.01)	9.80 (2.91)	<i>t</i> = 0.73	.47
Sport ( <i>M</i> , <i>SD</i> )	11.29 (4.34)	9.53 (2.59)	<i>t</i> = 1.42	.17
Condition ( <i>M</i> , <i>SD</i> )	10.75 (3.43)	9.20 (2.60)	<i>t</i> = 1.50	.14
Body ( <i>M</i> , <i>SD</i> )	9.54 (3.66)	9.87 (3.81)	<i>t</i> = -0.27	.79
Strength ( <i>Mdn</i> , range)	11.50 (6.00–24.00)	11.00 (7.00 – 14.00)	<i>z</i> = -1.15	.26
Physical self-efficacy ( <i>M</i> , <i>SD</i> )	27.33 (10.21)	24.20 (5.91)	<i>t</i> = 1.21	.23
Physical activity ( <i>Mdn</i> , range)	45.00 (0–361.00)	15.00 (0–100.00)	<i>z</i> = -2.19	.03

<sup>a</sup>One participant missing data, so completers *n* = 23 for this variable.

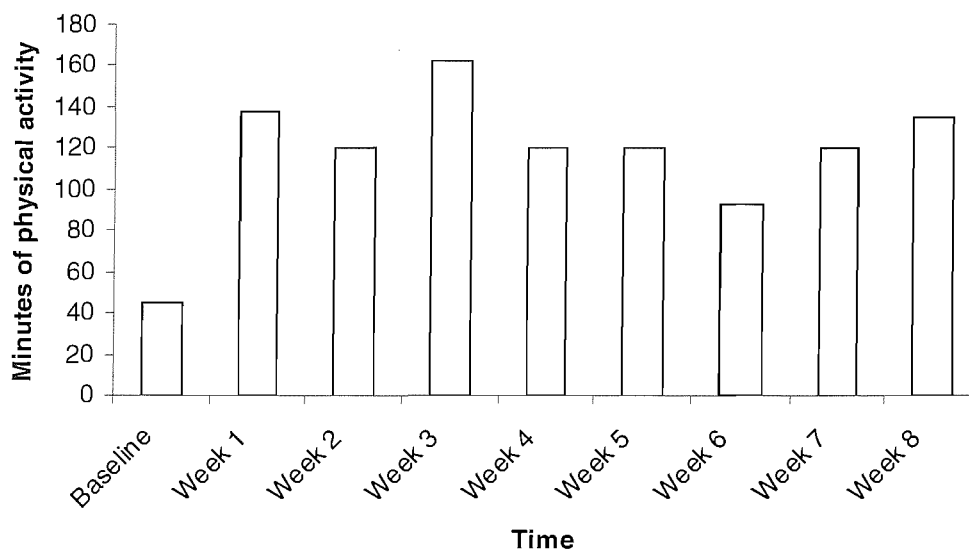


Figure 2. Median number of minutes of physical activity engaged in by completers at baseline and during each week of the study ( $N = 24$ ).

participants took part in more physical activity than the 60 – 90 minutes they were guided to do each week. There was a significant increase in physical activity between both baseline ( $Mdn = 45.0$  minutes, range = 0 – 361.0) and week 1 ( $Mdn = 137.5$  minutes, range = 30.0 – 360.0;  $z = -3.20$ ,  $p = .001$ ), and baseline and average weekly minutes ( $Mdn = 116.5$  minutes, range = 41.9 – 288.1;  $z = -2.83$ ,  $p = .005$ ).

#### 5.3.4 Change in Depression and the Potential Mechanisms

Participants' mean scores for depression and each of the potential mechanisms at weeks 0, 1, 3 and 8 are shown in Table 2, along with the results of the within-subject ANOVA for the main time effects and the associated effect sizes (partial eta-squared;  $\eta_p^2$ ). Significant main effects for time were found for depression and all of the potential mechanisms, except revitalisation and tranquility.

#### 5.3.5 Temporal Relation of Change

Table 3 shows the results of the ANOVA contrasts which were conducted to test for specific time effects (NB table does not include exercise-induced feelings). There were significant improvements in depression, self-esteem, physical self-concept, physical self-efficacy, PA and NA, between baseline and the end of week 8. In terms of the temporal relation of change, initial improvement in depression occurred at week 1 and initial improvements in PA, NA and physical self-efficacy coincided with this. The



Table 2

*Mean Depression and Potential Mechanisms Scores Over Time and Within-subject ANOVA Main Effects for Time (N = 24)*

	<i>n</i>	Baseline	Week 1	Week 3	Week 8	Within-subject ANOVA			
		<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>F</i>	<i>df</i>	$\eta_p^2$	<i>p</i>
Depression	23	28.4 (9.2)	22.9 (10.6)	17.7 (11.6)	14.1 (12.3)	24.96	3,66	.53	<.001
Positive affect	24	19.3 (6.7)	24.0 (7.8)	28.0 (8.4)	27.8 (8.7)	15.67	3,69	.41	<.001
Negative affect	24	27.7 (7.3)	24.5 (7.6)	20.8 (6.5)	18.8 (6.7)	16.52	3,69	.42	<.001
Self-esteem	23	25.6 (8.2)	27.2 (9.8)	31.0 (9.1)	34.7 (9.0)	17.94	3,66	.45	<.001
Physical self-worth	23	10.6 (4.1)	10.7 (3.7)	11.8 (3.7)	13.7 (3.6)	12.72	3,66	.37	<.001
Body	23	9.4 (3.7)	9.8 (3.9)	11.1 (3.1)	12.7 (3.6)	16.70	3,66	.43	<.001
Condition	23	10.7 (3.5)	10.8 (3.5)	12.7 (3.2)	14.4 (4.0)	12.92	2.10,46.24	.37	<.001
Sport	23	11.2 (4.4)	11.8 (4.4)	12.4 (4.0)	12.7 (4.0)	3.12	2.40,52.83	.12	.04
Strength	23	12.7 (4.3)	13.2 (4.4)	14.1 (3.8)	14.9 (4.6)	7.92	1.89,41.52	.27	.001
Physical self-efficacy	24	27.3 (10.2)	29.8 (8.7)	32.6 (8.1)	35.9 (9.9)	16.17	1.95,44.77	.41	<.001
Positive engagement	24		4.6 (2.7)	5.6 (2.4)	6.4 (3.0)	5.05	1.61,37.10	.18	.02
Revitalisation	24		5.7 (2.7)	6.0 (2.5)	6.0 (2.6)	<1.00	1.55,35.54	.01	.71
Tranquillity	24		5.4 (2.5)	5.7 (2.3)	5.8 (3.0)	<1.00	1.52,34.92	.02	.65
Physical exhaustion	24		5.5 (3.5)	6.0 (3.2)	4.3 (3.0)	3.54	2,46	.13	.04
Psychological distress	24		2.2 (2.9)	1.9 (2.5)	2.0 (2.9)	<1.00	2,46	.89	<.01

Table 3

*Within-subjects ANOVA Contrasts Examining Change in Depression and the Potential Mechanisms Over Time (N = 24)*

Variable	Change Weeks 0 – 1			Change Weeks 0 – 3			Change Weeks 0 – 8			Change Weeks 3 – 8		
	<i>F</i>	$\eta_p^2$	<i>p</i>	<i>F</i>	$\eta_p^2$	<i>p</i>	<i>F</i>	$\eta_p^2$	<i>p</i>	<i>F</i>	$\eta_p^2$	<i>p</i>
Depression	15.19	.41	.001	33.54	.60	<.001	51.69	.70	<.001	2.80	.11	.11
Positive affect <sup>a</sup>	11.10	.33	.003	35.92	.61	<.001	25.91	.53	<.001	0.01	<.01	.92
Negative affect <sup>a</sup>	6.95	.23	.02	23.79	.51	<.001	31.13	.58	<.001	2.39	.09	.14
Self-esteem	1.73	.07	.20	12.98	.37	.002	33.92	.61	<.001	5.53	.20	.03
Physical self-worth	0.01	<.01	.94	4.47	.17	<.05	23.77	.52	<.001	13.24	.38	.001
Body	1.08	.05	.31	13.36	.38	.001	32.00	.60	<.001	8.16	.27	.009
Condition	0.03	<.01	.86	9.23	.30	.006	17.96	.45	<.001	5.29	.19	.03
Sport	1.12	.05	.30	4.08	.16	.06	5.75	.21	.03	0.62	.03	.44
Strength	2.42	.10	.13	9.29	.30	.006	10.55	.32	.004	2.85	.12	.11
Physical self-efficacy <sup>a</sup>	5.15	.18	.03	19.64	.46	<.001	22.33	.49	<.001	7.52	.25	.01

*Note.* All *dfs* = 1,22, except:

<sup>a</sup>*df* = 1,23

effect sizes showed that there was a larger effect for change in PA than NA or physical self-efficacy at this stage. There was no significant improvement in self-esteem or any of the physical self-concept variables at week 1. Most of the improvement in depression had occurred by the end of week 3, with no further significant improvement between weeks 3 and 8. Change in PA and NA followed a similar pattern to this, but physical self-efficacy still showed continued significant improvement between weeks 3 and 8. Self-esteem and all of the physical self-concept variables, except sport, showed initial significant improvement at week 3. There were continued improvements in self-esteem, physical self-worth, body, and condition between weeks 3 and 8, after there was no further significant improvement in depression.

The effect sizes for change showed that there were larger effects for PA, NA and physical self-efficacy than physical self-concept or self-esteem at weeks 1 and 3. Notably, the effect size for change in PA was greater than for change in NA or any other potential mechanism at both weeks 1 and 3. There were larger effect sizes for change in self-esteem, body and NA at week 8 than for change in PA – however, this was observed after all the significant change in depression had occurred.

In terms of the exercise-induced feelings, there were significant increases in positive engagement between weeks 1 and 3 ( $F(1, 23) = 5.87, p = .02, \eta_p^2 = .20$ ), and 1 and 8 ( $F(1, 23) = 8.31, p = .008, \eta_p^2 = .27$ ), and decreases in physical exhaustion between weeks 3 and 8 ( $F(1, 23) = 7.62, p = .01, \eta_p^2 = .25$ ).

### *5.3.6 Association Between Change in the Potential Mechanisms and Depression*

The results of the hierarchical, multiple regression analyses are summarised in Table 4. The table shows that change in depression was not predicted by early change (between week 0 and week 3) in any of the potential mechanisms nor any of the exercise-induced feelings at week 3. Diagnostic information showed a number of problems with leverage, influence, multicollinearity, and non-normal distribution of residuals, indicating unreliable models in this small sample (e.g. multivariate outliers).

Table 4

*Associations between early change in the potential mechanisms with overall change in depression*

Variable	Step and predictor	$R^2$	<i>Change in <math>R^2</math></i>	$F$	$df$	$p$
PA	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 PA	.42	.01	0.20	1,20	.66
	3. Week 3 PA	.42	<.01	0.03	1,19	.87
NA	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 NA	.43	.02	0.62	1,20	.44
	3. Week 3 NA	.45	.02	0.82	1,19	.38
Self-esteem	1. Week 0 Depression	.29	.29	8.06	1,20	.01
	2. Week 0 Self-esteem	.31	.02	0.54	1,19	.47
	3. Week 3 Self-esteem	.33	.02	0.50	1,18	.49
Physical self-worth (PSW)	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 PSW	.41	<.01	0.12	1,20	.74
	3. Week 3 PSW	.42	.01	0.34	1,19	.57
Body	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 Body	.42	.01	0.16	1,20	.70
	3. Week 3 Body	.42	<.01	0.11	1,19	.74
Condition	1. Week 0 Depression	.41	.41	14.60	1,21	.001

	2. Week 0 Condition	.41	<.01	0.11	1,20	.74
	3. Week 3 Condition	.44	.02	0.78	1,19	.39
Strength	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 Strength	.41	<.01	0.11	1,20	.74
	3. Week 3 Strength	.41	<.01	0.01	1,19	.92
Sport	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 Sport	.41	<.01	0.06	1,20	.81
	3. Week 3 Sport	.42	<.01	0.10	1,19	.76
Physical self-efficacy	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 0 PPA	.44	.03	0.93	1,20	.35
	3. Week 3 PPA	.44	<.01	0.06	1,19	.80
Tranquillity	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 3 Tranquillity	.42	.01	0.22	1,20	.65
Positive engagement	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 3 positive engagement	.44	.03	0.95	1,20	.34
Revitalisation	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 3 Revitalisation	.44	.03	1.16	1,20	.30
Physical exhaustion	1. Week 0 Depression	.41	.41	14.60	1,21	.001
	2. Week 3 Physical exhaustion	.44	.03	1.14	1,20	.30
Psychological distress	1. Week 0 Depression	.41	.41	14.60	1,21	.001

2. Week 3 Psychological distress	.50	.09	3.78	1,20	.07
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#### 5.4 Discussion

Although a formal intervention was not employed, the participants did increase their physical activity over the eight week period. Consistent with previous findings (Lawlor & Hopker, 2001), a reduction in depression was observed between baseline and the end of the increased physical activity period. In terms of change in the potential mechanisms, over this period the participants also experienced improvements in PA, NA, self-esteem, physical self-concept and physical self-efficacy. The positive direction of change in these variables is consistent with previous findings relating to the psychological effects of physical activity among nondepressed and mental health samples (Brown et al., 1992; Craft, 2005; Fox, 2000; Knapen et al., 2003; Ossip-Klein et al., 1989; Rejeski et al., 2001; Singh et al., 2005; Van de Vliet et al., 2003a; Yeung, 1996).

While concurrent overall change between depression and proposed mechanisms can provide some support for their mediating role, an examination of the timeline of change can offer greater insight (Kazdin & Nock, 2003). Change in depression occurred relatively rapidly, with initial reductions observed at the end of week 1 and all of the significant change occurring by week 3. After this point, there was no further significant change, suggesting that the reduction in depression levelled off and was maintained during the final weeks. In the absence of a control group comparison, it is not possible to attribute the reduction in depression to the increase in physical activity. The findings may have been due to other factors, such as regression to the mean, spontaneous recovery, selective participant dropout (the results may have been different if an intention-to-treat analysis had been employed) or expectancy effects. However, other studies have also found reductions in depression over short periods (Craft, 2005; Knubben et al., 2007). In particular, the course of change in the present study was very similar to the findings of Craft in which a 'no exercise' control condition was used. Craft also found a reduction in depression by the end of the third week with no further by the end of the intervention at week nine in the exercise group, but not in the control group. This provides some support that the change observed in the present study may have been due to the increase in activity.

As depression changed at the end of the first week, it was not possible to gauge whether any of the potential mechanisms showed change before depression. The effect sizes and timeline of change suggest that change in PA, NA and physical self-efficacy may

present stronger candidate mediators than change in physical self-concept or self-esteem. The effect sizes for change in these variables were larger at weeks 1 and 3 than for change in any of the self-concept or self-esteem variables. Further, initial change in PA, NA and physical self-efficacy coincided with initial change in depression at week 1.

Of note, at weeks 1 and 3 greater change was observed in PA than NA. This is consistent with findings that PA may be more strongly associated with physical activity than NA (Watson, 1988). The results provide some support for the hypothesis that physical activity may particularly tackle the anhedonia-related, low PA element of depression - at least in the early stages of increased activity. This hypothesis has not been proposed previously and the present data suggest that it warrants further investigation. In particular, future research might utilise statistical tests of mediation (Baron & Kenny, 1986, Judd & Kenny, 1981) to assess whether an increase in PA may be more strongly related to change in depression than a decrease in NA. Due to the limited sample size and diagnostic problems with the regression analyses, correlational relations between PA, NA and depression could not be assessed in the present research. The data provide support for the application of the tripartite model to this area and support its further investigation in the present PhD research – especially, as there is some evidence that an increase in PA may be particularly important, so the distinction between PA and NA may offer useful insights in mechanisms research.

The data also offer further support for the application of social cognitive theory to understanding mechanisms of change. An improvement over other studies was the use of a domain-specific measure rather than a general measure (Singh et al., 2005; Tsang et al., 2006). Physical self-efficacy did improve over the increased activity period, providing support for the idea that an increase in self-efficacy for the physical activity task may be associated with mood responses. One possibility is that the changes observed in PA, rather than NA, may have been associated with the increase in self-efficacy, as studies have found that increased self-efficacy for physical activity may be more strongly associated with PA than NA (Bartholomew & Miller, 2002; Bodin & Martinsen, 2004). Future research might use statistical tests of mediation to explore this possibility further.



This study is the first to explore longitudinally all of the factors within the EXSEM (Sonstroem et al., 1994) among a sample of depressed individuals engaged in physical activity. Some support for the application of the EXSEM to understanding the exercise-depression link was obtained, as all of the factors in the model showed change over time by the end of the physical activity period. Consistent with the causal relations in the model, physical self-efficacy evidenced larger changes than the other facets of the model in the early stages and preceded change in physical self-concept and self-esteem. The improvement in physical self-concept and self-esteem is consistent with the findings of previous studies with psychiatric inpatients (Knapen et al., 2003; Van de Vliet et al., 2003a) and extends the evidence to a depressed sample outside of a psychiatric inpatient setting who were not receiving any other form of treatment. Also, there were larger effect sizes for change in self-esteem at weeks 3 and 8 than for any of the physical self-concept variables (except body at week 3), supporting the inclusion of measures of global self-esteem rather than just physical self-perception measures when examining the effects of physical activity on self-esteem in mental health samples. The larger effect for self-esteem than physical self-concept is contrary to theoretical expectations that greater change will be observed at the more specific levels of the EXSEM (Sonstroem & Morgan, 1989). One possibility that might be investigated in future research is the necessary inclusion of physical self-concept, or whether there may be more direct routes to self-esteem change (i.e. from physical activity or self-efficacy).

Previous studies of self-concept or self-esteem change in mental health samples (e.g., Van de Vliet et al., 2003a) have not explored the temporal relation of change. In the present study, the effect size for change in self-esteem at week eight was larger than for change in PA and NA. However, many of the self-esteem and self-concept variables showed continued improvement between week 3 and week 8 after most of the change in depression had occurred. One possible implication of these findings is that much of the improvement in self-esteem and physical self-concept observed by week 8 may have been a consequence of the reduction in depression rather than a cause. Another possible explanation is that improvement in self-esteem and self-concept may be a psychological benefit of physical activity for depressed individuals, but may not be causally related to the depression outcome. It is possible that a hypothesised mechanism may be changed during an intervention, but not be related to the outcome (Hollon et al., 1987). A further possibility is that self-esteem change may not mediate

initial improvement in depression, but may mediate longer-term effects. The smaller effect sizes for change in self-esteem and physical self-concept at week 1 and 3 may also be due to a possibility that these measures were less sensitive to change than the PA, NA and physical self-efficacy measures.

Change in self-esteem and self-concept cannot be ruled out as possible mediators from the present data and further research is needed, particularly controlled studies in which path analytic techniques are used to assess whether early change in self-esteem mediates change in depression. Further research might also look at self-esteem and self-concept change in other depressed populations (e.g., older adults or adolescents). Different mechanisms may operate for different individuals (Fox, 1999). The physical self may be more salient in importance for some individuals (Fox, 1990) or groups and its influence on depression may be dependent upon this.

Although the inclusion of the EFI aimed to examine the role of exercise-induced feelings as mediators (Gauvin & Rejeski, 1993) and Gauvin & Rejeski's (1993) assertion that the EFI may be more sensitive to physical activity than the PANAS, little useful data was obtained. The aim had been to capture affective responses (retrospectively) to the acute physical activity context, but as feeling states prior to a session of physical activity were not measured, there was no information about how these changed pre- and post-session. Comment could only be made on how these feeling states after physical activity may have changed across the eight week period (i.e. the participants experienced significantly more positive engagement after a physical activity session between weeks 1 and 8). The way in which exercise-induced feelings were measured in this study may mean that little can be interpreted from the data about the utility of this model in comparison to the dimensional structure of mood proposed by Watson and Tellegen (1985). It may have been more appropriate in this longitudinal study to have used the chronic version (EFI-C; Rejeski et al., 1999) of the EFI rather than the acute version. Although a chronic measure, the EFI-C has been found to retain some specificity to the affective changes produced by physical activity (Rejeski et al., 1999). An improvement would be to use the EFI-C in further research in this PhD looking at the *chronic* effects of physical activity.

The effect sizes indicated that not only may PA be a stronger candidate mediator of change than NA, but the effects for PA at weeks 1 and 3 were also larger than for

change in any of the other potential mechanisms measured. This suggests that out of all the potential mediators, an increase in PA may be particularly important. These findings are in accordance with Elvasky et al. (2005) who found that while physical activity was associated with change in both physical self-worth and PA among nondepressed older adults, it was only change in PA that had a significant effect on the satisfaction with life outcome. Whether any one mediator (i.e. PA) may be more important than another is a possibility that might be investigated in further research. Ideally, studies could employ multiple mediation analyses during data analysis so that the significance of differences in effect sizes between mediators may be statistically examined.

While there were strong effects for change in the potential mechanisms by the end of week three, none of the early changes were predictive of overall change in depression. The analyses need to be interpreted with caution due to the small sample size and lack of statistical power. This means that it is not possible to confirm a causal role for any of the potential mechanisms from this data.

#### *5.4.1 Feasibility*

This study was conducted in part to assess the feasibility of a longitudinal study for this PhD. Despite the small sample size (which is typical of research in this area – e.g. Craft, 2005), enough participants were recruited and retained to demonstrate statistically significant effects, at least in the ANOVA analyses. Participants did increase their physical activity, showing that encouraging participants to increase their physical activity in their own time may be a feasible method for looking at longitudinal associations in this PhD. Further, median rates of physical activity were above those that participants were guided to do. Within this context, depression did significantly decrease over time. However, based on the small sample size and time taken to recruit participants (recruitment for the study ran from August 2004 until February 2005), initially after this study, a cross-sectional questionnaire study was planned instead of further longitudinal work. But based on the findings of the qualitative study (chapter 6) and an interest in pursuing exploration of the temporal relation of change in a controlled study, further longitudinal research was attempted in the end. Despite the present pilot work indicating some feasibility, the controlled longitudinal study proved unfeasible and had to be abandoned (see section 4.3.6, chapter 4).

#### *5.4.2 Future research and the controlled longitudinal study*

Little is known about the time course of psychological changes from physical activity, such as depression – i.e. the nature of change over time (Biddle et al., 2000). The findings of the present study offer some insight into the timeline of change, although insight is limited in the absence of a control group comparison. Change in depression may occur as early as the first or third weeks, and other studies (i.e. Craft, 2005; Knubben et al., 2007) provide support for early change. Notably, in the psychotherapy process literature a phenomenon termed ‘rapid response’ has been observed in relation to depression (and other conditions) in which most of the therapeutic response occurs within the first four weeks of treatment (Ilardi & Craighead, 1994; Wilson, 1999). Physical activity may also have a ‘rapid response’ effect on depression, as the both the present study and Craft (2005) found no further (significant) change in depression after the third week. Rapid response has implications for when potential mechanisms are measured. If interest is in the mediators of this initial response, this necessitates even earlier assessments of the potential mechanisms (Doss, 2004; Ilardi & Craighead, 1994). Therefore, future physical activity and depression research might measure mechanisms of change during this early period of response. Ideally, this would involve weekly measures that may be used to compare change with a ‘no physical activity’ control comparison to establish whether the changes observed in this study, especially at week 1, were due to the increase in physical activity.

Based on this, the controlled longitudinal study in this PhD was designed to include only a three week increased physical activity period with weekly assessments of the mediators to explore early change (see chapter 4, section 4.3.6.2). It was decided that a three week increased activity period may be sufficient for study mediators (of initial response) and that this may also attract more potential participants. And a ‘usual physical activity’ control comparison group was planned, in which participants maintained their usual (low level) of activity.

#### *5.4.3 Limitations*

The findings should be interpreted within the limitations of the within-subject design. It is particularly difficult to ascertain whether the early change observed in depression and the mechanisms was due to the increase in physical activity, natural changes over time or bidirectional effects. The findings should also be interpreted within the context of selective dropout from the study. The study completers engaged in more physical

activity during the week prior to entry to the study than the noncompleters, so the findings are limited to those who were more active at baseline. These individuals may have found it easier to increase their activity due to already being involved in some physical activity and may represent a particularly motivated group of individuals. Clinically, the findings indicate that it may be easier to increase physical activity among depressed individuals who are already somewhat active.

A further limitation was that there was some disparity between the baseline and screening measures of physical activity. Baseline physical activity data indicated that the participants may have been initially engaged in more physical activity than the screening form responses indicated. An improvement to the screening procedure would have been to use a more valid measure of physical activity (e.g. the International Physical Activity Questionnaire [IPAQ]; Craig et al., 2003) and this may have resulted in the exclusion of individuals who were very active. This improvement was made for the screening procedure in the controlled longitudinal study.

The sample size was too small to conduct reliable regression analyses, therefore, it was not possible to examine whether change in the mediators predicted change in depression. To do this, a larger sample would need to be obtained. It should also be considered that with a small sample the ANOVA effect sizes may have been more subject to individual influence. Examining mean changes across a group presumes that all individuals change in the same way (Tang & DeRubeis, 1999) and may be misleading if there is heterogeneity – especially in a small sample. Therefore, these findings warrant further replication with a larger sample.

A further limitation was the use of the PPA to measure physical self-efficacy. Although it has previously been used in tests of the EXSEM (e.g. McAuley et al., 1997), it may represent a poor measure of self-efficacy. Bandura (1997) cites that a self-efficacy scale should not only measure perceptions of ability, but should measure beliefs in those abilities at different levels of difficulty. The PPA does not do this. Furthermore, the PPA has recently been shown to be more a measure of self-concept than self-efficacy (Hu, McAuley, & Elavsky, 2005). Therefore, an alternative measure of physical self-efficacy should be used in future research, and this improvement was made in the design of the controlled longitudinal study and the cross-sectional study.

It is possible that the physical activity reported by the participants may not have been an accurate reflection of what they actually did, as physical activity was not monitored (e.g. with a pedometer). As there was no pressure on the participants to adhere to a particular level of physical activity, the self-report diaries may have not been subject to much distortion. However, a more valid measure of physical activity such as the Godin leisure time exercise questionnaire (Godin & Shephard, 1985) or IPAQ (Craig et al., 2003) may have provided richer exercise data - especially in terms of total energy expenditure. Future research may benefit from the use of valid and reliable measures that take into account total energy expenditure. This improvement was made in the controlled longitudinal study and the cross-sectional study.

A problem with the design of the study was the face-to-face mid-study and end-of-study meetings aimed at promoting adherence and retention in the study. In reality, convenient arrangements for the meetings were difficult to make and many participants did not attend. To aid adherence to a new exercise routine, an improvement may have been to conduct telephone calls using a frequent, low structured prompting technique (Lombard, Lombard, & Winett, 1995). This method has been found to increase adherence (Lombard et al., 1995) and was incorporated into the design of the controlled longitudinal study.

### *5.5 Conclusions*

Individuals with elevated symptoms of depression may experience improvements in depression, self-esteem, physical self-concept, physical self-efficacy and state mood when they increase their physical activity. Improvements in depression, PA, NA and self-efficacy appear to be more immediate than change in self-esteem or self-concept. Greater changes in PA than NA may be experienced in the early stages of increased physical activity, providing support that physical activity may particularly tackle the low PA element of depression. The findings suggest that self-efficacy, PA and NA may be stronger candidate mediators than self-esteem or self-concept, at least in the early stages. However, further longitudinal research using a controlled design is needed in order to confirm causal relationships between change in these variables and change in depression.

## Chapter 6

### Qualitative Study – Understanding the Process of Change

#### *6.1 Introduction*

In process research, one source that change mechanisms may be identified from is qualitative investigations of client or patient experiences of an intervention (Doss, 2004) (see chapter 3 for a discussion). The literature review in chapter 3 highlighted that there is a need for physical activity and depression research to take a qualitative approach to explore the process of change among depressed individuals with experiences of physical activity. The methodological consideration in chapter 4 highlighted the benefits of using qualitative methods in process research, including the identification of change processes and mechanisms outside of identified theoretical frameworks. Qualitative methods may also provide a richer, deeper understanding of the process of change (Faulkner & Biddle, 2004) and offer complementary insight into findings gained from quantitative research.

There has been an increasing use of qualitative methods to explore aspects of mental health enhancement through physical activity in other groups, such as those attending exercise referral schemes for physical health reasons (Crone, Smith & Gough, 2005; Hardcastle & Taylor, 2005), or to explore experiences of physical activity among individuals with mixed, severe mental health problems (Carless & Douglas, in press; Priest, 2007; Soundy, Faulkner, & Taylor, 2007). Other qualitative studies of general experiences of exercise have also highlighted some perceived mental health benefits in other populations, such as among students (Conrad, 1994) or older adults attending an exercise referral scheme (Stathi, McKenna, & Fox, 2003). Only two previous studies were found that have used qualitative methods to explore depressed individuals' experiences of physical activity (Faulkner & Biddle, 2001; Mental Health Foundation, 2005).

Faulkner and Biddle (2004) took a qualitative, longitudinal approach to focus on the experiences of three individuals with clinical depression who had been referred via mental health services to a leisure centre based exercise scheme. The study showed how the individuals' changing life circumstances over time affected their participation in the scheme, which highlights the importance of qualitative methods for clarifying contextual factors. In terms of the perceived role of the scheme in managing

depression, exercise was primarily viewed as a way of coping during recovery from depression rather than a key factor in its treatment, and the authors argued that its role in recovery was perceived to be through self-esteem enhancement. Any direct alleviation in depression immediately after exercise was viewed as transient. The Mental Health Foundation (2005) interviewed people who had upon their own initiative used exercise as a way of managing their depression and looked at themes regarding how and why people came to use exercise. People had often started to use exercise as the result of not being satisfied with the treatment they had received in primary care and saw exercise as a way that they could take control of getting better. Perceived benefits included feelings of energy and calm, self-esteem enhancement through physical improvements, and a sense that they could cope without medical or psychological intervention.

The studies above give some limited description of the perceived benefits and experiences of physical activity for depressed people, but they did not fully explore the *change process* in the way that grounded theory methods with individuals with a wider variety of experiences of physical activity would allow. Faulkner and Biddle (2004) focused on the stories of only three individuals who had more severe experiences of depression and thus the experiences of people with less severe depression may differ from this sample, especially as the majority of people with depression are treated in primary care (Paykel & Priest, 2002; Peveler & Kendrick, 2001) rather than mental health services. The Mental Health Foundation report only focused on people who had used physical activity as a management strategy of their own accord, which may mean that insight was only gained into positive experiences. To fully explore the process of change it may be necessary to access a variety of experiences of physical activity, including people who self-initiated physical activity, people recommended it by their doctor, people who attended exercise referral schemes, people with current and previous experiences of depression, and people who have been physically active for varying lengths of time. It may also be important to explore the experiences of those individuals who may not have experienced benefit (Fox, 1999), as this could provide insight into the factors associated with the process of exercise that may be related to experiencing response. The present study was designed to address this gap.

Individuals with experiences of depression or low mood took part in one-off, semi-structured interviews exploring their experiences of physical activity. A variety of



individuals were recruited, including people who were physically active to varying degrees, currently and previously depressed individuals, and participants from within and outside the National Health Service (NHS) care system. In particular, both people who had had positive and negative experiences were recruited. The aim was to sample people with a variety of experiences so that variations in the data may be explored. The focus of the study was on understanding the change *process* rather than just providing a descriptive summary of experiences. Data collection and data analysis followed a grounded theory approach, which is ideally suited to studying *process*. The aims of this study were:

- To explore the experience of physical activity and the process of change among a variety of individuals who have used it as a way of managing depression;
- To elucidate the process of change by focusing on both individuals who have and have not found physical activity beneficial for their depression.

## 6.2 Method

### 6.2.1 Ethical Issues

Ethical approval to conduct the study was obtained from the University of Southampton School of Psychology Ethics Committee (Ref: PG/03/67). To access patients from one general practice within the NHS, ethical approval was obtained from the Isle of Wight, Portsmouth and South East Hampshire Local Research Ethics Committee (Ref: 05/Q1701/100). Research Governance approval was obtained from Southampton City Primary Care NHS Trust (Ref: WHC 603).

### 6.2.2 Participants

Twenty-six individuals with experiences of depression or low mood participated in this study. The participants were recruited from a general practice ( $n = 11$ ) and non-clinical sources ( $n = 15$ ). Participants in the nonclinical sample were members of the general public, and the staff and student population at the University of Southampton, who were recruited via advertisements made at the University of Southampton, including the University gym and exercise / sports clubs, and one local exercise group. Twenty (76.9%) were women and six (23.1%) were men. The men were exclusively from the non-clinical sample. The age of the participants ranged from 21 – 65, with a mean age of 40. Twenty-one (80.8%) of the participants stated they had experienced depression at some point in their lives, while the remaining five (19.2%) felt that they had not been

depressed but had often experienced feelings of stress or low mood. Of the participants, 16 (61.5%) had been diagnosed with depression, two (7.7%) had been diagnosed with bipolar depression, two (7.7%) self-diagnosed depression (but had not received formal diagnosis), four (15.5%) self-diagnosed low mood, and whether or not formal diagnosis of depression had been made for two (7.7%) was unclear. All of the participants recruited from the general practice had consulted with their general practitioner about depression within the last two years. Of the participants, three (11.5%) had attended exercise referral schemes, three (11.5%) had been recommended physical activity for their depression by a health care professional and one (3.8%) had been recommended to do it by occupational health at work. The remaining participants ( $n = 19$ ; 73.1%) had been engaged in physical activity upon their own initiative for a variety of reasons.

Twenty-three (88.5%) of the participants reported that they had felt that physical activity had helped their depression, while only three (11.5%) had felt that it had not. However, some participants also had mixed experiences, which was not originally anticipated when recruitment began and which provided unexpectedly rich data. Table 5 contains further information about the participants.

*6.2.2.1 Recruitment.* To aid trustworthiness, it is important to provide clear, transparent details about the process of the research, including participant recruitment and sampling decisions (Yardley, 2000). Participants in the non-clinical sample were recruited via posters (see appendix O) and e-mails about the study (see appendix P). The recruitment literature stated that we were seeking to interview people who had any experience of using physical activity as a way of managing depressive feelings or low mood, and emphasised that we were equally interested in positive and negative experiences.

In the clinical sample, potential participants were selected by GPs at the practice if they were aged 18 – 65 and had consulted with their GP about depression in the last two years. The recruitment literature stated that we were seeking people with any experience of physical activity, including on the recommendation of the doctor, attendance at an exercise referral scheme or use as a self-help strategy. Potential participants were sent recruitment packs containing an invitation letter from their GP

Table 5

*Participant characteristics*

Pseudonym	Age	Occupation	Depression History	Exercise involvement	Helped? <sup>a</sup>	Recruitment source <sup>b</sup>
Margaret	48	Student	Has experienced depression since adolescence, frequently during 20s, less frequently during 30s. Last episode 5 yrs ago. Has been diagnosed with depression and previously has taken antidepressants. Not currently depressed.	Has been exercising since her 20s. Specifically started to use exercise to help her mood in her 30s. Use of exercise for depression self-initiated. Currently exercises once a day.	Yes	NC
Amy	21	Student	Experienced depression on and off for a period of 8 to 7 years.	Has been exercising for 5 years. Currently exercises 5 times a week.	Yes	NC
Geoff	52	Artist	Has had depressive feelings since childhood. Feels that his feelings of depression are 'always there below the surface'. Has never been diagnosed with depression.	Got into exercise about 15 years ago, after discovering yoga and stretching exercises. Has been 'deliberately' exercising to manage his mood for the past 10 years. Use of exercise for mood was self-initiated. Exercises every 3 <sup>rd</sup> day.	Yes	NC
Lucinda	38	Secretary	Suffered from bipolar depression since 17. Was diagnosed with bipolar 6 yrs ago. Currently taking antidepressants.	Very active. Has been involved in sport and exercise since childhood. Despite being very active, her GP told her to increase her exercise as it would help her depression. Exercises in part to manage mood.	Yes	NC
Norman	53	Careers Advisor	Experienced depression previously for a period of 2 - 3 months and it has recurred at intervals since then. GP diagnosed 'anxiety'.	Has been active since a child. Exercises every day. Exercise has always just been a part of lifestyle.	Yes	NC

Simon	44	Software Consultant	Has never been depressed, but suffers from the 'stresses and strains' of life. Experienced a period of increased stress due to difficulties at work.	Has been involved in sports since childhood. Exercises every day. Been using exercise to manage mood for the past ten years. Use of exercise for mood self-initiated.	Yes	NC
Harriet	45	PA	Has experienced depression for a greater or lesser extent for 30 yrs. Has been diagnosed with depression. Does not feel currently depressed, 'but still suffering from it'. Is currently taking antidepressants.	Active when a child. Stopped exercising from 20s onwards. Started exercising recently after GP referral to an exercise scheme. Did not find scheme beneficial. Recently started to walk and cycle to work and found it helped her mood. Now cycles twice a day.	Yes	NC
William	47	Senior Academic	Experienced depression for all of his life. "Possibly" currently experiencing depression. Has previously taken antidepressants.	Has always done sports since a child. Stopped for a period later in life after moving and starting a demanding job. Recently took up various sports again. Is very active. Has specifically been using exercise to manage depression for about a year. Use of exercise self-initiated.	Yes	NC
Mark	25	PhD Student	Has been diagnosed with manic depression. It comes and goes.	Has been involved in exercise for the past five years. Usually exercises for 2 hours a week.	Yes	NC
Tim	31	PhD Student / Navy Officer	Has felt negative mood due to being under pressure for past 6 years.	Began exercising when he joined the Navy at age 13. Has been specifically exercising to help his mood for the past year, since he realised it helped. Exercises for 1 hr every day.	Yes	NC
Mary	29	Administrator	Between the ages of 16 – 20 – a four year period	Been exercising since age 16. Was not consciously exercising to help mood. Currently exercises 2 – 3 times per week for 1.5 hrs per session.	Yes	NC

Sally	28	P/t employed, p/t student	Does not consider self to have been depressed, but has suffered from low moods for over 10 years	Been exercising for under a year. Exercises twice a week for 40 mins per session.	Yes	NC
Liz	48	Full-time student	Has experienced low moods on and off for 20 years	Been exercising for the past 30 years. Exercises daily.	No	NC
Celia	38	Community Mental Health Nurse	Been treated for depression several times – last episode lasted 3 months. Currently taking antidepressants.	5 years regularly – but was involved in exercise before that too. Exercising for mood has become more of an important factor in the last two years. Exercises 3 days per week.	Yes	NC
Sharon	27	Homemaker	8 years on and off (it comes and goes). Currently experiencing depression – but not severely.	Only started to exercise recently, for a period of 3 – 5 months. Does not exercise to help mood – exercises for weight loss. Not currently exercising.	Yes	C
Olivia	27	Waitress	Has experienced depression on and off since 19-years-old	Has been exercising for under a year. Runs on a treadmill at home everyday. Uses exercise to ‘control’ depression	Yes	C
Elizabeth	50	F/t student and p/t Counselling Psychologist	Was previously depressed – experienced depression for most of childhood, experienced depression on and off as an adult. Has had two major bouts. Found meditation eventually helped her move away from depression.	Likes being physically active – exercise has always been incorporated as part of lifestyle.	No	NC
Kathryn	37	Funding Assistant for a charity	For about 25 years – since childhood. Currently taking antidepressants.	Been involved in exercise since starting referral scheme two years ago. Stopped a year ago for health reasons, but currently walks a lot.	Yes	C
Mandy	43	Book-keeper	Has experienced depression for 9 years.	Started going to the gym with friends during one episode of depression. Eventually used exercise as a way of fighting her depression without antidepressants. Is not currently exercising.	Yes	C

Heather	54	Housewife	Has experienced depression for 7 years. Is currently depressed and currently taking antidepressants.	Has been exercising for the past five years. Exercise suggested by occupational health at work to help depression. Walks dogs every day.	Yes	C
Rose	65	Pharmacy dispenser	Experienced depression for 3 years on and off. Is currently receiving treatment for depression.	Started to exercise a couple of years ago to lose weight. Walks on a treadmill at home every day.	Yes	C
Felicity	44	Home schools son	Has experienced depression for 11 years, and is currently taking antidepressants.	Exercised until 20s and then not so much after that. Was referred to an exercise scheme a couple of years ago for depression - had a negative experience. Has just been referred again recently because of her weight concerns - has just started scheme.	Yes	C
Tracey	36	Part-time Care Assistant	Experienced depression for past 5 or 6 years periodically. Considers self to be currently depressed and is receiving counselling and taking antidepressants.	Has exercised all of life, except for 2.5 years after daughter was born. Recently started again. Plays netball twice a week, 2 hours training and 1.5 hours for the game.	No – but influenced decisions to get over depression	C
Sarah	39	Sales (part-time)	Current episode has lasted for a month, but has had depression on and off for years. Currently receiving counselling and taking antidepressants.	Went swimming for a six wk period 2 yrs ago during one episode of depression. Does not currently exercise.	Yes	C
Margo	49	P/t Local Government Officer	Chronic period of 4-5 months. Currently taking antidepressants.	Has been exercising for the past 18 months, following the recommendation of her GP and counsellor. Exercises every day.	Yes	C
Sophie	29	Claims Advisor -	Has been experiencing depression for approx 2 years. Currently taking antidepressants.	GP recommended exercise for her depression, but she did not do it. Started going to the gym to lose	Yes	C

Insurance

weight. Has been exercising for about a year.

Goes to the gym once a week and walks to and

from work for about an hour a day.

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<sup>a</sup>“Helped?” = participant’s overall evaluation of whether exercise has helped their depression. <sup>b</sup>“NC” = non-clinical sample, “C” = clinical sample

(appendix Q), an information sheet about the study (appendix R), a copy of the consent form (appendix S), a reply slip and reply envelope. If the individual was interested in taking part, they returned the reply slip and the researcher then contacted them to discuss the research and arrange an interview. The recruitment literature for this group stated the purpose of the study was to explore and understand the experiences of people who have tried exercise to help overcome feelings of depression. Again, it was emphasised that we were interested in positive and negative experiences.

*6.2.2.2. Sampling.* In grounded theory, data analysis and data collection proceed as a parallel process (Charmaz, 1995; Charmaz, 2006; Henwood & Pidgeon, 2003; Pidgeon & Henwood, 1996). As data analysis progresses, further sampling needs are determined by the ongoing analysis (see Chapter 4 for a detailed discussion). The initial phase of a grounded theory study involves speaking to anyone who has any experience of the area of interest (Chamberlain, Camic, & Yardley, 2004) and collecting rich data that reflects the broad area (Pidgeon & Henwood, 1996). The present study began by recruitment of participants who had *any* experience of physical activity and depression. These participants were drawn from a convenience sample of individuals from the non-clinical sources (as ethical approval was pending for the clinical sample). Although the aim of initial recruitment is to open up the study and start data analysis, Chamberlain et al. (2004) state that it can be useful to purposively sample people that cover the scope of the individual characteristics that may be relevant. In the present study, the aim of the initial sampling was to recruit participants to cover the following characteristics considered relevant: people who had only just started to be physically active and people who had been long-term physically active; people who were currently and had been previously physically active; people who were currently and had been previously depressed; and, people who had found exercise to be helpful and people who had not. As the initial analysis progressed, participants were purposely sampled on the basis of these characteristics. For instance, initial recruitment resulted in a number of people who had been physically active all their lives, so further participants were selected on the basis that they had more recent experiences of starting to be physically active. This also formed part of the theoretical sampling, as a category relating to motivations for physical activity emerged during



analysis of data from the longer-term active people and prompted a need to speak with people with more recent experiences of becoming physically active.

Participants drawn from primary care with recent experiences of depression were recruited mid-way through the analysis (January 2006). Participants were drawn from both clinical and non-clinical populations, so that comparisons and contrasts could be made between the experiences of the groups. It was anticipated that recruitment from these two sources would contribute greater diversity in terms of depression experience, socioeconomic status and accessing experiences both within and outside of the NHS care system, aiding transferability of the findings. As the clinical participants were recruited mid-way through the analysis, this meant that categories developed from the initial non-clinical interviews could be subject to verification and further development in a different group.

Part way through the analysis, sampling resulted in a bias towards participants with positive experiences. To try to obtain participants with negative experiences, recruitment efforts with literature making explicit reference to our wish to interview people with negative experiences were made (see appendices T and U). This resulted in three participants contacting the researcher. Data collection ceased when category saturation was reached.

### *6.2.3 Interviews*

Individual, one-off, semi-structured interviews (Smith, 1995) were used to explore participants' experiences. A topic guide was used to probe areas related to the research question. The interview questions covered participants' current and previous involvement in physical activity, how they came to use physical activity to manage their depression, experiences of beginning to be physically active, the physical, emotional and mental experience of physical activity, the experience of keeping it up over time, and thoughts and beliefs about the role that it had played in the management of their depression (see appendix V for a copy of the initial interview protocol). Open ended questions were used (Smith, 1995) and the researcher followed up issues that emerged during the interview (Charmaz, 2006). As data analysis proceeded, the topic guide was altered to focus on the emergent categories of interest (Charmaz, 2006; Charmaz, 1995; Henwood & Pidgeon, 2003).

Interviews were conducted between August 2005 and May 2006. Where possible, interviews were arranged so that there was a sufficient gap between them for the analysis of previous interviewees' data so that the ongoing analysis informed the collection of further data. Interviews were conducted either in a room at the University of Southampton or at the doctors surgery, depending upon the participants' preferences.

At the beginning of the interview, participants were told that we wanted to find out about their experiences of using physical activity for their mood. As analysis progressed, it became clear that not all of the participants 'used' it as such to manage their moods, so the opening line was altered to state that we were interested in their experiences of physical activity and depression and whether they felt that it had had any kind of impact on their depression.

Written consent to take part was obtained before the interview began, including consent to audio record the interview and quote verbatim in reports (see appendix W for the information sheet and consent forms for the nonclinical sample, see appendices R and S for the clinical sample). All participants gave consent for the interviews to be recorded and for their quotes to be used. All interviews were transcribed verbatim and the transcripts were used for data analysis (see appendix X for a copy of the transcription protocol).

Written field notes kept by the researcher were also submitted to the data analysis process, as often participants talked further about their experiences after the interview had formally ended and the tape-recorder had been switched off.

#### *6.2.4 Data Analysis*

Grounded theory methods were used to analyse the data. The research was conducted from an interpretive, constructionist epistemological perspective and data analysis was guided by the procedures outlined by authors within this approach (Charmaz, 1995; Charmaz, 2006; Henwood & Pidgeon, 1995; Henwood & Pidgeon, 2003) (see chapter 4 for a discussion). Data analysis started with the analysis of the first interview conducted.

Analysis began with the open coding of the interview transcripts. Codes were assigned to each meaning unit within the text to reflect the meaning or concept contained in it. Earlier

coding attempts were revised in an iterative fashion and eventually reflected both more action-oriented and *in vivo* codes, which are advocated at this substantive level (Chamberlain et al., 2004; Charmaz, 2006). This phase of the analysis also involved listening to the tape recordings and reading through the transcripts to become thoroughly immersed in the data (Chamberlain et al., 2004). The method of constant comparison was employed to compare instances within and between cases, and codes to other codes. As the analysis progressed, focused coding of the central and most frequently occurring codes took place to identify categories in the data (Charmaz, 2006; Henwood & Pidgeon, 2003).

Strauss and Corbin (1990) suggest that the next stage of analysis should be axial coding whereby an analysis framework is used to specify the properties and dimensions of a category. However, this can impose a pre-defined framework on the analysis, and Charmaz (2006) suggests that researchers who can tolerate ambiguity in their data should skip this phase and follow-up the leads suggested by the data itself. Thus, in this analysis, axial coding was not used. Finally, theoretical coding was used to explore the relationships between the categories and sub-categories identified during focused coding to move the analysis to a more theoretical level (Charmaz, 2006). Categories were re-sorted and graphical techniques (e.g. diagramming) were used to create conceptual models of the analysis (Charmaz, 2006; Henwood & Pigeon, 1995).

Throughout the analysis, theoretical memoranda were written in which I recorded and explored thoughts, theorising and emerging conceptualisations relating to the data (Henwood & Pigeon, 2003). These memoranda also served as a place where I kept an ongoing reflexive diary as the analysis progressed. As well as helping to develop conceptualisation of the data, memos can act as an audit trail for the analysis.

#### *6.2.5 Trustworthiness*

The trustworthiness of the results was enhanced by the use of reflexivity, checking for internal coherence (deviant case analysis) and reader evaluation (see chapter 4 for details).

*6.2.5.1 Reflexivity.* As researchers, we seek to understand and present ‘truths’ about the world in which we live. Yet we may only be able to provide an interpretation of reality, constructed through our own interactions with the research process (Charmaz, 2006; King,

1996). The analysis I present here may be partly shaped by my own ideas, preconceptions and interactions with the data and the research participants. While I cannot put aside what I brought to the research process, I can make plain the position from which I approached the analysis so that the reader may evaluate the interpretation offered (Madill et al., 2000).

I came to this research with the perspective that physical activity is a *really very good thing indeed*. I believe in a strong link between the mind and the body. I believe that what we do with our bodies affects how we think, feel and who we are. I have a negative view of antidepressants, because I see depression as being more than a biological condition. People encounter difficulties in life, often arising from difficult situations or unfortunate circumstances, and I question how passively taking a pill may be of any benefit. My perspective on mental health very much reflects the positive psychology movement (Seligman & Csikszentmihalyi, 2000). I believe that positive mental health partly comes from being active and involved in life, and I see physical activity as a part of this. People cannot be happy all the time, but living as positive and as involved a life as possible (given circumstances) may help smooth a bumpy ride. From this perspective, I see physical activity as a natural, empowering and positive intervention for depression.

When analysing the transcripts, I could see how my positive bias may have sometimes affected my questioning and participant responses. Initially, I did not always pick up on or fully explore more negative experiences. Although sensitive to people's meanings, I also found it initially difficult to leave psychological concepts and the mindset of a quantitative researcher behind. This affected my questioning at times (i.e. inviting abstract answers rather than 'story telling'). When the issue of the importance of being active in helping to ease feelings of depression came out in the analysis, I had to be especially wary to 'flip-flop' between my own views and the data (Henwood & Pidgeon, 1995). In fact, the participants' accounts taught me more about this, in that being active in itself may not be the important element, but for the activity or involvement to be *engaging, pleasant or enjoyable*. I provide the reader with my position and the participants' own words, so that they may make their own interpretation.

Reflexivity also involves taking into account how, as a researcher, I presented myself to the participants (King, 1996). I always described myself as a student when introducing

myself rather than as a “researcher”, to minimise any perception of myself as an ‘expert’. I am a moderately physically active person, so I am neither very serious about sport nor entirely inactive, which I feel placed me well to develop rapport and shared empathy with participants with all kinds of physical activity experiences.

### 6.3 Results

#### 6.3.1 Overview of Core Category: *A forward movement into life*

Figure 3 summarises the analysis, the categories identified and the relationships between the categories. In terms of the meaning of physical activity, it represented taking a forward movement into life for people when they were depressed. It brought a greater sense of engagement in and with life which was in contrast to the feelings of disconnection often experienced with depression. ‘A forward movement into life’ encompasses many other aspects of this analysis too. Taking steps to become more involved in life or participating in or engaging in activities was experienced by some to be an important part of moving away from depression - at least temporarily and, for some, in the longer-term. Physical activity was seen to be a part of this for some. For others, including those who had not experienced benefit from physical activity, examples include meditation, going back to work or meeting up with friends. ‘A forward movement into life’ reflects that it may not just be meaningful to feel more involved in life, but also that the involvement or activities may need to be enjoyable, pleasant or engaging to be of benefit.

‘A forward movement into life’ also encompasses how embodied experience and knowledge may be a fundamental part of the process of change in physical activity for depression. Human experiences and interactions with the world are characterised by perceptual, sensory, bodily and emotional responses (Ignatow, 2007). People come to know their worlds through their bodily involvement with and sensory and emotional responses to it. Therefore, knowledge is not just a disembodied, cognitive based phenomenon, but is fundamentally based on emotions and bodily experiences (Ignatow, 2007). People’s own embodied experiences inform their knowledge about the world. The participant’s own direct interactions with the physical activity context in terms of affective and bodily responses to it (particularly, feelings of enjoyment) were a significant part of the change process. These embodied experiences appeared to influence perceptions of benefit, changing motivations (i.e. moving from ‘having to’ do it to ‘wanting to’ do it) and

## A Forward Movement into Life (core category)

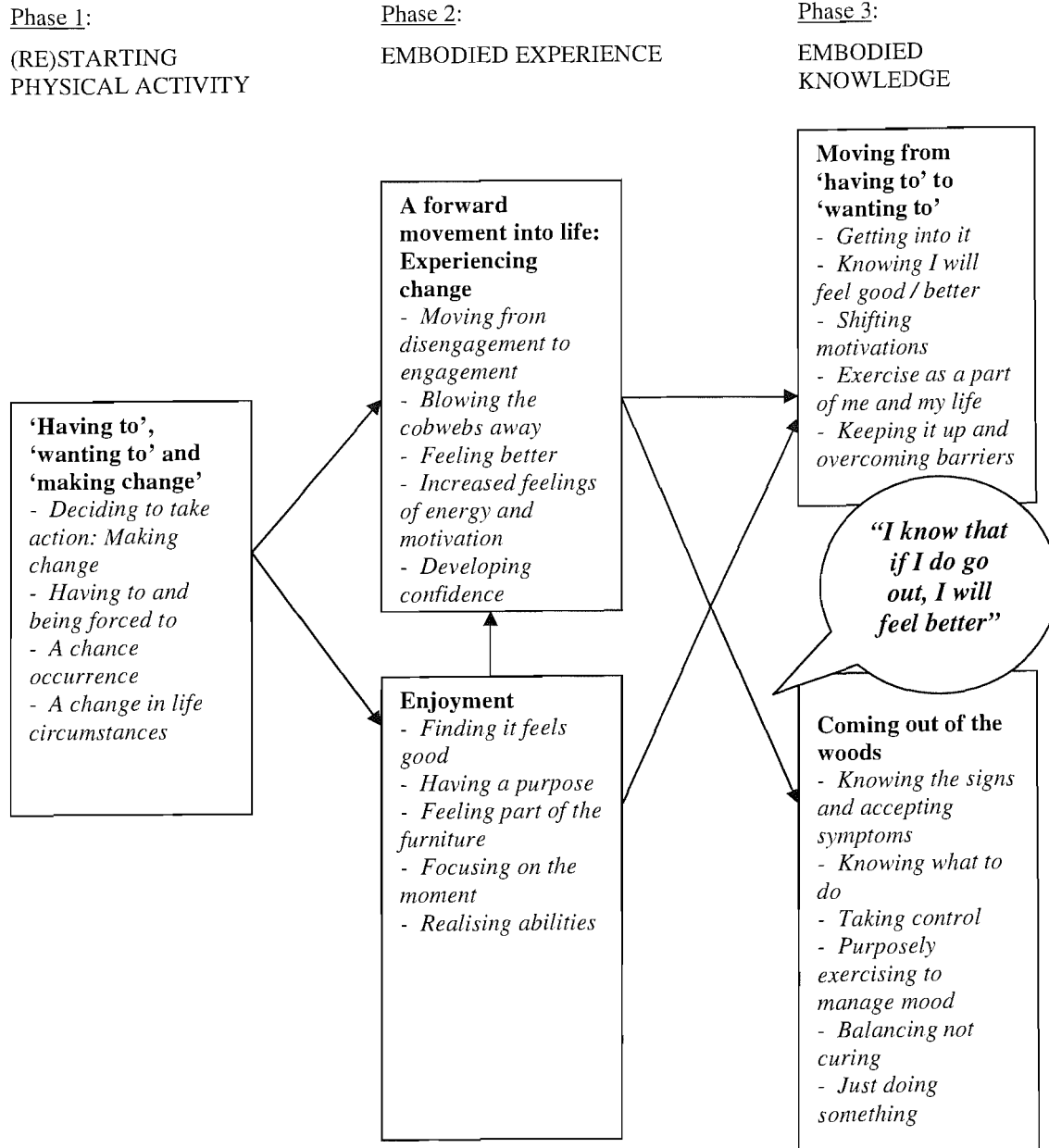


Figure 3. The process of change in physical activity for depression: overview of analysis, categories and their inter-relationships.

a movement over time for some towards using physical activity as a way of self-controlling moods. It was also through embodied experience of depression that some people came to 'know' their depression over time and began to take more control of it. Embodied experience and knowledge appeared to be a fundamental aspect not only of the process of change in physical activity for depression, but also in people's overall experiences of and movement away from depression over time.

'A forward movement into life' also captures how the experience of depression was inseparable from the body for these participants. Depression experiences were often described in relation to the body and physical sensations, such as a lack of movement. 'A forward movement into life' reflects that the experience may be one of making a physical, as well as a mental, step into life. Given that the body is always present in all human experiences and interactions with the world, it may be argued that the 'Cartesian' notion of a mind-body split is an impossibility: all experience is embodied (Yardley, 1999). Depression may be a bodily, as well as a mental, experience – and the two may be intertwined. The first phase of the process of change was (re)beginning to be physically active.

### 6.3.2 '*Having to*', '*Wanting to*', and '*Making change*': (Re)starting

Although we initially advertised for participants who had used physical activity as a way of managing their depression, it soon emerged from the earlier interviews that a variety of reasons had brought people to be physically active during periods of stress or depression. These motivations were often not linked to their current feelings of depression, but were linked to their greater life contexts or experiences of physical activity across the lifespan. Most were initially unaware of any link between physical activity and mood or mental health benefits. This initial unawareness and the reasons that brought people to be physically active provide an important contextual background to the process of change - for this reason they are described next in more detail.

There was wide variation in the extent that people had been involved in sports and exercise during their lives. Lucinda stated "I'd always been sportive" while Sophie said, "I'm not completely sport minded or particularly active". These self-statements mirrored varying degrees of personal engagement with physical activity that had developed from

experiences across the lifespan. Level of personal engagement was reflected in the differing motivations people had for being physically active. Motivations ranged from external factors, such as having to walk the dog or a wish to lose weight, to factors intrinsic to the activity itself, such as enjoyment or a wish to improve abilities. Mark said, “mostly I do it because I enjoy it”. At the theoretical stage analysis, this spectrum of motivations was found to map onto the range of extrinsic to intrinsic motivations for behaviour outlined by self-determination theory (Ryan & Deci, 2000). In this analysis, these different motivations are therefore referred to as ‘intrinsic’ and ‘extrinsic’ motivations. These motivations emerged as an unexpectedly important part of the process of change. There was a perception that for continued benefit, physical activity needed to be maintained, so the motivations that people had were important. Therefore they are defined below.

At the most extreme end of extrinsic motivation there was a sense of disconnection with physical activity. It was not seen to be important, people did not self-identify as ‘exercisers’ and even a “hate” (Sarah) was reported. For these people physical activity was prompted and maintained by external factors (e.g. weight loss). At the most extreme end of intrinsic motivation people tended to see physical activity as important and a “love” (Tim) was mentioned. These people tended to see it to be very much a part of themselves and their lives. Elizabeth said, “I mean I would never live a life ... where I didn’t do that sort of stuff, you know”. Intrinsically motivated people tended to be physically active because they *wanted* to rather than because they *had* to. Most people’s initial involvement in physical activity in life was prompted by external factors (e.g. having encouraging parents, walking with a grandfather in the countryside, being made to do it in school). For some, through positive, embodied experiences, a personal engagement and move towards intrinsic motivations developed over time. This was important in the process of change, because people who were intrinsically motivated tended to be more self-regulative in maintaining physical activity and overcoming barriers.

Despite these different motivations, physical activity over the lifespan was characterised by stops and starts. Even when people had somewhat intrinsic motivations, life circumstances such as moving or starting a new job often resulted in physical activity being ceased. Similarly, people’s reasons for (re)starting, both at points over the lifespan



and during periods of depression, were often weaved within their greater life context or life circumstances at a particular time. Starting to be physical active (again) was often prompted by external life factors:

KW: Um, so to start with, um, you mentioned in your e-mail that you started going to the gym for a period of three months. Um, can you tell me a bit about that?

P: It wasn't initially for ... the treatment of the depression, I was never advised to take it, it was purely because I felt I needed to, to lose some weight and get a bit fitter so I could do more things with the kids. (Sharon)

Sharon's motivations demonstrate one theme in reasons for people becoming more physically active: a conscious decision to take action over some part of their lives and a desire to make change. Often this resulted from having reached a critical point which prompted a need for action. Making change was frequently related to wanting to feel better about themselves in some way, such as getting healthier or losing weight. As William said, "The general idea was to sort of make me feel better about myself".

While for some a (re)turn to physical activity was prompted by a desire to make change, a number of other participants did not make a conscious decision to get started. Instead, initial involvement was characterised by *having to* do it; for instance, having to cycle or walk to work, being told to do it by the GP or being made to go by friends:

KW: What kind of prompted you to start exercising?

P: Just friends really, just they wanted to go to the gym. Um, I think basically what they were trying to do was just to keep getting me out, you know, to introduce me to different things, just to give me motivation otherwise I would have just sat in bed all day, so ... um ... yeah, basically it was just friends. (Mandy)

For others, (re)starting was a chance occurrence that came about through other circumstances or knowing other people involved in exercise:

it must have just been by chance that, erm, I knew somebody ... who, erm, became a yoga teacher, this was in the late 1970s, somebody who happened to be sharing a

house that my partner was in at the time, and, er, I, we went to her yoga lessons just to sort of give her a bit of support (KW: Mm) because she was starting off, but, erm, found that it was quite good. (Geoff)

It is important to note that most of the participants' participation in physical activity was either a continuum of previous exercise habits or a new period of exercise which happened to coincide with an episode of depression. For people who were extrinsically motivated, external prompts were an important part of getting started (again) and maintaining activity. Most of the participants were initially unaware of the mood and mental health benefits, and even experienced exercisers stated that they were not aware of any mood effects of physical activity until they started to experience stressful or difficult times.

### *6.3.3 A Forward Movement into Life: Experiencing change*

While an increase in physical activity during periods of depression was often prompted by external factors in the greater life context or a continuation of normal habits, some people reported gradually becoming aware over time that it helped their depression. This awareness arose from embodied experiences of change in their moods, feelings and symptoms with engagement in physical activity. The changes experienced by the participants are outlined below. The meaning of physical activity in the lives of many of the participants was that it brought a sense of a forward movement into life, moving them away from feelings of disengagement to a greater sense of engagement in life and the immediate situation.

*6.3.3.1 Moving from disengagement to engagement.* Experiences of depression were characterised by feelings of disengagement and dissociation from life and the immediate situation. People described lives that were to some extent isolated or had experienced a loss of a sense of engagement with life:

I've always been in-between times, an incredibly positive and buoyant and ... you know, kind of outward going person, so ... um, it's always been part of who I am in terms of active and doing things, and interested in life, and the depression just came in and kind of crushed that all out of me. (Elizabeth)

People became housebound, found it difficult to be motivated to do anything and experienced overwhelming feelings of lethargy. Margaret said: “what happens with me when my mood becomes low is that I become very inactive [...] in the periods when I’ve been depressed I’m the sort of person who just closes down completely, I can sleep a whole day”.

Although functioning was affected to varying degrees, the depression experience as a whole was typified by a movement towards an inward-focused, dissociated state – a sense of being removed from life. Tracey said “the depressive feelings I have is what I call a total drowning, whereas ... in a matter of twenty-four hours I become totally introverted [...] it’s like somebody has put a bag over your head”. There was a sense of disconnection from the immediate situation. Elizabeth described going “through the motions” of daily life in a “completely unaware, unconscious state”.

What was striking was that the feelings of disengagement were not just a mental experience, but were also described in physical, bodily terms:

For me, it becomes like I say, like a bag, like a cloak where you just personally, I sink and I physically can just curl myself up, I have become totally, at times, totally lethargic ... um ... there have been days where I’ve just not wanted to sort of get off the couch. (Tracey)

There was a disengagement of the body. Mark said: “You sort of feel almost disabled when you’re depressed, sort of it’s difficult to, to move”.

Physical activity was experienced as a transformative process, which took people both temporarily and in the longer-term away from the disengaged, dissociated state of depression towards a greater sense of engagement with and in life. This involved not just a mental engagement, but also involved an engagement of the body. Margaret said: “if you are feeling quite isolated and not very good at talking with people, exercise is something that you can participate in, and that, you’re just using your body”. She later said:

so for me where I'm so stuck inside myself and, physically I, you know, I have terrible inertia so it's, it's like a forward movement into life, you know, I am actually having to change the physical [laughs a little] position, even, something as simple as that. (Margaret)

Just getting out of the house and *doing something* were experienced to be an important part of moving away from the depressed state, even if only temporarily. Being out and around others, even if not directly interacting with them, was sometimes experienced to be beneficial. Being outside, around nature was also experienced to be beneficial, providing a shift to a more outward focus on life:

Well I think I've noticed nature more [from getting out and walking the dog] ... and as a result I've done a lot more in our garden and being outside in the garden helps me as well. I've done quite a lot of digging and rearranging the garden, um, you know, just literally being outside has helped, with fresh air and listening to the birds and looking at the sun and the flowers. I mean, I've been much more aware from that point of view. (Heather)

For some, exercise was experienced as a way of getting back to or maintaining a sense of a normal life:

as I say, in a period of two-and-a-half years, I went from being happy, active, in a job, to being the complete opposite of everything that I had known for ... hence, where, to get myself back, I started the sport again [...] like I say, I've ... just in a small part I've found myself, um ... that, you know, that side of me (KW: Uh huh), and as I say, it's like this little arm is sticking up and saying Tracey is still here. (Tracey)

Celia said, "You know, there's a sense of achievement, 'oh, I've done something that I normally do'".

Experiencing a sense of achievement from exercising was frequently reported – not just a sense of achievement from seeing, for instance, improvements in fitness or ability, but also

a sense of achievement from having done something during the day, rather than doing nothing. Attending an exercise referral scheme or leaving the house were mental achievements in themselves for people who found it difficult to be around others or perform any activity when depressed.

Physical activity was experienced as a movement away from an inward to a more outward focus. People found that it helped them move from being inside their heads with revolving thoughts to a greater sense of being in the here-and-now. Part of this was having to focus on something else, such as the positioning of the body during yoga or balancing while skating:

you focus on something else [during yoga] and it kind of, again, it allows you to ... sort of focus in, in on yourself in a positive way and ... you know, leave everything behind and just almost like have a respite from it (KW: Mm-hm) especially when, you know, you've got, like, crap going on in your head. (Celia)

*6.3.3.2 Blowing the cobwebs away.* Many people reported feeling physically and mentally 'clearer' or 'freshened up' as a consequence of physical activity. Harriet described it as a process of "blowing the cobwebs away". People often felt that they had 'clearer heads' and experienced a greater sense of engagement with the immediate situation. There was a shift in focus to more pleasant things in the here-and-now:

If I am feeling fed up and a bit down, it gives me space and time ... to think, just to look around me, erm, and clear my head, clear my thoughts. So I feel, and there's always something that happens on the way to work, I'll either see something or I'll say hello to somebody or someone's dog comes up and makes a fuss and says hello. So I get to work and it's been a pleasant experience, um, and my, my form of depression I feel that, um ... the good things get absorbed quickly and sort of dissipate, but the bad things linger. So if I have these, these nice little things on the way to work, I start the day in a good frame of mind. (Harriet)

Physical activity was experienced to be "uplifting" (Margaret) and made people "feel so much better about life" (Amy).

*6.3.3.3 Feeling better.* ‘Feeling better’ was a phase that was frequently used to encapsulate the experienced short-term and long-term benefits of physical activity. During periods of increased physical activity people reported feeling generally better in themselves, feeling better about their lives, feeling fitter, happier and that moods were generally improved. People found that their sleep improved and that it was easier to get up in the morning. Physical activity was experienced to release feelings of tension and anxiety, and resulted in greater feelings of calm:

I find if, erm, I’m regularly exercising, I just feel ... calmer and sort of ... I’m ... less aware of my body being there, it feels like it’s just, (happily) there, it’ll do what I ask of it ... whereas otherwise it sort of feels ... sort of, trapped. (Mark)

In particular, immediately post-physical activity people reported feeling simultaneously calmer, having a clearer head, refreshed, relaxed and invigorated:

I felt sort of like, um ... as I was exercising I was gradually getting more, um ... it’s difficult to describe, maybe relaxed in a way but also invigorated at the same time, sort of, like, tensions, tensions easing, easing off in certain ways, sort of, um, generally my muscles relaxing also, signs of the tension going. (Mary)

Sharon said: “your mind just clears cause you’re completely focused on what you’re doing (KW: Mm-hm), and you just feel so mind refreshed, body refreshed and relaxed when it, when it is time to go”. Physical activity also provided people with a good, physical tiredness as opposed to the mental tiredness that accompanied depression. Lucinda said: “if you’re depressed, you feel tired all the time, if, if you do physical exercise you feel physical tired but not mental and that’s a big difference”. These feelings were summarised as the ‘good’, ‘pleasant’ feeling that was often experienced post-physical activity. It is notable that many of these feelings were described in a bodily, physical sense – mood was not just a mental experience.

*6.3.3.4 Energy and motivation.* Notably, people reported experiencing greater feelings of energy and motivation both during periods of regular physical activity and immediately

after physical activity. Kathryn said “I had so much energy” and Olivia said that she felt “more lively, I felt more, more alive ... I think ... like afterwards, after the exercise”. Mark said: “if I’m depressed, I feel that I need enormous amounts of willpower for some time before to build myself up to the smallest things, and, er, after exercise I feel that I have that motivation”. This was in direct contrast to the feelings of lethargy experienced with depression. Although there were differing perceptions regarding how long such feelings lasted, many people felt that they generally had more energy in their daily lives during the times that they were physically active. In particular, they reported an increased amount of activity in other areas of their lives, such as increased efforts to see friends or doing more with the children – activity seemed to breed activity. This was another way that physical activity seemed to be experienced as a forward movement into life:

Erm, I feel more energetic, erm, generally speaking. Erm, before I started cycling to work, you know, when I used to drive, I would get home and just slump in a chair [...] so when I get home in the evenings now, I’m far more inclined to go and do something like ... go out in the garden for an hour and do some gardening or go and visit somebody after work. You know, I do sometimes cycle down to friends’ houses straight from work rather than just going home and slumping. (Harriet)

*6.3.3.5 Developing confidence.* For some, a further way in which physical activity was experienced as a forward movement into life was through increased feelings of confidence. Kathryn, who stated her depression partly centred around finding it difficult to be around other people, attended an exercise referral scheme and said, “it gave me confidence I didn’t have before in myself”. People surprised themselves with what they were able to achieve, both physically and mentally. For some, attending a referral scheme or taking part in exercise were achievements in themselves which contributed to greater feelings of confidence. For others, exercise was part of other life experiences that made them realise that they were more capable than they thought and, in some cases, led to efforts to make other life changes. Amy felt that leaving home and becoming more independent had helped her move away from depression over time. She said:

I went to [another country] as an exchange student when I was like sixteen, but I think that it was really a big thing to just like pack up and leave, and I don’t really

know if that has much to do with like just exercise, but I'm sure, like, it was part of all the things that were going on in my life that I realised that I can actually do, like, things. (Amy)

For some, the realisation of abilities contributed to changing views of the self. This was predominantly a shift towards beginning to develop an identity and confidence as an exerciser:

I always thought of myself as a very ... uncoordinated, clumsy little blob [laughs slightly] that could, that could never do any exercise [...] and I suddenly thought, no, actually I'm quite fit and I actually, in fact it turned out that I was fitter than most people within half a year or so and so, yeah, it just made me feel, yeah, 'I've made up for this, I'm not, I'm not, after all, that little sluggish blob.' (Mary)

#### *6.3.4 Enjoyment*

Although most of the participants experienced some change with physical activity, perception of benefit appeared to be dependent on the degree to which people had found it to be an enjoyable or engaging experience. Although making a forward movement into life represented making a step away from depression, it was not enough if the experience was not pleasant. People who found exercise enjoyable often talked about, for instance, getting a "buzz" or experiencing "moments of beauty". An example of a more disengaging experience was one in which people found it to be "boring". These embodied experiences of physical activity appeared to be a crucial aspect in whether people experienced 'feeling better'. Sarah went swimming for a period during one episode of depression, but found it to be a disengaging experience and perceived little benefit for her depression. Sarah said: "I can't say that it had a dramatic effect on lessening the depression, nothing that I noticed, (KW: Uh huh) as I said, it was just a diversion but it was a bit of a boring diversion". She ceased swimming after just six weeks. These embodied experiences, both during periods of depression and across the lifespan, also appeared to influence the extent to which physical activity was maintained and the development of a personal engagement with physical activity over time (i.e. a movement towards intrinsic motivation). Negative experiences could become barriers and result in cessation. It is important to note that individuals reported a variety of positive, negative or mixed experiences over the lifespan



or in relation their depression experiences, rather than uniformly good or bad. Even when people had previously been put off physical activity by negative experiences, a personal engagement developed later for some with more positive experiences. Key elements of an enjoyable or engaging experience were finding that it felt good, having a purpose, focusing on the moment, discovering personal abilities, and finding it to be a pleasant and comfortable experience.

*6.3.4.1 Finding it feels good.* Finding it felt good encompassed enjoying the physical sensations of physical activity and how the body felt:

also the nice thing about swimming is the breathing as well, and I think that is why I like yoga, 'cos I am co-ordinating ... regular breathing, and breathing quite deeply (KW: Yeah), so I'm sure that, I'm sure that has some good effect on me, but, that I, I just I like that. (Margaret)

People who had started to increase their physical activity due to initial external prompt factors often expressed finding it felt good as a *personal discovery*:

I found out that you have these muscles inside your abdomen (KW: Mm) that hold your spine up (KW: Yeah), and it's, I found that I could improve my posture and, I found that it also felt quite good. (Geoff)

As with others, this represented the start of a personal engagement with exercise for Geoff.

The physical sensations of physical activity were an important part of the embodied experience. Feeling physically uncomfortable or not enjoying the sensations resulted in a less engaging experience. Felicity, attended an exercise referral scheme twice, and first time round did not experience benefit. She had health problems which she felt the instructors did not take on board. She said:

They put me on an exercise bike ... my back hurt and when I said, 'can I go on the comfy seat', one with a back support added on, um, the answer was 'no because it's not been ticked off on your form that you need that' (KW: Right). Um, and the

cross trainer was the xxx but they just said it was because ‘you’re not used to doing it and if it hurts, surely you need to do it a bit more gently’ (KW: Yeah), and that was the bit, the degree that it was affecting me, I don’t think that it was taken on board at the time. (Felicity)

In the end, a problem hernia had recurred and she was convinced that the exercise had caused it. She did not experience any benefit for her depression and ceased to go. A couple of years later, Felicity attended the scheme again, and this time they had a swimming pool option which she found to be more physically pleasant: “I’ve been to their swimming ... um ... class, the aerobics in water (KW: Yeah) which is really quite pleasant, you are working hard but it doesn’t, you don’t go all hot and sweaty cause you’re in cool water”. This made a difference, and she found the exercise to be more positive and beneficial.

*6.3.4.2 Having a purpose.* Having a sense of purpose to the exercise also contributed to a more enjoyable, engaging experience. For instance, having goals (such as training for a sponsored walk or trying to run to a certain point in a certain amount of time) and a reason for the exercise (such as getting to work) could make exercise more engaging. Finding exercise rewarding and gaining a sense of achievement were also factors that contributed to an engaging experience.

*6.3.4.3 Focusing on the moment.* An enjoyable exercise experience was also one in which people’s awareness was focused on what they were doing, the exercise itself or their surroundings. An engaging experience was characterised by a focus on the moment and a sense of being in the here-and-now. Although Elizabeth had been physically active all her life, during periods of depression she did not feel that it provided any benefit:

sometimes the depression would actually ... deepen while I was out walking because I would be so lost in my thoughts; instead of being mindful about what was around me, enjoying the surroundings, I’d, I’d go out and sort of be walking and almost be unaware of what was around me because, um, the walking would be automatic and I wouldn’t really feel it. (Elizabeth)

*6.3.4.4 Realising abilities.* Seeing improvements in fitness and ability also contributed to an engaging exercise experience, providing a sense of satisfaction. Although initially prompted by external factors, a level of personal engagement with exercise also developed for some as they realised they had capabilities that they did not previously think they had:

And then I did track when I was in [another country] and I actually had to compete, and it was, like, I first was like ‘Oh, I’m not, I don’t want to’ [...] they made me run because I was part of the team, and I realised that I wasn’t actually, like, a loser, I wasn’t the last one that finished, and it’s kind of like, wow, you know (KW: Mm), you can actually do things that you never thought you could (KW: Yeah).  
(Amy)

*6.3.4.5 Feeling part of the furniture.* Perceptions of the physical activity environment also played a role in whether experiences were found to be enjoyable. Elements included the presence of others (e.g. other exercisers or the instructors), the physical characteristics of the environment (e.g. décor and lighting), and preferences for being outside or inside (e.g. at the gym or in the park). An environment which contributed to an enjoyable experience was one that was pleasant and one in which people felt mentally and physically comfortable. A number of the participants experienced initial feelings of discomfort, awkwardness or intimidation when (re)beginning physical activity and entering a new, unfamiliar environment, such as the gym or an exercise class. This was more pronounced for people who did not see themselves as ‘sporty types’ or people who were not used to exercising. However, for the more experienced exerciser, entering a new exercise environment having lost confidence during their experiences of depression, also presented a similar trial:

I was then entering into a group, um, it’s a very large [netball] squad that I play for, they have, like, six or seven teams and to suddenly be going into that environment, you turn up at training and there were probably, I’m not exaggerating when I say there were probably fifty people there training because you had your junior squad, middle squad, adult, veterans, trainers, the whole lot. That I found nerve wracking and I’ve genuinely never, ever been that nerve wracked, you know, [by that] sort of stuff. (Tracey)

These feelings were an initial difficulty for some, but faded over time with developing experiences. People gradually came to feel more comfortable with growing familiarity with the environment and the people in it, realising all types of people exercised (not just “slimfits”), finding the environment pleasant, realising capabilities and movement towards seeing oneself as an ‘exerciser’. Sharon said:

well, in the end, once you’ve been there [the gym], cause they’re going regularly on a Monday, Wednesday and Friday at more or less the same times in the evening, you get to know the sort of some people that are going to be there, so, not get to know them but they’ll pass a smile as you’re coming in, sort of thing, you know (KW: Uh-huh), and, and ... and it’s just ... you, you gradually feel like you’re part of the furniture in there and that you can, you’ve settled in and you don’t feel intimidated by anything or anyone. (Sharon)

For others, these feelings of discomfort did not diminish. These individuals experienced little benefit from the physical activity for their depression. Tracey found herself among a netball training group of much younger women and had experiences that made her feel uncomfortable. With her loss of confidence, she found attending netball training a demoralising experience:

but, like I say, the actual ... confidence thing, yeah, I find it actually can be quite demoralising to me. So, as I say, the sport helps physically but I don’t believe that sport, at this moment in time, is helping me mentally [...] As I say, physically I don’t have a problem with it (KW: Mm-hm), er, emotionally I feel ... um ... the underdog, if that makes sense. (Tracey)

Similarly, Harriet, who had attended an exercise referral scheme on the instruction of her doctor, felt uncomfortable in the gym and did not perceive any mood benefit from the exercise. After a short period she ceased to attend the scheme:

just going made me even more depressed, (KW: Okay) because I didn’t like the gym, I didn’t like the people there, I was the only woman there and they were all,

all male body builders (KW: Right), there was nobody else there on the sort of programme and I felt ... I felt as if I stood out like a sore thumb, and I didn't enjoy the exercise at all, and it, really, it just made me feel worse and I stopped after about 6 weeks ... stopped going. (Harriet)

The importance of finding exercise to be an enjoyable, engaging experience for experiencing mood benefit is well demonstrated within the case of Harriet. After she ceased the scheme, she started a new job and, out of necessity (i.e. *having to*), started cycling and walking to work. This time around she found the exercise to be a much more positive and enjoyable experience, and, consequently, found that it had improved her mood:

But recently, erm, since I started working [at organisation] in March, no April, because I don't live close enough to drive to work, I have to use public transport or walk or cycle, so I've bought a bicycle and I cycle half the way, drive, drive to where I park the bike (KW: Yeah) and then cycle across the common and I really have found that it's improved my mood, and that is when I started cycling that I cut down on my medication, and I look forward to it, I actually look forward to the ride in the morning and especially the ride going home cause it's downhill. But it has improved my overall fitness and I really do feel better when I get to work for having had. If I don't cycle, I walk, if the weather's not good enough for cycling then I'll walk (KW: Mmm), and I feel, I really do genuinely feel better, for the exercise, but it's a kind of natural exercise rather than being forced into a gym. (Harriet)

A pleasant environment was also one in which people were friendly and where to some extent social relationships were struck up. Some people felt that the social side made it more enjoyable and acted as a motivation. However, the deviant case analysis also highlighted that, paradoxically, for some people a pleasant and comfortable environment was one where they could do their exercise alone, be ignored and not have to socialise. Some people did not want this social side, particularly when feeling depressed. This highlighted that it was not social contact that made for an enjoyable environment, but the

level of comfort and pleasantness that the presence or absence of social interaction provided.

### 6.3.5 Moving from 'having to' to 'wanting to'

6.3.5.1 *Getting Into It*. Although extrinsic prompt factors often initially brought people to (re)beginning physical activity, through positive, embodied experiences, some people found themselves starting to 'get into it'. Harriet said:

the main reason [for buying a bike to cycle to work] was to save an extra ten minutes cause then I could have an extra ten minutes in bed in the morning (KW: Uh-huh), erm, and I love my bed, I hate to get out of it. But then I did gradually find that I was enjoying it. (Harriet)

People's own discovery that they liked and enjoyed physical activity represented the beginning of a move away from a disconnection with it to a greater personal engagement: people began to experience a shift away from *having to* or *being forced to* do it to *wanting to* do it:

So, yeah, basically that was the main reason why I started [to get fitter], and then I just felt I liked it [...] I started maybe, started getting a bit, um, ambitious when I saw that I actually was making progress and sort of my fitness was improving, I felt, I felt sort of, 'yeah, I want to do this, I want to, I want to be better and I want to be able to, whatever, do the fifteen miles ... cycling in ... half an hour rather than forty minutes', and I sort of worked towards things that motivated me (Mary)

Harriet said: "Cause sometimes at weekends now I go out, I go out for a walk even though I don't have to walk to work". Physical activity came to be motivated by enjoyment, the activity itself, and the feelings derived from it, including mood benefits. It began to be a self-reinforcing activity.

6.3.5.2 *Embodied knowledge: Knowing from experience*. This represented a shift from extrinsic to more intrinsic motivations. The benefits, enjoyment and importance of physical activity came to be 'known' by the individual from their own experience. People

with more intrinsic motivations were motivated to do it because they knew that they would feel better, because they knew that they would feel good and because they knew that they would enjoy it. Margaret said, “and now I know that I’ll feel good (KW: Yeah), so I am more likely to do it”. The direct experience of mood benefits and feel good effects motivated future engagement in and with physical activity:

I, we went to her yoga lessons just to sort of give her a bit of support (KW: Mm) because she was starting off, but, erm, found that it was quite good [...] but, I remember, you know, immediately upon doing the things, I, I thought this does make you feel good, and at the end of the session, there was a sense of wellbeing that, er, made an appointment that day and go back the next time (Geoff)

*6.3.5.3 Keeping it up and overcoming barriers.* The move towards more intrinsic motivations was an important part of the change process, as it was a key factor in people keeping up physical activity over time and overcoming barriers, especially during periods of depression. A number of barriers were identified, including finding time and feeling tired. Aspects of the embodied experience of physical activity context, such as finding exercise boring or feeling uncomfortable, could also become barriers. Periods of depression presented additional barriers including a loss of motivation, difficulty leaving the house, difficulties being around others and feelings of lethargy.

External motivations (e.g. *having* to walk to work) or external support factors (e.g. being forced to do it by friends) were important for maintaining physical activity and overcoming barriers when people were not intrinsically motivated. Movement towards intrinsic motivations represented a move towards physical activity behaviour becoming more self-regulated. Individuals moved from passively *having to* or being *forced to* do it to the more active stance of *wanting to* and *forcing themselves*. At this stage, people began to take more control from within to actively overcome barriers (e.g. setting themselves targets to overcome boredom, joining teams to make themselves do it regularly) and barriers were therefore less likely to stop people. Harriet’s experience shows the importance of embodied experience and knowledge in this:

Although I still get down days, I still do feel very lethargic and depressed and, well ‘I really don’t want to do this’, and I’ll just sit indoors, but I know that if I do go out, I will feel better and it’s, having had that experience of feeling better for getting out and doing something, rather than somebody telling me, ‘oh, you’ll, it’ll make you feel better, it’ll do you good’ (KW: Mmm), it’s actually knowing myself from experience (KW: Mmm) that’s more, gives me more of an impetus to do it. (Harriet)

At the extreme end of the intrinsic motivation spectrum, physical activity became a habit and was engaged in a fixed pattern. Regular activity took little conscious effort, as it was incorporated as a part of daily lives. Liz said: “Well, you see, because it’s a habit, I’ve been doing it for so long, I don’t have any problem with sticking to it”. These people also reported a strong *need* to be physically active. This was often talked about in a physical sense, in terms of the body *needing* to be active – a bodily hunger for movement. Lucinda said: “I walk, to work, half an hour there, half an hour back, and if I’m home at the weekend, I don’t do that, I feel that my body just needs to walk again” (lines). This was not viewed to be an addiction in any way, just more a sense that when there was disruption to the physical activity habit, there were feelings of bodily agitation and restlessness. These feelings often prompted a return to physical activity and was part of how physical activity had become a self-reinforcing activity for these people.

For people at the extreme end of intrinsic motivation, physical activity had become an integral part of their identity, their feelings about themselves and their lives. These people often expressed a personal commitment to it, which also played a role in it being kept up and barriers being overcome. In the absence of such a sense of commitment, even when people had moved towards more intrinsic motivations, physical activity would not necessarily always be maintained:

I think it’s discipline ... not very well disciplined when it comes to that [exercise], and it’s something that you start but you don’t finish, you know, it’s ... some people are dedicated to it, some people can discipline themselves really good, um ... I can do it every now and then. (Mandy)



The deviant case analysis of individuals who had continued being physically active despite stating no perceived benefit for depression, highlighted that personal commitment meant that physical activity would be maintained even if it was not found to be an enjoyable or beneficial experience.

Not only was embodied experience and knowledge an important part of moving towards intrinsic motivations and keeping physical activity up, but it also appeared to be an important part of people learning to take control of their depression over time, including the use of physical activity as a way of self-managing symptoms.

#### *6.3.6 Coming Out of the Woods*

People's feelings of depression were experienced as coming and going over time. People sometimes found themselves emerging from an episode, and then, without notice, being brought back down. Sophie said, "You don't always know how you're going to feel from one day to the next". People stated varying degrees of self-control over their moods or feelings of depression. Some people felt at the mercy of it and expressed that they did not know what they could do when feelings arose. Sophie said: "you just feel hijacked by this depression and you don't know (what you can do)". Others expressed a greater sense of control and felt that they could actively control their symptoms. Elizabeth said:

I think the last time I had anything like that was, um, about six months ago, and I let it go for about two hours and I found I could just turn it off as soon as I decided to. I was actually totally in control of it, it was no longer in control of me.

(Elizabeth)

*6.3.6.1 Taking control: embodied knowledge.* As people lived with their depression over time, they described coming to 'know' it. They described beginning to know from experience the early warning signs of symptoms returning and what they could do to deal with symptoms – such as knowing from experience the importance of seeking help, or knowing from experience that taking 'a forward movement into life' would help. Greater knowledge developed from their own embodied experiences seemed to be an important step in people taking more control. Often this shift came about as the result of reaching a significant turning point in their experience, such as *knowing* what it was like to hit rock

bottom or finally *knowing* the cause. When people had moved to taking more control, they had a greater acceptance of negative moods when they arose and actively sought ways to manage them – often by making a forward movement into life. Although symptoms may still be present, knowing what to do about them in itself helped people feel better and cope.

6.2.6.2 *Purposely using physical activity to self-manage mood.* Against this background, some of the participants reported purposely using physical activity to self-manage their moods and symptoms:

I think that I am in a period now where, you know, you can't say for sure, but I feel I'm, I'm much more sensitive to, erm, how my mood is, and I can kind of register with myself, erm, you know I'm getting into habits of thinking and I know that that, that maybe that particular, er, mood I'm in, you know, I can either go down or stay on a level or go up, and that's fine, I think that I'm at that stage where okay, I understand that, and using different types of exercise, the ones that suit me, erm ... it's almost like a balancing act, balancing things (KW: Right), balancing my mood (KW: Yeah) (Margaret)

Although the original recruitment material for the study had advertised for participants who had “used” physical activity to manage their mood, there were differing degrees of awareness that there was a relationship between physical activity and depression. This was despite some being recommended it by their doctor or attending an interview about their experiences. It was people's own embodied experiences of feeling better from physical activity over time that gradually led them to *making the connection* for themselves:

Um ... being depressed ... it was ... I was told by family and that, 'why don't you just go out for a walk' ...and that ... just going out ... and having to like (look at) people, I couldn't do it, I couldn't do anything, really, I didn't have any energy at all ... so I think that doing exercise while I was depressed just didn't seem, didn't seem possible, but, um, when I started working, waitressing at one restaurant, well, it's like moving about all the time, after I'd finished the shift ... I did feel better, I didn't feel tired, I felt like I could carry on like a normal life and then when I stopped working and found that I wasn't getting ... er, activity, then I felt my mood

slipping down again so that's when I decided to get on the treadmill (KW: Mm-hm) and get going. (Olivia)

This embodied knowledge often resulted in a move towards the conscious use of physical activity to actively self-regulate moods and manage feelings of depression:

I have at times when I've felt, well, I call it depressed, I don't know whether it's anything like clinically depressed, I have deliberately resorted to doing a set of sort of stretching and abdominal exercises, erm, when I've been moping around the house and knew that I wasn't mentally going to be motivated to do anything of any use anyway (KW: Mm-hm), I knew that if I then just devoted an hour to that (KW: Right), it would sort of break that mood. (Geoff)

Although initial extrinsic prompts, such as being told by the doctor that it would help, may have prompted some to try being more physically active, it was people's *own experiences* which led to this further engagement with exercise as an active self-management strategy.

The shift towards purposeful use of physical activity was part of the way in which it had become a self-reinforcing activity: it was engaged in, in part, for the mood benefits. This contributed to keeping it up over time. Some people purposely set aside time in their daily schedule as they knew that it was important to maintaining positive mood. Even when people had breaks, experiencing a negative change in their mood would often prompt them to resume.

*6.3.6.3 Balancing not curing.* Physical activity was viewed to be a part of *managing* depression, rather than a cure. For some, it was seen to be part of a greater package of ways of managing symptoms, such as taking antidepressants. The participants often talked about it "balancing the mood", stopping it from getting worse and maintaining an "equilibrium". It was mainly experienced as a way of gaining temporary relief and a way of feeling better in the short-term, rather than having an enduring effect. Movement away from depression in the long-term may ultimately require that the cause is identified and resolved, but (self-) management strategies such as physical activity were seen to be of benefit for obtaining some alleviation in the short-term.

6.3.6.4 *Just doing something*. It was not just physical activity that was perceived to help depression, but engaging in any kind of activity, whether that was going outside, doing paperwork or doing housework. Some of the participants who had moved towards taking greater control stated that they had learnt from experience the importance of *just doing something* to move away from feelings of depression:

I mean, I found it wasn't only just the exercise, it was just doing something, you know, it doesn't have to be exercise, it's just, I found that the more I, um ... made myself do things rather than just sit, which is what I felt like doing, um ... that I could improve how I felt. (Margo)

Taking a forward movement into life by engaging in some kind of activity, rather than being disengaged or doing nothing, seemed to be an important part of moving away from feelings of depression. Some people had learnt from experience that involvement or participation in life, particularly activities that they experienced to be pleasant or engaging, could help them feel better. Physical activity was a part of this:

And probably with other things, I don't know, like just being outside or a nice meal or a nice bottle of wine or something like that, so the exercise is part of that, and, erm, yeah, I need to erm, participate myself in something. (Margaret)

Even if their depression was still present, through embodied experiences and knowledge, people began to develop a greater sense of control. By making a forward movement into life, people began to find a way out of the woods.

#### 6.4 Discussion

The analysis suggests that physical activity may in part benefit depression because it gives people a greater sense of engagement in life and the immediate situation. It may help people move away from a disengaged, inward-focused state to a more activated, outward-focused state. The participants' accounts suggest that greater participation in life or any kind of activity, not just exercise or physical activity, may be an important strategy for moving away from the depressed state, even if only temporarily. The experiences suggest,

though, that the involvement or activity may need to be enjoyable, pleasant or engaging to be of benefit.

Other qualitative studies of physical activity have found that among the benefits for mental health may be the provision of structure (Faulkner & Biddle, 2004), a sense of purpose (Crone et al., 2005; Hardcastle & Taylor, 2001) and “a sense of social inclusion” (Hardcastle & Taylor, 2001, p. 322). Among older adults, Stathi et al. (2003) found that exercise referral schemes “disrupt[ed] a lifestyle characterised by growing purposeless, pessimism and social isolation” (p.22). Priest (2007) found that a walking group for people with severe mental health problems gave the participants a sense of greater connectedness. Connectedness with others, with nature and with memories of former pleasant experiences in nature. These findings offer corroboration for the suggestion in the present study that participation in and a sense of engagement in life may be an important aspect of the benefit of physical activity for mental health. Also similar to the present analysis, Hardcastle and Taylor (2005) found that (non-depressed) older women participating in an exercise referral scheme experienced increased feelings of energy and greater levels of activity outside of the scheme.

Experiencing a sense of engagement in life and engaging in activity may be an important element of mental health. According to self-determination theory (Ryan and Deci, 2000), humans are naturally inclined to be active and engaged in their worlds, and this represents a state of positive mental health. Previous research with patients with depression and anxiety has shown that their experience is one of being “apart, isolated and locked away” (Kadam, Croft, McLeod, & Hutchinson, 2001, p. 378). With repeated episodes of depression, people begin to turn away from life (Kuyken, 2006). In this sense, people use avoidance-coping to deal with difficulties, which results in a worse prognosis for depression (Kuyken, 2006). Kuyken (2006) argues that a turn towards life is a key factor in the recovery process: people’s functional status needs to be addressed. Getting back to work and developing satisfying social relationships are part of a turn towards life (Kuyken, 2006). The experiences of the participants in present analysis suggest that physical activity and being more active may also be a part of a turn towards life.

The importance placed by the participants on the benefit of *just doing something* suggests that physical activity may be a form of behavioural activation. Behavioural activation treatment for depression seeks to move people away from passive, avoidant behaviours towards more adaptive coping styles by increasing overt behaviour. An increase in activity improves mood and provides positive reinforcement for more healthy behaviours (Hopko, Lejuez, Ruggiero, & Eifert, 2003). The exact mechanisms by which behavioural activation works are unknown (Hopko et al., 2003), but notably the behavioural activation system is more strongly associated with PA than NA (Holzwarth & Meyer, 2006). Commensurate with the proposal in this thesis, increasing activity may be particularly relevant for moving depressed people away from anhedonia to an increase in PA.

The benefit of exercise in the present study was, indeed, mainly perceived to be through improvements in state mood. A reduction in feelings of tension and increased feelings of calm and relaxation correspond to the low NA dimension of mood proposed by Watson & Tellegen (1985). An increase in feelings of energy, motivation and pleasant activation correspond to the high PA dimension. Watson, Clark and Carey (1988a) have stated that the negative relationship of PA with depression indicates “that the loss of pleasurable engagement is a distinctive feature of depression” (p.97). The participants’ experiences in this study suggest that an important part of the benefit of physical activity for depression was an increase in pleasurable engagement. Therefore, physical activity may particularly move people away from feelings of anhedonia. In terms of identifying potential mediators for quantitative analysis, the insights from the present study provide support for the further investigation of change in the mood dimensions of depression, particularly the role of PA.

Some of the participants’ accounts indicated that physical activity helped them to move away from negative rumination, and when participants felt that physical activity had not been of benefit, some reported not being distracted away from rumination. Rumination of negative thoughts is a feature of depression and people who distract themselves from rumination tend to experience a better prognosis (Nolen-Hoeksema, 1991). Distraction away from rumination may be a potential mediator of the physical activity-depression relationship (Craft, 2005) and may be part of the experience of the increase in pleasurable engagement reported by the participants in this study. However, while a decrease in rumination could be subject to further investigation as a potential mediator, it is suggested

below that concepts such as ‘mindfulness’ or ‘flow’ may be more appropriate measures of such an increase in pleasurable engagement rather than just mere distraction.

It is notable that the participants in the present study talked about the depression experience and mood changes from physical activity in very much a physical, bodily sense. Thayer, Newman and McClain (1994) point out that “mood involves the whole body. It is not a purely mental phenomenon, as it is often treated” (p. 927). Dimensional mood theories emphasise the role of bodily arousal in mood. This is a holistic approach in which skeletal-muscular, cardiovascular and cognitive systems are all viewed as interacting in their influence on mood (Thayer et al., 1994). Faulkner and Biddle (2001) found that clinical psychologists did not perceive a theoretical rationale for the role of the body in treating depression. However, the dimensional theory of mood and the present analysis suggest that mood and depression may be embodied experiences. From this perspective, the role of physical activity in treating depression has a clear theoretical rationale. Priest (2007) also found that the physical experience of walking was as an important part of the perceived healing effect as the mental experience among individuals with mental health difficulties. It is also notable that human pleasure may take two primary forms: pleasure derived from physical, bodily sensations and pleasure derived from social interaction. These map directly onto the two types of anhedonia that may be experienced with depression: physical anhedonia and social anhedonia (Loas, Salinas, Guelfi, & Samuel-Lajeunesse, 1992). Again, the role of the body in depression is emphasised. In the present analysis, for participants who found the physical activity experience to be enjoyable, part of the pleasure was through physical sensations and engagement of the body.

The insights from present analysis suggest that not only may taking part in physical activity and increasing activity represent a turn towards life, but the embodied experience of benefit may lead to the use of more active coping strategies in the future. Physical activity may also be a forward movement into life in the sense that it may provide people with a way that they can actively self-regulate their moods. Both self-determination theory (Deci & Ryan, 2000) and social cognitive theory (Bandura, 1997) emphasise the importance of self-regulation in mental health. In the present study, the move towards the use of physical activity as a way of actively self-controlling depression suggests that one way it may help depression is through an increase in self-efficacy for coping with or self-

regulating moods. Craft (2005) found that depressed individuals taking part in an exercise intervention experienced an increase in depression coping self-efficacy. In terms of identifying potential mediators for quantitative analysis, the insights gained from the present analysis suggest that coping self-efficacy should be subject to further investigation.

In the present study, the participant's use of physical activity as an active self-management strategy came from their own embodied experiences and knowledge of the mood benefits. Hsiao and Thayer (1998) have pointed out that people often begin exercise for a number of physical or health-related reasons, and it is only with experience that people become aware of the psychological benefits. Thayer et al (1994) have found that exercise is one method that people use for self-regulating moods. However, experienced exercisers are more likely to cite mood regulation as a reason for exercise than inexperienced exercisers (Hsiao & Thayer, 1998). In accordance with the insights gained from the present analysis, this suggests that it may be the *experience* of these mood benefits that may be important in movement towards using exercise to self-regulate moods. From the present study, it may be hypothesised that state mood changes (and perhaps especially increased PA) may be responsible for initial reductions in depression and that coping self-efficacy may be a mechanism responsible for longer-term effects.

From the insights gained in the present analysis, coping self-efficacy may be viewed to be a form of embodied knowledge developed from embodied experiences of both depression and physical activity over time. Mood changes (physiological / emotional arousal) and mastery experiences (performance accomplishments) from taking a forward movement into life may be sources of self-efficacy information (Bandura, 1977, 1997) that contribute to an increase in coping self-efficacy over time. Although self-efficacy may be a cognitive concept, an examination of the theoretical sources of self-efficacy (i.e. performance accomplishments, physiological / emotional arousal, vicarious experience and verbal persuasion) suggests that a number of these sources could be considered to be forms of embodied experience. There has been a move in social cognition theory towards acknowledging the role of bodily responses and emotions in the development of higher level cognitions (Niedenthal, Barsalou, Winkielman, Krauth-Gruber & Ric, 2005). From the present analysis, it may be suggested that embodied knowledge may be important in



the self-regulation of mood and in the movement towards people taking more control of their depression over time.

One insight gained from the accounts in the present analysis which has received little attention in the literature was that experience of benefit from physical activity may be dependent upon the extent to which it has been found enjoyable. In the literature, exercise enjoyment has been defined as “a positive response to the movement experience that reflects feelings such as pleasure, liking, and fun derived from the activity” (Raedeke, 2007, p. 106). This definition and the insights from the present analysis emphasise the embodied nature of the experience of enjoyment. Embodied experiences of physical activity may be important determinants of perception of benefit. In quantitative terms, it may be hypothesised that exercise enjoyment may moderate affective outcomes of physical activity. People who enjoy exercise less or people in circumstances that do not make for an enjoyable exercise experience may be less likely to experience benefit.

Enjoyment may also act as a mediator of affective outcomes of physical activity. The participants’ accounts suggested that it may not just be taking a forward movement into life that is important, but that the experience or activity provides an increase in pleasant feelings of enjoyment and engagement. In quantitative terms, an increase in feelings of enjoyment may be a proximal mediator of the physical activity context that underlies change in more distal mediators such as PA and NA. Notably, exercise enjoyment has been found to be related to increases in PA post-exercise, but not decreases in NA (Raedeke, 1997). Therefore, positive affective outcomes of physical activity (i.e. decreased anhedonia) may be particularly sensitive to enjoyment.

The accounts in the present analysis also suggested that a mental focus on the present may be important for moving away from feelings of depression. It has been previously speculated that physical activity may alleviate depression because it serves as a distraction (e.g. Lawlor & Hopker, 2001) (see section 3.6.1, chapter 3). However, the participants’ accounts suggest that rather than looking at concepts such as distraction, it may be more appropriate to employ concepts such as flow (a state in which people are fully engrossed in and enjoying what they are doing when involved in a challenging task which their skills meet; Csikszentmihalyi, 1999) and mindfulness (an awareness of and attention to the

present moment; Brown & Ryan, 2003). The participants' experiences suggest that it may be *engagement* rather than mere distraction that is important. Mindfulness has been found to be associated with less depression, less NA and greater PA (Brown & Ryan, 2003). Feelings of flow during an exercise class have been found to be associated with improved affective outcomes (Karageorghis, Vlachopoulos, & Terry, 2000).

The participants' accounts offered insight that not only may embodied experiences of physical activity influence experience of benefit, but that positive embodied experiences may also influence a shift in motivations over time. Although an exploration of motivations for physical activity was not an initial aim of the study, the different motivations that people had appeared to be an important part of the process of change. If physical activity needs to be maintained for benefit, then motivations are an important consideration. The qualitative approach was especially beneficial for gaining insight into the dynamic nature of the participants' motivations over time.

The change in motivations described by the participants mapped directly onto the nature of motivation as described by self-determination theory (Ryan & Deci, 2000). According to self-determination theory, there is a continuum of motivation from amotivation where an individual is not motivated to perform a behaviour at all, to extrinsic motivation where behaviour is externally prompted and regulated, to intrinsic motivation where behaviour is motivated by internalised factors and is self-determined. At this far end of the spectrum, the behaviour is carried out for the enjoyment, interest and inherent satisfaction that it provides. At the furthest end of intrinsic motivation, behaviours are more self-regulated and performed because they are a part of the individual's values and needs: a part of the self (Ryan & Deci, 2000). Intrinsic motivation has been found to be related to better exercise adherence (Papaioannou, Bebetos, Theodorakis, & Christodoulidis, 2006; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Thogersen-Ntoumani & Ntoumanis, 2006) and people who enjoy physical activity have been found to report higher amounts (Salmon, Owen, Crawford, & Sallis, 2003). According to self-determination theory, a move towards intrinsic motivation can be facilitated by a social context which provides people with feelings of relatedness, competence and autonomy (Ryan & Deci, 2000). These factors did not directly arise in the present analysis, although there were statements to support the role of these factors and, from a constructivist perspective, a different researcher may have

been more sensitive to these theoretical constructs in interpreting the data. However, in this analysis, interpretation of the participants' accounts suggested that positive embodied experiences, and especially enjoyment, may be important in the move towards intrinsic motivation and physical activity becoming a self-reinforcing activity. In a study of older women's experiences of an exercise referral scheme, Hardcastle and Taylor (2005) also found a gradual shift over time from the external reasons that brought people to the scheme to more intrinsic motivations, and the authors also related this to self-determination theory, providing corroboration for the present findings.

The present analysis builds on previous qualitative studies of physical activity and depression (e.g. Faulkner & Biddle, 2004; Mental Health Foundation, 2005) by going beyond description of experience and offering a theorised account of the process of change. In particular, the analysis suggests that embodied experience and knowledge may be an important part of the process of change – an issue which has not been raised by previous studies. In accordance with the findings of Faulkner and Biddle (2004), in the present analysis, physical activity was primarily viewed to be a way of managing depression, providing temporary relief, rather than a cure. However, unlike the findings of Faulkner and Biddle (2004) the present analysis suggests that engagement in physical activity held the meaning of taking a forward movement into life for people when they were depressed, and that benefit may be obtained from participation in enjoyable, pleasant or engaging activities. This suggested that the role of physical activity in alleviating depression may be through state mood changes – and perhaps especially a reduction in anhedonia – that were linked to being actively engaged in *doing something* rather than through self-esteem change, as suggested by Faulkner and Biddle (2004).

#### *6.4.1 Limitations*

Despite efforts to recruit participants with more negative experiences, only a few of the participants had mixed or negative experiences and this may have biased the results. However, the mixed and negative experiences obtained were rich and were particularly useful for gaining an understanding of the central importance of embodied experiences of enjoyment.

Although some attempts were made to sample according to the needs of the analysis, theoretical sampling was not fully employed in this study. A fruitful approach which may have moved the grounded theory beyond the substantive area may have been to interview people engaged in other activities, other than physical activity, which they feel have helped their depression. The importance of 'a forward movement into life' may go beyond the experience of physical activity (as suggested by the participants accounts), and may be an overall concept of importance in the management of and movement away from depression. A further way to theoretically explore this concept and the importance of embodied knowledge may have been to interview people with other chronic conditions to explore how they coped with them over time. Although limited use of theoretical sampling may mean that the transferability of the findings is limited to some extent, the use of two different sources of participants (clinical and nonclinical) does aid transferability.

I felt that the semi-structured interview format often evoked disjointed stories from the participants. In retrospect I feel a more narrative approach, which is unstructured, may have been more facilitative of story telling. Such an approach involves beginning with one opening line, e.g. "can you tell me about when you first started exercising?", which invites the participant's own story with a timeline. The analysis may have also benefited from participants being interviewed on more than one occasion, as through coding I often identified areas of interest which I did not notice or fully follow-up during interview.

### *6.5 Conclusion*

Physical activity may represent a forward movement into life for people experiencing depression and move them away from the feelings of disengagement which accompany depression. Making a forward movement into life, however, may not be enough if the experience is not enjoyable, pleasant or engaging. Physical activity may particularly move people away from feelings of anhedonia. Embodied experiences and knowledge seem to play an important role in the process of change. In particular, enjoyment may be important for experiencing benefit and the movement towards intrinsic motivations. Centrally, the results highlight the importance of embodied knowledge for both the continuation of physical activity over time and the movement towards using it as a self-management strategy. Physical activity may partly help depression because it gives people a way of actively self-managing symptoms. Research might further explore the role of change in

PA, NA and coping self-efficacy as potential mediators. These factors were examined in the cross-sectional, multiple mediation analysis study presented in chapter 7.

## Chapter 7

### Cross-sectional Study – A Multiple Mediation Analysis

#### *7.1 Introduction*

Although further longitudinal work involving a control group comparison would have been ideal to build on the findings of the previous two studies in this PhD, an attempt to carry out a controlled prospective study proved infeasible (see section 4.3.6.2, chapter 4). Therefore, a cross-sectional questionnaire study was conducted instead. In this study, the relationship between physical activity / exercise, depression and potential mediators identified from the first two studies was examined in a multiple mediation analysis. While the cross-sectional design meant that further elaboration of the temporal relation of change was not possible, the design offered the advantage that the strength of association between exercise / physical activity, depression and the potential mediators could be assessed in a larger sample than would have been possible with further longitudinal research with limited resources. This chapter reports the cross-sectional study.

The longitudinal study (chapter 5) suggested that change in physical self-efficacy and the mood dimensions of depression were stronger candidate mediators of the physical activity-depression link than change in self-esteem and physical self-concept. There was some evidence to support that an increase in PA may be especially important. The qualitative study (chapter 6) also provided qualitative indications that changes in state mood, and especially an increase in pleasant feelings may be important. Benefit of physical activity was primarily described as pleasant, ‘feel better’ effects on mood through a greater sense of engagement in the immediate situation and life. Reported feelings such as increased motivation, energy and pleasant engagement reflected the high PA dimension of mood, while reported feelings such as an increased sense of calm and the removal of tension reflected the low NA dimension (Watson & Tellegen, 1985). This supported further exploration of the potential mediating role of PA and NA. The central theme of a forward movement into life also suggested that physical activity may particularly help move people away from feelings of anhedonia.

The qualitative study also suggested that embodied experience of benefit resulted in some individuals gradually using physical activity as a way of actively self-managing symptoms.

In social cognitive (Bandura, 1997) and quantitative terms, the analysis suggested that physical activity may help depression by providing depressed individuals with a sense of mastery of their symptoms and thus increased self-efficacy to cope with and self-regulate their symptoms and their moods. Craft (2005) has already shown that an exercise intervention may increase depressed individuals' sense of depression coping self-efficacy. Therefore, this insight gained from the qualitative study was operationalised as coping self-efficacy for further examination as a potential mediator in the present quantitative study. \*

The longitudinal and qualitative studies suggested that PA, NA, exercise-induced feelings, physical self-efficacy and coping self-efficacy warranted further investigation as potential mediators in this cross-sectional study. Measurement of exercise-induced feelings was included as many of the items in the measure corresponded to the feelings that the participants described from physical activity in the qualitative study. Rejeski et al. (1999) have suggested that the exercise-induced feeling inventory may be more sensitive to the affective experience of physical activity than the PANAS and that the feeling states measured may mediate mental health outcomes (see section 3.9.4, chapter 3). This measure was also included in the present study to empirically examine this. This study improved on the design of longitudinal study by the use of the chronic version of the measure (Rejeski et al., 1999) rather than the acute version, which is more appropriate outside of the context of acute physical activity.

In the qualitative study, the participants experienced benefit from all kinds of physical activity, including housework and cycling or walking to and from work, not just exercise. At present it is not clear whether it is just exercise that is beneficial for depression or whether physical activity in general may also have an effect. Most studies have just concentrated on exercise (see chapter 1 for definitions). Findings from Lin (2003) and Stephens (1988) suggest that exercise may offer superior mood benefit over general physical activity (see section 2.11.2, chapter 2). As benefit was experienced from both physical activity and exercise in the qualitative study, two measures of physical activity were included in the present study: one which measured leisure-time exercise, and one that measured all physical activity, including leisure, household, work and transport. The aim was to assess whether exercise or physical activity was more strongly associated with

depression, and to then look at the mediating effects for the one that was more strongly related.

Individuals currently experiencing low mood or depression completed a one-off questionnaire containing measures of depression, physical activity, exercise and the potential mediators. It was decided that it was important to use a 'depressed' sample, rather than a general population sample, to avoid skew towards non-depression and so maximise variation in the depression measure. The mediating role of the potential mechanisms was examined within a multiple mediation analysis. Despite researchers often hypothesising a number of purported mediators for an effect, even in other areas few studies have used this design (Preacher & Hayes, in press). The advantage is that assessment may be made of both whether the mediators as a whole mediate the effect (rarely will just one mediator be responsible for an effect) and the relative contribution of individual mediators (Preacher & Hayes, in press). This design also means that comparison may be made between different theories of the mediating factors (Preacher & Hayes, in press) and insight may be gained into whether some factors are stronger candidate mediators than others. The literature search did not identify any previous studies which have examined the proposed mediators of the physical activity-depression link within this kind of design.

The relationships between exercise / physical activity, the mediators and depression were estimated after taking into account the influence of a number of covariates (age, gender, employment status, education, social support, current treatment and recent negative life events) which may influence both physical activity and depression (Brown et al., 1987; Brown et al., 2005; Hasin et al., 2005; Kaplan et al., 1987; Kritz-Silverstein et al., 2001; Michalak et al., 2002; Ohayon et al., 1999; Weyerer, 1992). Few previous studies have included social support (Kritz-Silverstein et al., 2001) or negative life events as covariates, which may have resulted in an over- or under-estimation of the contribution of physical activity / exercise to depression. Physical limitation (Kritz-Silverstein et al., 2001; Weyerer, 1992) was also a potential confounding variable that was taken into account.

Improvement on the method of the longitudinal study was made by the use of valid and reliable physical activity scales that operationalise physical activity in terms of total energy



expenditure, as this may have more important implications for the depression response than frequency (Dunn et al., 2005) (see section 2.11.4.3, chapter 2). The use of valid and reliable measures is also an improvement on some previous cross-sectional studies (e.g. Harris et al., 2006), which have been criticised for the use of arbitrary, categorical measures created for the study (O'Neal et al., 2000). Improvement on the method of the longitudinal study was also made by the use of a different measure of physical self-efficacy, as the measure used the longitudinal study been shown to be more a measure of self-concept (Hu et al., 2005).

The aims of this study were:

1. To assess whether, after controlling for the covariates, physical activity or exercise was more strongly associated with depression.
2. To assess, if an association between exercise / physical activity and depression was found, whether positive affect, negative affect, coping self-efficacy, physical self-efficacy, and exercise-induced feelings cross-sectionally mediated the relationship.
3. To assess the relative importance of each of the potential mediators.

## *7.2 Method*

### *7.2.1 Ethical Considerations*

Ethical approval to conduct the study was granted by the School of Psychology, University of Southampton, Ethics Committee.

### *7.2.2 Design and Procedure*

This was a cross-sectional, one-off postal questionnaire study with a convenience sample of self-selected participants (see appendix Y for a copy of the questionnaire – please note that the BDI-II is not included due to copyright). Although it was considered that an internet questionnaire may have been a quicker and more convenient way to collect data, in the event a postal design was used as the depression measure, the BDI-II (Beck et al., 1996), is copyrighted and individual paper record forms have to be purchased for its use, so it cannot be posted on a website.

Participants were recruited via national advertisements about the study at universities, exercise groups, depression support groups and depression organisations. Participants were also recruited via online classified adverts and snowballing (e.g. passed details by a friend). (Exact numbers recruited through these methods are detailed in section 7.3.1 below.) Advertisements were in the form of e-mails sent to distribution lists (appendices Z and AA), notices in newsletters, notices posted online on depression organisations', universities' and exercise groups' websites (appendices AB and AC), posters (appendices AD and AE), and distribution of the questionnaire in depression support group sessions via the group facilitator.

Advertisements stated that individuals aged 18 – 65 who were currently experiencing feelings of depression or low mood were sought to take part in a survey about physical activity and depression / a survey about depression (depending upon the target group). Participants were therefore self-selected based on their own subjective self-evaluation of whether or not they were currently experiencing feelings of depression or low mood. The age limit for recruitment was restricted to 18 – 65, as children, young people and older adults were considered to be more special populations in which findings relating to the physical activity-depression relationship and potential mediators may potentially differ to a working-age adult sample. The advertisements stated that a variety of people were sought, including people who were physically active at any level and people who did not do much (or any) physical activity. The aim was to avoid bias towards recruitment of only physically active individuals and to maximise variation in the physical activity / exercise data for examining the cross-sectional associations.

If individuals were interested in taking part, they contacted me to request a copy of the questionnaire. Questionnaires were posted to participants along with an information sheet (appendix AF), debriefing statement (see end of questionnaire, appendix Y) and freepost return envelope. Each questionnaire contained a code number which linked to a separately filed list of names and addresses to monitor the return. To increase response rate, reminder questionnaires were sent out three weeks later to participants who had not returned the original questionnaire. The only exception to this procedure was that two depression support groups requested a batch of anonymised questionnaires which they distributed to

their members – in these cases reminder questionnaires were not sent as participant details were unknown ( $n = 27$ ).

Participants were asked to complete measures of current depression, recent physical activity and exercise, the potential mediators, the covariate variables, and background and demographic data. Participants were informed that the purpose of the study was to find out more about the relationship between physical activity and depression. Participants were instructed that completion and return of the questionnaire indicated informed consent to take part. They were instructed that return of a non-completed questionnaire indicated non-consent and that they would receive no further contact. On the first page of the questionnaire, participants were asked if they currently had any disabling or physically limiting problems which prevented them from being physically active. If they answered ‘Yes’, they were instructed not to complete the remainder of the questionnaire and to return the questionnaire. These participants were then excluded from the study.

### 7.7.3 Measures

*7.7.3.1 PA and NA.* PA and NA were measured by the PANAS (Watson et al., 1988). In line with study 1, the ‘past few days’ timescale was used. (See chapter 5, section 5.2.4.3 for a description.)

*7.7.3.2 Exercise-induced feelings.* Exercise-induced feelings were measured by the chronic version of the Exercise-induced Feeling Inventory (EFI-C; Rejeski et al., 1999; see Appendix Y). This measure is an adaptation of the original acute exercise measure (see section 5.2.4.4, chapter 5) and measures affect in the context of chronic physical activity. Although the measure will be sensitive to other influences on mood, there is evidence that it retains some specificity to physical activity and that it may be sensitive to mood changes brought about by physical activity (Rejeski et al., 1999). The measure consists of twelve adjectives describing different moods (e.g. ‘refreshed’, ‘calm’, ‘worn-out’) and respondents rate the extent to which they have felt each mood over the past week. Each item is rated on a 6-point scale, ranging from 0 (*none of the time*) to 5 (*all of the time*). The scale measures two feeling states: *pleasant feeling states* (hereafter referred to as ‘pleasant affect’) and *unpleasant feelings of physical exhaustion* (hereafter referred to as ‘physical exhaustion’). Pleasant affect is assessed by nine adjectives and total scores range

from 0 – 45. Physical exhaustion is assessed by three adjectives and total scores range from 0 – 15. The authors report correlations with the BDI of  $r = -.52$  for pleasant affect and  $r = .52$  for physical exhaustion, showing that the factors are conceptually distinct from the depression measure. The scale shows good internal consistency with reported coefficient alphas of .88 for pleasant affect and .90 for physical exhaustion (Rejeski et al., 1999).

*7.7.3.3 Depression.* The BDI-II (Beck et al., 1996) was used to measure symptoms of depression experienced over the past two weeks (see chapter 5, section 5.2.4.2 for a description).

*7.7.3.4 Coping self-efficacy.* Self-efficacy for coping with difficult thoughts and emotions was assessed by the *stop unpleasant emotions and thoughts* subscale of the Coping Self-Efficacy Scale (CSE; Chesney, Neilands, Chambers, Taylor, & Folkman, 2006; see Appendix Y). The CSE was originally developed and validated in a depressed sample. The stop unpleasant emotions and thoughts subscale was selected as the items corresponded with the statements of the participants in the qualitative study and the subscale has been found to be the most predictive of positive changes in psychological well-being (Chesney et al., 2006). Participants are asked to rate the extent to which they are confident that they can control unpleasant thoughts and feelings when they are experiencing difficult times. The scale presents participants with four items relating to this (e.g. ‘Keep from feeling sad’) which they rate on an 11-point scale anchored, 0 (‘cannot do at all’), 5 (‘moderately certain can do’) to 10 (‘certain can do’). Total score on the scale is created by calculating the mean response, so scores can range from 0 – 10, with a higher score indicating a greater level of self-efficacy. The scale shows good reliability, with a reported Cronbach alpha of .91 (Chesney et al., 2006).

*7.7.3.5 Physical activity self-efficacy.* The Self-Efficacy for Exercise Scale (Resnick & Jenkins, 2000; see Appendix Y) was used to measure physical activity self-efficacy and was modified to reflect self-efficacy for physical activity rather than just exercise. In the original scale, participants rated the extent to which they were confident they could continue to exercise three times per week for 20 minutes per session when presented with a number of barriers. In this study, the instructions were changed to reflect physical activity

at least three times per week for 20 minutes at a moderate intensity. This level of activity was chosen to reflect self-efficacy for the minimum amount that may be beneficial for depression (derived from reports and recommendations from the Department of Health, 2004 and NICE, 2004). The scale consists of nine items reflecting different barriers (e.g. feeling tired, bothersome weather). Scale items were adapted to reflect physical activity, so the terms 'exercise' and 'exercising' were removed from the items and replaced with 'activity'. Total score on the measure is obtained by summing all responses and dividing by the number items. Scores can range from 1 – 10, with a higher score indicating a stronger level of self-efficacy. The scale shows good internal consistency, with a reported Cronbach alpha of .92 (Resnick & Jenkins, 2000).

*7.7.3.6 Physical activity.* The International Physical Activity Questionnaire (IPAQ) – Short Form (Craig et al., 2003) was used to measure physical activity over the previous seven days (see Appendix Y). The IPAQ takes into account all types of physical activity, including housework, gardening, recreation, sport and exercise, and activity performed at work and for transport. Participants indicated the number of days and the average amount of minutes per day they engaged in vigorous, moderate and walking activities. The total physical activity score from the IPAQ can either be operationalised as a continuous measure (total energy expenditure) or as a categorical score of level of physical activity (low, moderate or high). In this study, the continuous operationalisation was used, in the unit of 'MET-minutes/week'. Each level of intensity of activity carries a MET value which represents energy expenditure above resting metabolic rate. A MET-minute is calculated by multiplying the activity MET score by the number of minutes the activity was performed. MET-minute/week scores were calculated by the following formulae provided by the authors:

Walking MET-minutes/week = 3.3 \* walking minutes \* walking days

Moderate MET-minutes/week = 4.0 \* moderate-intensity activity minutes \* moderate days

Vigorous MET-minutes/week = 8.0 \* vigorous-intensity activity minutes \* vigorous-intensity days

Total physical activity MET-minutes/week = sum of Walking + Moderate + Vigorous MET-minutes/week scores

A higher score reflects a greater level of total energy expenditure. A number of data cleaning rules are provided by the authors and these were followed in this study (i.e. recoding any values above a weekly total of 180 minutes on any category of physical activity to a maximum of 180 minutes). The IPAQ has been shown to have acceptable reliability and validity (Craig et al., 2003).

*7.7.3.7 Exercise.* The Leisure Time Exercise Questionnaire (Godin & Shephard, 1985) was used to measure recreational exercise (see Appendix Y). The scale has been shown to be valid and reliable (Godin & Shephard, 1985). The original scale asks participants to think about their *average* week and rate how many times they usually engage in strenuous, moderate and mild exercise for fifteen minutes or more per session. For the purposes of this study, the timescale was changed to “the last seven days”, as there is some evidence that exercise may need to be maintained for mood benefit (Morris et al., 1990) and recent exercise may be more relevant for mood (see Chapter 2, Section 2.8 for a discussion). This was also changed to make the timescale commensurate with the instructions for the IPAQ, allowing the relative associations between exercise and physical activity with the other variables to be comparable. To help ensure participants did not report other kinds of physical activity, an additional instruction was presented: “do not include the activities you do as part of your house or yard work, to get from place to place or the activities you do at work”. Total score is operationalised as a continuous measure of total energy expenditure. It is obtained by multiplying the number of sessions of strenuous, moderate and mild exercise by their arbitrary MET value (9, 5 and 3 METS respectively) and summing the resulting scores ( $T = [9 \times \text{Strenuous}] + [5 \times \text{Moderate}] + [3 \times \text{Light}]$ ). A higher score reflects a greater level of total energy expenditure.

*7.7.3.8 Negative life events.* The List of Threatening Experiences (Brugha & Cragg, 1990) was used to measure recent stressful life events (see Appendix Y). Participants were presented with a list of 12 adverse life events (e.g. “You broke off a steady relationship”) and were asked to tick boxes next to any events that they have experienced in the past six months. Total score on the measure is the aggregate of the number of events ticked and can range between 0 – 12, with a higher score indicating a greater number of negative life events. The scale has been shown to be a valid and reliable measure of negative life events (Brugha & Cragg, 1990).

*7.7.3.9 Social support.* Perceived social support was measured by the short form of the Social Support Questionnaire (SSQ; Sarason, Sarason, Shearin, & Pierce, 1987; see Appendix Y). The SSQ measures two dimensions: the number of people an individual feels that they can turn to in different situations of need (Number or Perceived Availability score; SSQN) and an individual's overall satisfaction with the level of support available to them in each situation (Satisfaction score; SSQS). The scale consists of six items referring to different situations (e.g. "Whom can you really count on to help you feel more relaxed when you are under pressure or tense?") and participants are asked to write the initials and relationship to them of individuals whom they can count on in that situation (up to a maximum of nine). If there is no-one, they circle 'no-one'. They then rate their overall level of satisfaction with the perceived support available to them in that situation from 6 ('very satisfied') to 1 ('very dissatisfied'). Total score for the SSQN is derived by summing the total number of people cited for each situation and dividing by six to get a per item average rating. Total scores can range from 0 – 9. Total score for the SSQS is derived by summing the satisfaction ratings for each situation and dividing by six to get a per item average rating. Total scores can range from 1 – 6. Higher scores indicate a higher amount of perceived social support in that domain.

*7.7.3.10 Demographics and other questions.* Questions were included in the questionnaire to obtain demographic information on age, gender, current employment status, highest level of education and ethnicity (some of which were used as covariates in data analysis). Participants were also asked whether they were currently taking medication for depression (Yes/No), and whether they were currently receiving any other form of treatment for depression (e.g. counselling, St Johns Wort) (Yes/No).

Descriptive information was also obtained regarding a) the extent to which their current physical activity met current recommendations for physical health (number of days per week of at least 30 minutes of moderate-intensity physical activity; Department of Health, 2004) and b) how long they had been physically active at a minimum level expected to provide some benefit for depression (at least three 20 minute sessions of moderate-intensity physical activity per week – derived from reports and recommendations from the Department of Health, 2004 and NICE, 2004). Participants were also asked how long they

had been experiencing their current feelings of depression and how they had heard about the study.

#### *7.7.4 Statistical Analyses*

*7.7.4.1 Covariates.* During study planning, based on the literature, it was decided that the following covariates would be controlled for in all data analyses: age, gender, employment status, education, SSQN, SSQS, negative life events, current antidepressant treatment and current other treatment. Covariates were not determined by bivariate associations between the variables and depression during data analysis, as it is important to select variables based on prior evidence rather than statistical significance in the data set (which can lead to over-fitting of the model) (Babyak, 2004). At data analysis, the data showed little variation between participants in employment and education status (see section 7.3.1 below), so these factors were dropped as covariates. The two questions measuring current treatment were combined into one to reflect whether the participants were receiving any treatment for depression ('any treatment'). This was more parsimonious, as some participants were both taking antidepressants and receiving other forms of treatment. This resulted in a revised list of six covariates to be included in data analyses: age, gender, SSQS, SSQN, life events and any treatment.

*7.7.4.2 Power analyses and tests of multiple mediation.* Prior to data collection, a multiple mediation analysis following the multiple regression procedures outlined by Baron & Kenny (1986) was planned. The largest model using these techniques would have consisted of 16 predictor variables (1 IV [exercise or physical activity], 6 potential mediators and 9 original covariates). Based on an expected medium effect size, the following rules of thumb were used to calculate the required sample size:  $N > 50 + 8m$  (for testing the multiple correlation) and  $N > 104 + m$  (for testing individual predictors), where  $m$  is the number of predictor variables (Tabachnik & Fidell, 2007). If both the multiple correlation and individual predictors are to be tested, the largest estimate is taken as the required sample size. This resulted in a sample size estimate of 178 participants.

Although the sample size calculation was based on original plans to conduct a multiple mediation analysis using procedures outlined by Baron and Kenny (1986), at data analysis alternatives to this method were considered. The Baron and Kenny approach has been



shown to have low statistical power (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). SEM was considered, as this method is preferable to multiple regression for conducting path analyses (Meyers, Gamst, & Guarion, 2006). SEM offers a number of advantages over multiple regression, including: a) the overall fit of the model with the data may be assessed; b) covariance between all of the variables is taken into account in the path coefficient estimates; and, c) measurement error is taken into account (Meyers et al., 2006). Recommendations for the minimum sample size to conduct SEM vary. One rule of thumb is that 200 cases are needed for models with over ten variables (Meyers et al., 2006). The least conservative recommendation is that in datasets without any problems such as non-normal distribution of variables, five cases are needed per parameter estimated (Bentler & Chou, 1987, as cited in Meyers et al., 2006). In the present study, there were 32 parameters to be estimated (including error variances) which would have required at least 160 participants. The complete dataset consisted of 164 participants (see below), but a number of the variables were non-normally distributed even after data transformation (see below). The power of the RMSEA fit statistic ( $\epsilon$ ) to assess the fit of the anticipated model with 73 degrees of freedom and 164 cases was low. There would have been a power of .65 to detect a perfect fit ( $\epsilon = 0$ ) and a power of .50 to detect a less than perfect fit ( $\epsilon = .02$ ) (Hancock & Freeman, 2001). Based on these considerations, it was decided that the sample size was too small to use SEM.

It was decided that the multiple mediation analysis would be conducted using the product of coefficients with bootstrapping method outlined by Preacher and Hayes (in press). The product of coefficients method (i.e. the product of path coefficients  $a$  and  $b$ ) involves a direct assessment of whether or not there is a statistically significant difference between the direct and indirect effects (see section 4.3.2, chapter 4 for a discussion of how mediating effects are assessed). In the Baron and Kenny (1986) approach there is no explicit test of the statistical significance of the mediating effect – mediation is simply deemed to have occurred if the direct effect is no longer significant. Product of coefficients methods have been shown to be more powerful than the Baron and Kenny (1986) approach (MacKinnon et al., 2002). However, a problem with product of coefficients methods, such as the Sobel test, is that there is an assumption that the sampling distribution of  $ab$  is normal (Preacher and Hayes, in press). This is rarely the case in smaller samples (Preacher & Hayes, 2004) and skew in the sampling distribution has been

found in samples with up to 400 cases (Stone & Sobel, as cited in Shrout & Bolger, 2002). In the case of smaller samples, bootstrap procedures are recommended for a more powerful analysis (Preacher & Hayes, in press). Bootstrapping is a nonparametric approach which does not assume that the variables are normally distributed or that the sampling distribution of  $ab$  is normal. The sampling distribution of  $ab$  is bootstrapped and confidence intervals derived from the bootstrap are used to determine statistical significance of the product of coefficients (Preacher & Hayes, in press). This method was considered to be the most appropriate for assessing the multiple mediation model in the present study. Preacher and Hayes (2007) provide MACROS and syntax for running the analyses in SPSS and covariates may be included in the models (as planned for this analysis). Figure 4 illustrates the multiple mediation model tested in the present study.

The product of coefficients bootstrapping method offers a number of advantages. First, the number of statistical tests to establish mediation is reduced in comparison to the Baron and Kenny (1986) method as it only requires that a) there is a direct effect between the IV and the DV, and that b) the indirect effect through the mediator(s) is significant in the expected direction. Second, pairwise contrasts between the individual mediators in the model may be conducted to assess whether one mediator has a statistically significant stronger effect on the outcome than another (Preacher & Hayes, in press) – which was one of the aims of the present study.

*7.7.4.3 Data screening.* Prior to data analysis, the data were screened for missing values, outliers and normality. There was some missing data on nearly all variables. The physical activity and social support measures appeared to be particularly problematic. Twenty (12.1%) cases had missing data on the IPAQ, 9 (5.5%) had missing data on the SSQN, and 40 (24.2%) had missing data on the SSQS. The rest of the variables either had less than 5% of cases missing data or none. Where half or more of the items on a scale were complete, missing data were imputed by calculating the within-person mean for that scale from the complete items (Hawthorne & Elliott, 2005; Shrive et al., 2006). This method has been found to be superior to sample mean substitution (Hawthorne & Elliott, 2005; Shrive et al., 2006). However, where there was not enough information to do this, missing data were imputed by insertion of the sample mean (Tabachnick & Fidell, 2007), so that all cases could be included in analyses.

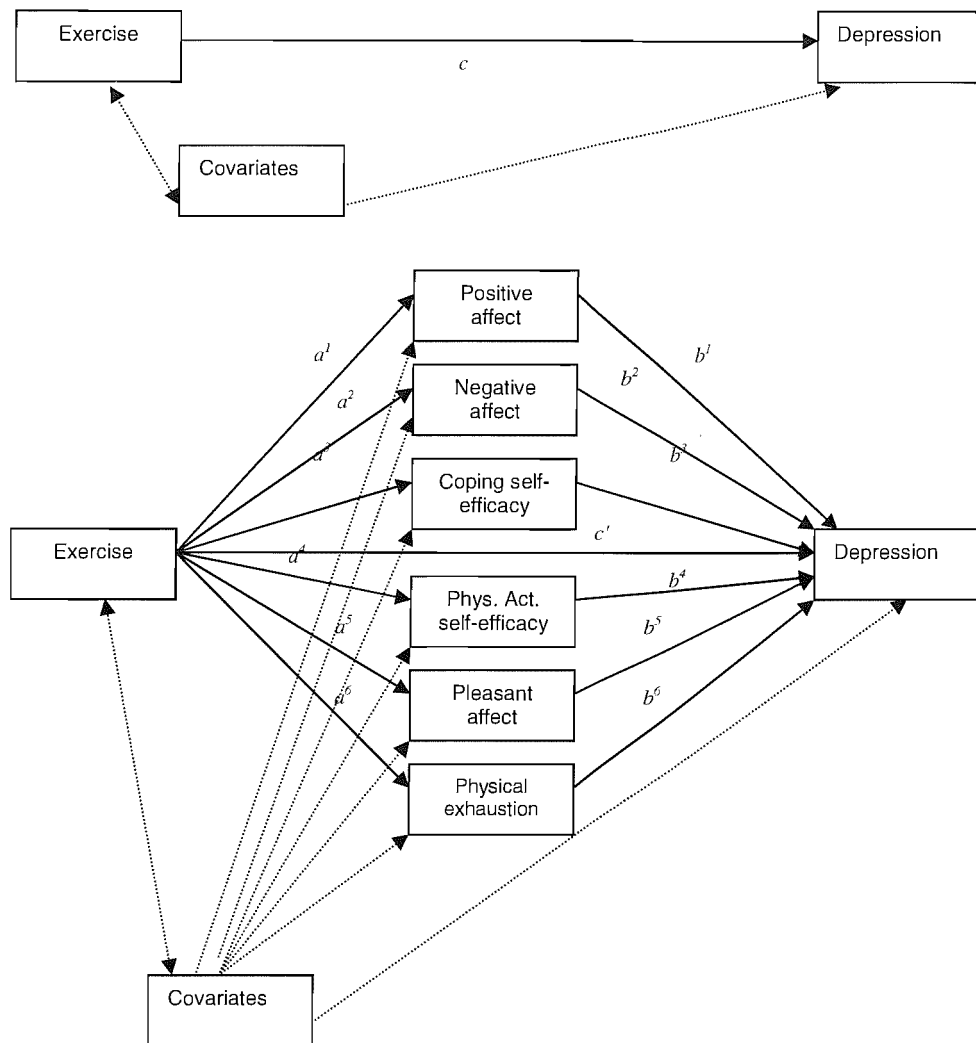


Figure 4. Multiple mediation model of the exercise-depression relationship. Adapted from: Preacher, K. J. and Hayes, A. F. (2007). *SPSS and SAS macros for estimating and comparing indirect effects in multiple mediator models*. Retrieved November 30, 2007, from <http://www.comm.ohio-state.edu/ahayes/SPSS%20programs/indirect.htm>. Adapted with permission of the author.

Univariate outliers on the continuous measures were identified by identification of cases with standardised scores ( $z$  scores) greater than  $\pm 3.29$  on a variable (Tabachnick & Fidell, 2007). Eight outliers were found – four on physical activity, one on negative life events, one on SSQS and one on pleasant affect. The cases were examined to determine if they were sampled as part of the target population (Tabachnik & Fidell, 2007). The outlier on pleasant affect had a score of zero on the BDI-II. This suggested that the case may not

have been part of the target population and it was excluded from data analysis (Tabachnick & Fidell, 2007). The remaining outliers did not appear to differ from the target population and were retained. Outliers were dealt with by transformation of the relevant variables (Tabachnick & Fidell, 2007) – see below.

Normal distribution was assessed by examining skew and kurtosis statistics (Tabachnick & Fidell, 2007). The following variables were not normally distributed: age, coping self-efficacy, SSQN, SSQS, physical activity and exercise. Transformations were applied to these variables (Tabachnik & Fidell, 2007). Square root transformation was applied to age, coping self-efficacy, exercise, physical activity and SSQN. Reflect and square root transformation was applied to SSQS and logarithm transformation was applied to negative life events. After transformation, all variables were normally distributed, except SSQS, physical activity and coping self-efficacy. There was also still one borderline outlier on physical activity ( $z = 3.29$ ). As the transformation of coping self-efficacy resulted in greater skew and kurtosis values, the original variable was retained for data analysis. The transformed versions of SSQS and physical activity were used in data analysis, as the skew and kurtosis values were lower than for the original variables.

### *7.3 Results*

#### *7.3.1 Participant Characteristics and Response Rate*

Data collection took place between April 2007 and September 2007. During this period, 237 questionnaires were requested and sent out. Of these, 172 were returned, representing a response rate of 72.6%. Of the returned questionnaires, three participants self-reported physical limitations, and four had returned blank questionnaires indicating non-consent. This left a total of 165 participants who had returned data. Of these, one participant was excluded from data analysis due to being an outlier (see section 7.7.4.3 above), resulting in a complete dataset of 164 participants.

The age of the participants ranged between 19 – 63 years, with a median age of 30. Table 6 summarises the other participant characteristics. Roughly two-thirds were female and most were from a White ethnic background. The majority were recruited through advertisement about the study at universities, with a smaller number recruited via depression support groups, exercise groups and other methods. The bias towards

recruitment through universities may possibly be reflected in the employment and education data. Most were either in employment or were university students, and most were educated to either degree or postgraduate level. As there was little variation in the employment and education data, these variables were not entered as covariates in the main analyses as planned.

The mean BDI-II score of the sample was 23.4. To describe the severity of depression in the sample, participants were divided into the categories provided by Beck et al. (1996) based on their BDI-II scores. According to Beck et al. (1996) scores of 0-13 indicate minimal depression, 14 – 19 indicate mild depression, 20 – 28 indicate moderate depression and 29 – 63 indicate severe depression. Table 6 shows that the level of depression in the sample was well distributed across each of these categories, with nearly two thirds in the moderate or severe categories. This suggests that there was good variation in the depression measure for the statistical analyses and also suggested that the efforts to recruit a low mood or depressed sample had been successful. Just over half stated that they had been experiencing their current feelings of depression for over a year and just under half of were currently receiving treatment for depression.

In terms of usual physical activity, only 20.7% of the participants were physically active five days a week or more at the recommended level for physical health. The mean number of days of 30 minutes of moderate physical activity per week was 2.75 ( $SD = 2.04$ ). In terms of physical activity at the minimum level for benefit to depression, Table 6 shows that 26.8% were not active to this level and that 41.5% had been active to this level for over a year.

### *7.3.2 Descriptive Statistics*

Tables 7 and 8 show the descriptive statistics and scale reliability coefficients for all of the measures. To aid interpretation, the median value before variable transformation is provided for the non-normally distributed variables. All of the measures showed good internal consistency reliability in this sample.

Table 6

*Participant Characteristics (N = 164)*

Characteristic	n	%
<b>Gender</b>		
Male	59	36.0
Female	105	64.0
<b>Recruitment Source</b>		
University	100	61.0
Depression support group	12	7.3
Through a friend	19	11.6
Exercise club	15	9.1
Online advert	9	5.5
Other	9	5.5
<b>Employment</b>		
Employed	71	43.3
Self-employed	6	3.7
Homemaker	2	1.2
Retired	4	2.4
Unemployed	5	3.0
Undergraduate student	25	15.2
Postgraduate student	50	30.5
<i>Missing</i>	1	0.6
<b>Education</b>		
Secondary	3	1.8
GCSEs / equivalent	4	2.4
A-levels / equivalent	30	18.3
Diploma / HND	10	6.1
Degree	56	31.1
Postgraduate degree	61	37.2
<b>Ethnicity</b>		
White	144	87.8
Indian	3	1.8

Black Caribbean	1	0.6
Black African	3	1.8
Chinese / South East Asian	7	4.3
Other	5	3.0
<i>Missing</i>	1	0.6
Antidepressants <sup>a</sup>		
Yes	48	29.3
No	115	70.1
<i>Missing</i>	1	0.6
Other Treatment <sup>b</sup>		
Yes	49	29.9
No	114	69.5
<i>Missing</i>	1	0.6
Any Treatment <sup>c</sup>		
Yes	70	42.7
No	94	57.3
Depression Status <sup>d</sup>		
Minimal	29	17.7
Mild	34	20.7
Moderate	53	32.3
Severe	48	29.3
Time Depressed <sup>e</sup>		
1 – 2 weeks	7	4.3
3 – 4 weeks	7	4.3
5 weeks – 3 months	24	14.6
4 – 6 months	17	10.4
7 months – 1 year	19	11.6
Over 1 year	86	52.4
<i>Missing</i>	4	2.4
Time Active at 3 Days/Week <sup>f</sup>		
Not active to this level	44	26.8
1 month or less	9	5.5

2 – 3 months	13	7.9
4 – 6 months	15	9.1
7 months – 1 year	12	7.3
Over 1 year	68	41.5
<i>Missing</i>	3	1.8

<sup>a</sup>Antidepressants = whether currently taking medication for depression. <sup>b</sup>Other Treatment = whether currently receiving any form of treatment for depression excluding medication. <sup>c</sup>Any Treatment = whether currently receiving any form of treatment for depression including medication. <sup>d</sup>Depression Status = BDI-II depression category. <sup>e</sup>Time Depressed = length of time participants have been experiencing their current feelings of depression. <sup>f</sup>Time Active at 3 Days/Week = length of time participants have been physically active to the level of at least three 20 minute sessions per week of moderate intensity.

Table 7  
*Descriptive Statistics and Scale Reliability for Normally Distributed Measures*

Measure	<i>M</i>	<i>SD</i>	Cronbach's $\alpha$
Depression	23.40	10.75	.89
Positive affect	23.00	6.85	.87
Negative affect	26.42	7.65	.83
Pleasant affect	13.16	6.42	.90
Physical exhaustion	9.71	3.12	.87
Physical activity self-efficacy	4.74	2.08	.91



Table 8

*Descriptive Statistics and Scale Reliability for Non-normally Distributed Measures Before Transformation*

Measure	<i>Mdn</i>	Range	Cronbach's $\alpha$
Coping self-efficacy	3.25	0 – 8.50	.92
SSQN	2.67	0 – 9.00	.89
SSQS	4.58	1.00 – 6.00	.91
Negative life events	1.00	0 – 7.00	
Physical activity	1865.00	0 – 12960.00	
Exercise (Godin)	25.00	0 – 104.00	

*7.3.3 Partial Correlations*

The partial correlations between exercise, physical activity, depression and the potential mediators controlling for the covariates (negative life events, SSQS, SSQN, age, gender, and current treatment) are shown in Table 9. The partial correlations were computed to examine whether there was a direct effect between physical activity / exercise and depression and to illustrate the correlations between all variables to be entered into the multiple mediation analysis.

Table 9 shows that exercise was significantly negatively associated with depression, while physical activity was negatively associated with depression but this association was not statistically significant. The physical activity results, however, need to be interpreted with caution due to the non-normal distribution of this variable even after transformation and the large amount of missing data which was imputed. Before substitution of the scale mean, the partial correlation between physical activity and depression was  $pr = -.14$ ,  $p = .11$  and after mean substitution was  $pr = -.15$ ,  $p = .06$ , indicating that mean substitution may have affected the correlation and its significance. As the data were not normally distributed, the assumptions of the parametric partial correlation analysis were violated. Therefore, the non-parametric Spearman's Rho correlation (not including the covariates) between physical activity and depression before mean substitution was calculated. This

Table 9

*Partial Correlations Between Depression, Physical Activity, Exercise and the Potential Mediators, Controlling for the Covariates*

Variable	1	2	3	4	5	6	7	8	9
1. Depression	-								
2. Exercise	-.19*	-							
3. Physical activity	-.15	.46***	-						
4. Positive affect	-.51***	.25**	.24**	-					
5. Negative affect	.59***	-.22**	-.22**	-.33***	-				
6. Pleasant affect	-.52***	.25**	.21**	.71***	-.39***	-			
7. Physical exhaustion	.40***	-.27**	-.27**	-.33***	.42***	-.45***	-		
8. Physical activity self-efficacy	-.18*	.45***	.47***	.35***	-.15	.31***	-.25**	-	
9. Coping self-efficacy	-.58***	.13	.06	.44***	-.36***	.49***	-.20*	.16*	-

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

resulted in a correlation of  $r_s = -.18, p = .04$ , showing a significant effect with an effect size comparable to that for exercise in the partial correlations. As the exercise data were more reliable and the effect size slightly larger, exercise was entered into the multiple mediation analysis as the IV rather than physical activity.

In terms of the other variables, Table 9 shows that contrary to theoretical expectations, there was a significant correlation between PA and NA. The table also shows that PA and pleasant affect were very highly correlated, suggesting that these variables may have considerable conceptual overlap. Interestingly, both variables were correlated with depression and exercise to a similar extent. Highly correlating variables can present a collinearity problem in multiple mediation models (Preacher & Hayes, in press). Field (2000) states that correlations of above .80 or .90 are problematic for collinearity, so as the correlation was below this both variables were retained for the multiple mediation analysis.

Table 9 also shows that all of the potential mediators were significantly correlated with both exercise and depression in the expected direction, except coping self-efficacy. While coping self-efficacy was significantly negatively correlated with depression it was not significantly associated with either exercise or physical activity.

#### *7.3.4 Multiple Mediation Analysis*

The results of the multiple mediation analysis following the bootstrapping method are reported in Tables 10 and 11. Table 10 illustrates the results of the path coefficients for the model in Figure 4 and the direction of the effects. The results show that after taking into account the covariates and the presence of the other potential mediators, the direction of all the path coefficients in the model were in the expected direction, except physical activity self-efficacy. The result for path *b* showed that as physical activity self-efficacy increased, depression also increased. As the partial correlation analysis showed that the relationship between physical activity self-efficacy and depression was in the expected direction, these results suggest that the relationship was altered when the presence of the other mediators was taken into account. Table 10 shows that the direct effect of exercise on depression was reduced after the potential mediators were entered into the model. The model explained 64% of the variance in depression ( $R^2 = .67$ , adjusted  $R^2 = .64$ ,  $F(13,150) = 23.23, p < .001$ ).

Table 10

*Unstandardised Path Coefficients for Multiple Mediation Analysis Including Covariates*

Path and Variable	B	SE B	<i>t</i>	<i>p</i>
<b>Covariates</b>				
Gender	-1.24	1.13	-1.09	.28
Age	0.62	0.61	1.01	.32
Any Treatment	-1.94	1.12	-1.72	.09
SSQN	-1.73	1.09	-1.58	.11
SSQS	-2.18	1.78	1.22	.22
Negative life events	6.97	2.24	3.11	.002
<b>Exercise to mediators (paths <i>a</i>)</b>				
Physical exhaustion	-0.34	0.10	-3.48	<.001
Coping self-efficacy	0.09	0.05	1.57	.12
Physical activity self-efficacy	0.36	0.06	6.30	<.001
Positive affect	0.66	0.21	3.18	.002
Negative affect	-0.64	0.23	-2.80	.006
Pleasant affect	0.63	0.19	3.28	<.001
<b>Mediators to Depression (paths <i>b</i>)</b>				
Physical exhaustion	0.34	0.20	1.70	.09
Coping self-efficacy	-1.86	0.36	-5.11	<.001
Physical activity self-efficacy	0.15	0.31	0.50	.62
Positive affect	-0.26	0.11	-2.29	.02
Negative affect	0.47	0.08	5.53	<.001
Pleasant affect	-0.10	0.13	-0.74	.46
<b>Direct Effect of Exercise on Depression (path <i>c</i>)</b>				
Exercise	-0.72	0.31	-2.35	.02
<b>Effect of Exercise on Depression When Mediators Included (path <i>c'</i>)</b>				
Exercise	0.03	0.24	0.14	.89

Table 11

*Bootstrap Results for Indirect Effects in Multiple Mediation Analysis*

Mediators	Point Estimate	SE	Percentile 95% CI	
			Lower	Upper
Total indirect effect	-0.75	0.24	-1.23	-0.27
Physical exhaustion	-0.11	0.08	-0.28	0.03
Coping self-efficacy	-0.16	0.09	-0.36	0.02
Physical activity self-efficacy	0.06	0.12	-0.18	0.29
Positive affect	-0.17	0.09	-0.39	-0.02
Negative affect	-0.30	0.12	-0.55	-0.08
Pleasant affect	-0.06	0.08	-0.23	0.09
Contrast: Positive affect vs. Negative affect <sup>a</sup>	0.13	0.15	-0.17	0.42

*Note.* Bootstrap resamples = 5000.

<sup>a</sup>Pairwise contrasts only reported for significant mediators.

The data in Table 10 are provided only for illustrative purposes to aid interpretation of the indirect effects, and, although  $p$ -values are provided, these tests are not the statistical tests of whether the indirect effects were significant. In the bootstrapping product of coefficients approach, rather than inferring mediation from the statistical significance of each path, only the significance of the product of coefficients (the ‘point estimate’) for the indirect effects is assessed to determine mediation. The bootstrap results for the indirect effects are presented in Table 11. The results for both the total indirect effect for the whole model and the indirect effect for each potential mediator are shown. When a confidence interval contains the value zero, the effect is deemed to be nonsignificant (Preacher and Hayes, in press).

The results showed that the potential mediators as a whole significantly mediated the relationship between exercise and depression. In terms of the individual mediators, only PA and NA were significant. The pairwise contrast showed that the magnitude of the mediating effects of PA and NA were equal, as the contrast was non-significant. It is possible that the high correlation between PA and pleasant affect may have attenuated the mediating role of these variables to some extent (Preacher and Hayes, in press).

Therefore, the same multiple mediation analysis was run again twice, with each of these variables omitted in turn. The results showed little difference in the resulting models. With exclusion of pleasant affect, the point estimate of PA rose to -0.20 ( $CI_{lower} = -0.43$ ,  $CI_{upper} = -0.06$ ) and there was little change in the explanatory power of the model ( $R^2 = .67$ , adjusted  $R^2 = .64$ ,  $F(12,151) = 25.20$ ,  $p < .001$ ). The pairwise contrast between NA and PA remained nonsignificant. With the exclusion of PA, the point estimate for pleasant affect rose to -0.17 and was significant ( $CI_{lower} = -0.36$ ,  $CI_{upper} = -0.03$ ) and there was again little change in the explanatory power of the model ( $R^2 = .66$ , adjusted  $R^2 = .63$ ,  $F(12,151) = 24.06$ ,  $p < .001$ ). The pairwise contrast between NA and pleasant affect was nonsignificant.

### *7.3.5 Post-hoc analyses*

One possible reason why neither coping nor physical activity self-efficacy emerged as significant mediators in the multiple mediation model may be that the effect of these variables on depression may be mediated by PA and / or NA. Theoretically, self-efficacy may be a cognitive antecedent of affective outcomes of exercise such as PA and NA (Ekkekakis, 2003; McAuley et al., 1999), and the literature suggests that self-efficacy may be particularly associated with PA (Bartholomew & Miller, 2002; Bodin & Martinsen, 2004). In chapter 3, it was highlighted that theoretically self-efficacy may either be a direct or indirect mediator. Given this possibility, using the bootstrapping procedures above, a series of post-hoc mediation analyses were conducted to examine these indirect pathways. The same covariates as above were controlled for in each analysis.

First, an analysis was conducted to examine whether coping and physical activity self-efficacy mediated the relationship between exercise and depression in the absence of the affect mediators. The results are summarised in Table 12 and suggest that neither type of self-efficacy was a direct mediator. Second, two multiple mediation analyses were conducted to examine pathways from exercise to both types of self-efficacy to PA and NA (see Tables 13 and 14). Coping self-efficacy did not mediate the effect of exercise on either PA or NA. However, physical activity self-efficacy significantly mediated the effect of exercise on PA but not NA. A final analysis was conducted to establish whether PA and NA mediated the effect of physical activity self-efficacy on depression. Table 15 shows that the effect was only mediated by PA and not NA. The results suggest an indirect

Table 12

*Post-hoc Analysis: Unstandardised Path Coefficients and Bootstrap Results for the Indirect Effects of Coping Self-Efficacy and Physical Activity Self-efficacy in Mediating the Effect of Exercise on Depression*

Mediators	Path <i>a</i>				Path <i>b</i>				Point Estimate	SE	Percentile 95% CI	
	B	SE B	<i>t</i>	<i>p</i>	B	SE B	<i>t</i>	<i>p</i>			Lower	Upper
Coping self-efficacy	0.09	0.05	1.57	.12	-3.17	0.37	-8.55	<.001	-0.27	0.15	-0.58	0.03
Physical activity self-efficacy	0.36	0.06	6.30	<.001	-0.24	0.36	-0.66	.51	-0.08	0.14	-0.36	0.18
Total indirect effect									-0.36	0.21	-0.74	0.05

*Note.* Bootstrap resamples = 5000. Path *c*: B = -0.72, SE B = 0.31, *t* = -2.35, *p* = .02. Path *c'*: B = -0.36, SE B = 0.28, *t* = -1.28, *p* = .20.

For parsimony path coefficients for the covariates for this model are not reported. Model:  $R^2 = .51$ , adjusted  $R^2 = .48$ ,  $F(9, 154) = 17.83$ ,  $p < .001$ .

Table 13

*Post-hoc Analysis: Unstandardised Path Coefficients and Bootstrap Results for the Indirect Effects of Coping Self-Efficacy and Physical Activity Self-efficacy in Mediating the Effect of Exercise on PA*

Mediators	Path <i>a</i>				Path <i>b</i>				Point Estimate	SE	Percentile 95% CI	
	B	SE B	<i>t</i>	<i>p</i>	B	SE B	<i>t</i>	<i>p</i>			Lower	Upper
Coping self-efficacy	0.09	0.05	1.57	.19	1.51	0.27	5.57	<.001	0.12	0.07	-0.01	0.28
Physical activity self-efficacy	0.35	0.06	6.30	<.001	0.84	0.26	3.20	.002	0.30	0.10	0.11	0.53
Total indirect effect									0.43	0.13	0.19	0.70

*Note.* Bootstrap resamples = 5000. Path *c*: B = 0.66, SE B = 0.21, *t* = 3.18, *p* = .002. Path *c*': B = 0.24, SE B = 0.21, *t* = 1.14, *p* = .26. For parsimony path coefficients for the covariates for this model are not reported. Model:  $R^2 = .35$ , adjusted  $R^2 = .32$ ,  $F(9, 154) = 9.39$ ,  $p < .001$ .



Table 14

*Post-hoc Analysis: Unstandardised Path Coefficients and Bootstrap Results for the Indirect Effects of Coping Self-Efficacy and Physical Activity Self-efficacy in Mediating the Effect of Exercise on NA*

Mediators	Path <i>a</i>				Path <i>b</i>				Point Estimate	SE	Percentile 95% CI	
	B	SE B	<i>t</i>	<i>p</i>	B	SE B	<i>t</i>	<i>p</i>			Lower	Upper
Coping self-efficacy	0.09	0.05	1.57	.19	-1.44	0.32	-4.51	<.001	-0.12	0.07	-0.27	0.02
Physical activity self-efficacy	0.36	0.06	6.30	<.001	-0.08	0.31	-0.27	.79	-0.03	0.11	-0.25	0.19
Total indirect effect									-0.15	0.13	-0.40	0.11

*Note.* Bootstrap resamples = 5000. Path *c*: B = -0.64, SE B = 0.23, *t* = -2.80, *p* = .006. Path *c'*: B = -0.49, SE B = 0.24, *t* = -2.01, *p* = .05.

For parsimony path coefficients for the covariates for this model are not reported. Model:  $R^2 = .29$ , adjusted  $R^2 = .25$ ,  $F(9, 154) = 6.94$ ,  $p < .001$ .

Table 15

*Post-hoc Analysis: Unstandardised Path Coefficients and Bootstrap Results for the Indirect Effects of PA and NA in Mediating the Effect of Physical Activity Self-efficacy on Depression*

Mediators	Path <i>a</i>				Path <i>b</i>				Point Estimate	SE	Percentile 95% CI	
	B	SE B	<i>t</i>	<i>p</i>	B	SE B	<i>t</i>	<i>p</i>			Lower	Upper
Positive affect	1.18	0.25	4.65	<.001	-0.51	0.09	-5.37	<.001	-0.61	0.18	-1.00	-0.29
Negative affect	-.056	0.29	-1.92	.06	0.64	0.08	7.63	<.001	-0.36	0.18	-0.73	0.001
Total indirect effect									-0.96	0.27	-1.51	-0.42

*Note.* Bootstrap resamples = 5000. Path *c*: B = -0.89, SE B = 0.39, *t* = -2.29, *p* = .02. Path *c'*: B = -0.08, SE B = 0.31, *t* = 0.25, *p* = .80. For parsimony path coefficients for the covariates for this model are not reported. Model:  $R^2 = .59$ , adjusted  $R^2 = .57$ ,  $F(9, 154) = 24.91$ ,  $p < .001$ .

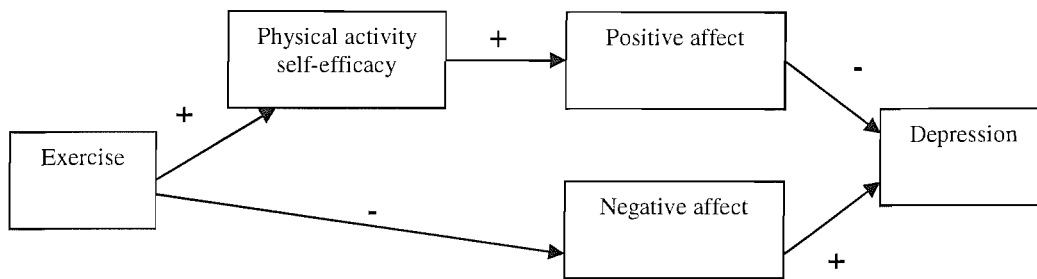


Figure 5: Final path analysis model of the mediation effects explaining the exercise-depression relationship derived from the planned and post-hoc multiple mediation analyses. For parsimony the covariate paths are not included in the figure, but all relationships are controlled for the covariates. The symbols ‘+’ and ‘-’ denote the direction of the path coefficients.

mediation pathway for physical activity self-efficacy through increased PA. This finding may explain why the relationship between physical activity self-efficacy and depression was not in the expected direction in Table 10, as the relationship may have been altered in the presence of PA as a mediator. The resulting mediation model of the exercise-depression link from the post-hoc analyses is summarised in Figure 5.

#### 7.4 Discussion

In this sample of individuals experiencing depression and low mood, after taking into account the influence of other factors such as negative life events and social support, increased exercise was significantly associated with lower levels of depression. This finding is consistent with previous cross-sectional findings in both healthy (e.g. Brown et al., 2005; Weyerer, 1992) and depressed populations (Harris et al., 2006), and is consistent with the exercise intervention research (e.g. Craft & Landers, 1998). The results of the multiple mediation analysis showed that increased PA and decreased NA significantly mediated the relationship. Although the study was not originally designed to analyse a more complex model with additional pathways, the post-hoc analyses suggested that increased physical activity self-efficacy may indirectly mediate the relationship through increased PA but not decreased NA. Coping self-efficacy, however, was not a significant direct or indirect mediator. Exercise-induced feelings also did not emerge as significant mediators, and the results suggest that pleasant affect and PA may not be conceptually distinct using these measures.

Next, the results are discussed in more detail, including problematic issues with the use of the exercise-induced feeling inventory in this area. The implications of the results for understanding the exercise-depression link are highlighted, including why it may be important to distinguish between PA and NA as mediators even though neither was found to be a stronger mediator than the other in this analysis. First, the implications of the findings for distinguishing between exercise and physical activity are discussed.

#### *7.4.1 Exercise, Physical Activity and Depression*

In terms of the aim of assessing whether exercise or physical activity was more strongly associated with depression, it is difficult to draw conclusions from the present data due to the non-normal distribution of the physical activity data even after transformation. As expected, a negative association was found between physical activity and depression, and the nonparametric correlation (not including the covariates) revealed the association to be significant. The effect size was comparable to the relationship between exercise and depression. This indicates, in accordance with the qualitative data, that exercise and physical activity may be equally beneficial for depression. Although this conclusion cannot be made with confidence from these data, the results suggest that it warrants further examination in future research. If there were no difference in benefit, clinically this would imply that practitioners could recommend physical activity to patients rather than just structured exercise as is currently recommended in the NICE (2004) guidelines. Notably, the partial correlations between exercise and physical activity and the potential mediators were very similar, also suggesting that both may have comparable psychological benefit.

Previous studies suggested that exercise may be superior to other types of physical activity for psychological benefit (Lin, 2003; Stephens, 1988). These studies were conducted with general population samples and this may account for the difference between the findings and the present study findings. General physical activity may have stronger implications for the mood of depressed individuals than non-depressed individuals (perhaps particularly as just *engaging in activity* may be important for movement away from the disengaged depressed state, as suggested by the participants' accounts in the qualitative study).

#### 7.4.2 PA and NA

Both PA and NA were found to have an equal mediating role. Therefore, contrary to the proposal in this thesis, an increase in PA was not a more important mediator than a decrease in NA. The results suggest that exercise may not be more relevant to reducing the symptoms of anhedonia than to reducing high NA. This differs from the findings of the longitudinal study which suggested that there may be slightly larger effects for PA than NA. The finding is also contrary to theory that PA is more strongly associated with exercise than NA (Watson, 1988). The present findings suggest that, at least among people experiencing low mood or depression, exercise may be equally associated with PA and NA.

It is important to note that the equal association of exercise with PA and NA emerged in this *cross-sectional* design. The longitudinal study results suggested that the effect of physical activity on PA and NA may be time dependent. In the first three weeks of increased activity there were larger effect sizes for change in PA than NA. However, by the eighth week there were larger changes in NA than PA. One possibility is that PA may only be a stronger candidate mediator during the early stages of increased activity, suggesting that the associations between exercise and PA and NA may be moderated by the length of time people have been physically active.

Contrary to theory that PA and NA represent independent mood dimensions (Watson & Tellegen, 1985), the two were found to be significantly correlated in the present study. This has also been found by a number of other investigators (e.g. Crawford & Henry, 2004), which suggests that PA and NA may not be entirely independent. The correlation between PA and NA may have affected the mediating influence of these variables to some extent, as correlations between potential mediators can attenuate the path coefficients in multiple mediation analyses (Preacher and Hayes, in press). In particular, if potential mediators are correlated, pairwise contrasts may be less likely to show that either variable is a more important mediator as contrasts represent a variable's *unique* mediating role (Preacher & Hayes, in press). This may account for the lack of difference between the mediating effects of PA and NA. Ideally, uncorrelated potential mediators should be entered into a multiple mediation analysis (Preacher and Hayes, in press) – although, this is perhaps rarely possible in psychological research. A further consideration is that the BDI-II is very much biased towards the measurement of the negative affective elements of depression and does not

substantially address loss of pleasure (Watson et al., 1988b). Therefore, by nature of the content, any correlations with PA in the mediation analysis may have been reduced, which may have affected the nature of the mediation associations found.

While PA and NA were found to have equal mediating roles, the results suggest that regardless of whether one may be a more dominant mediator than the other, it may still be important to distinguish between these two components as different processes may underlie them. In particular, the post-hoc analyses suggested that an increase in physical activity self-efficacy may be more strongly related to PA than NA. Other studies have also suggested increased feelings of self-efficacy from exercise may be particularly relevant to PA responses (Bodin & Martinsen, 2004; Bartholomew & Miller, 2002), providing support for this post-hoc finding. This suggests that physical self-efficacy may be an indirect mediator of the exercise-depression link through PA. Some caution needs to be applied when interpreting unplanned, post-hoc analyses, but this is an interesting finding and this possibility might be tested and subject to replication in future research. In terms of this PhD, the finding suggests that the distinction between PA and NA may be a useful theoretical framework to apply when trying to understand the process of change.

A number of physiological and cognitive antecedents proximal to the exercise context may mediate or moderate more distal responses such as PA and NA to exercise (Ekkekakis, 2003). From the present work, it may be suggested that distinguishing between PA and NA may be useful as different factors proximal to the exercise context may differentially affect these outcomes. Indeed, as discussed in relation to the results of the qualitative study, enjoyment of exercise has been found to be related to change in PA but not NA post-exercise (Raedeke, 2007). Other studies have found that the exercise environment may also have more influence on positive mood states than negative mood states (Gauvin & Rejeski, 1993). It may be that PA is more sensitive than NA to the social-psychological context of exercise (Raedeke, 2007). If this were so, it would be important to know, because certain factors in the exercise context, such as enjoyment and self-efficacy, may then be targeted in interventions or exercise counselling to improve PA outcomes from exercise. The use of distinguishing between PA and NA as a conceptual framework for understanding mediators of the exercise-depression link is discussed further in chapter 8.

### *7.4.3 Exercise-induced feelings*

The results suggested that the relationship between exercise and depression was not mediated by exercise-induced feelings. The high correlation between PA and pleasant affect appeared to attenuate the mediating role of pleasant affect and may explain why pleasant affect did not emerge as a significant mediator in the main model. Despite Gauvin and Rejeski's (1993) argument that the EFI may be more sensitive to mood responses to exercise than the PANAS, there was no evidence to support this in the present data. The results suggest that PA and pleasant affect may, in fact, be interchangeable factors for measuring positive affect. Further, the partial correlations between PA and pleasant affect and the other variables were near identical, providing additional evidence that PA and pleasant affect may be indiscriminate variables. The present data suggests that at least within a cross-sectional, chronic exercise context, the EFI and PANAS may be equally sensitive to affective responses associated with exercise. It is perhaps notable that while Gauvin and Rejeski (1993) suggest that the EFI may more sensitive to the affective experience of exercise than the PANAS, they have not provided empirical evidence to support their claim.

As there was little difference between the EFI-C and the PANAS, in terms of examining mediators of the exercise-depression link, the PANAS may be a more appropriate measure of affect. The PANAS is conceptually related to the tripartite model and its use is based on a sound theoretical rationale of how the affective components relate to depression. Although Rejeski et al. (1999) and Gauvin and Rejeski (1993) suggest that exercise-induced feelings may mediate the mental health outcomes of exercise, they do not offer a clear theoretical rationale as to why. As discussed in chapter 3, this is symptomatic of a general problem with the development of the EFI scales – the development was based on many unsupported conjectures made by the authors rather than from a conceptual framework of affect (Ekkekakis & Petruzzello, 2001).

From a hierarchical mood perspective (Watson et al., 1999) it may be argued that exercise-induced feelings (Gauvin & Rejeski, 1993) are micro level emotions particularly responsive to the immediate exercise context that are encompassed by more distal, global factors such as PA and NA. From this perspective, it may be argued that exercise-induced feelings may be proximal mediators that may lead to change in more distal mediators such as PA and NA. However, this possibility was not explored in the

post-hoc analyses in the present study for a number of conceptual and empirical reasons. First, as discussed above, the data indicated that PA and pleasant affect may be conceptually indistinct and thus not independent mediators. In the development of the original EFI-A, the factors which comprise the pleasant affect scale in the EFI-C (positive engagement, tranquillity and revitalisation) all significantly correlated with the PANAS PA scale, with positive engagement showing a correlation of .69 with PA (Gauvin & Rejeski, 1993). Other authors (e.g. Ekkekakis & Petruzzello, 2001) have noted that positive engagement and revitalisation highly correlate and that there is little evidence for discriminate validity between these variables and PA. A notable absence in the development of the EFI-C was data pertaining to the discriminate and construct validity of the pleasant affect scale with PA. The present data relating to the EFI-C and previous findings regarding the EFI-A suggest that the pleasant feelings measured by both the EFI-A and EFI-C scales may not be different to PA. Second, while categorical feeling states relating to exercise may be argued to be proximal mediators, the measurement timescale of the EFI-C measures affect over the past week rather than proximally to the exercise context. The latter, along with the high correlation of pleasant affect and PA, suggests that the affective factors measured by the EFI may be as distal mediators as PA and NA. Third, empirically in this data there was no evidence that pleasant affect was more sensitive to exercise or physical activity than PA.

The use of the EFI-A and EFI-C in the longitudinal study and present study in this PhD, respectively, point to a number of issues problematic with the use of this scale in this area of research – these issues are discussed further in chapter 8.

#### *7.4.4 Physical activity self-efficacy and coping self-efficacy*

The results suggested that the mediating role of physical activity self-efficacy may be indirect through an increase in PA, rather than direct. The results support the use of physical activity-specific measures of self-efficacy for understanding the exercise-depression link and offer insight into in *what way* self-efficacy may play a role – an issue given little consideration in previous studies (see section 3.7.3, chapter 3). An increase in physical activity self-efficacy may be an important determinant of PA responses to exercise among depressed individuals. This possibility could be subject to further examination in longitudinal research. Future research might also utilise other exercise-specific self-efficacy measures, such as self-efficacy for the exercise task or



exercise abilities, rather than just barriers self-efficacy, which may offer further insight into the role of self-efficacy.

In terms of coping self-efficacy, the results suggest that PA, NA and physical self-efficacy may stronger candidate mediators. Contrary to expectations based on Craft (2005) and the insight gained from the participant accounts in the qualitative study, coping self-efficacy did not emerge as a significant mediator. The role of coping self-efficacy, however, cannot be discounted from these findings. As Kazdin & Nock (2003) point out, the evidence for a mediator of change will accumulate from a number of studies rather than just one. There may be a number of possible explanations of why coping self-efficacy did not emerge as a significant mediator in the present study.

First, the operationalisation of exercise as total energy expenditure and the statistical analyses used assume a linear relationship between total energy expenditure and all of the variables. While this may be relevant to affective responses such as depression (Dunn et al., 2005), PA or NA, increased coping self-efficacy may not be a function of a linear association with greater energy expenditure. A simpler distinction may be categorical between whether people are physically active or not.

Second, the extent to which coping self-efficacy may be a mediator may be dependent on the length of time people have been exercising, rather than how much exercise they have done recently. The understanding gained from the qualitative study was that with experience, people gradually began to realise that physical activity helped their depression and then started to actively use it as a coping strategy. Hsiao and Thayer (1998) found that more experienced exercisers were more likely to use exercise to self-regulate mood. Therefore, coping self-efficacy as a mediator may be moderated by length of experience (this would be termed 'moderated mediation'; MacKinnon, Fairchild, & Fritz, 2007). This possibility could be investigated in future research. It is also worth noting that the relationship between exercise and coping self-efficacy may be relatively subtle. The participants' accounts in the qualitative study suggested that a shift towards taking more control of one's depression was often tied up with the greater context of the depression experience over time, of which physical activity was only a part.

The lack of support for coping self-efficacy in the present study is contrary to the findings of Craft (2005) who found evidence to support coping self-efficacy as a potential mediator. One possible explanation is that Craft (2005) assessed coping self-efficacy within the context of an *intervention*, while in the present study free-living exercise was measured. In the Craft study, it may not have been the exercise per se which resulted in the increase in coping self-efficacy, but taking part in an *intervention*. Actively involving oneself in an intervention aimed at helping one's depression and maintaining attendance over time may offer a sense of mastery and thus a source of increased self-efficacy in itself. Also, Craft explicitly included sources of mastery to facilitate the self-efficacy experience, whereas the free-living exercise in the present study may have had less scope to provide sources of self-efficacy. Future intervention research assessing coping self-efficacy as a mediator could include a placebo comparison group, such as the stretching and relaxation exercise group used by Dunn et al. (2005), which may help disentangle whether such effects are due to the *participation in an intervention* or the exercise itself.

#### 7.4.5 Limitations

One of the main limitations of this study is self-selected sampling. There was a demographic bias in the sample towards people who were highly educated and either in employment or currently university students. This limits the generalisability of the findings.

While the findings provide some insight into the strength of association of each of the potential mediators with exercise and depression, the findings must be interpreted within the limitations of the cross-sectional design. It is not possible to determine the direction of causation between any of the variables. Many possible explanations for the observed data may exist, including that the DV may have caused the IV, or that the 'mediator' may have caused the IV (MacKinnon et al., 2007). One of the assumptions of mediation analyses is that the outcome does not cause the mediator (Judd & Kenny, 1981), and in a cross-sectional design this cannot be determined. A common mistake in interpreting mediation analyses is to interpret the findings in causal language in the absence of any evidence of temporal relation (Judd & Kenny, 1981). The mediation findings in the present study merely represent *associations* between the potential mediators and exercise and depression rather than *mediation* per se. However, such

information can provide insight into associations worthy of investigation in future longitudinal research.

A strength of the mediation analysis in the present study was the inclusion of more than one potential mediator in the same design. However, the whole scope of potential mediators of the exercise-depression link were not included in the analysis. Path coefficient estimates in models are sensitive to the presence of other mediating factors (Preacher and Hayes, in press) and may therefore be over- or under-estimated in the absence of other relevant mediators. Therefore, the effects found in the present study may differ when other mediators are included or omitted from models.

A further limitation may be the accuracy of retrospective reporting of physical activity and exercise behaviour over the previous week. Difficulties may include poor recall or social desirability in responses, and any inaccuracies may have affected the relationship observed between exercise / physical activity and depression. However, social desirability for self-report measures of exercise has been found to be minimal in other samples (Motl, McAuley, & DiStefano, 2005).

Although the use of the multiple mediation analysis via bootstrapping methods was most suited to this data and was a well considered statistical analysis, the use of SEM may have uncovered further pathways of interest and a model with a better fit to the data. The post-hoc analyses allowed exploration of additional pathways of interest, but a SEM analysis may have resulted in a different model. SEM would have been a more parsimonious approach to exploration of the data than the post-hoc analyses. Future research might use SEM with a larger sample to explore more complex relationships between the proposed mediators.

### *7.5 Conclusion*

PA and NA seem to be stronger candidate mediators of the exercise-depression link than coping self-efficacy or exercise-induced feelings. Physical activity self-efficacy may be an indirect mediator through PA rather than a direct mediator. Theoretically, the tripartite model of anxiety and depression may present a useful framework for understanding the benefit of this atheoretical treatment for depression by distinguishing between PA and NA. Factors proximal to the social psychological context of exercise, such as physical activity self-efficacy, may especially be associated with PA rather than

NA. Future research might include other relevant proximal mediators, such as enjoyment, and seek to understand further processes that may be differentially or equally associated with PA and NA. Contrary to the proposal in this thesis, PA and NA may equally mediate, but this finding warrants further examination in longitudinal conditions. Exercise and general physical activity may equally benefit depression, but this distinction should also be subject to further investigation.

## Chapter 8

### General Discussion

#### *8.1 Introduction*

In this chapter, the overall aims of the research in this thesis are reviewed and the original contribution to the field of knowledge is considered. The main findings from each study are integrated and the overall picture considered. A new, tentative theoretical model for understanding the process of change, developed from the complementary findings of the longitudinal, qualitative and cross-sectional studies, is proposed. The proposal of this new theoretical model makes a substantial, novel contribution to this field of knowledge. Implications and directions for future research and clinical practice are then discussed. Finally, the limitations of the present research are considered.

#### *8.2 Overview of Aims and Unique Contribution*

The overall aim of the research in this PhD was to identify potential mediators of the physical activity-depression relationship and gain insight into the process of change. As discussed in chapter 3, the difficulty with understanding ‘why’ and ‘how’ physical activity works is that there is no theoretical rationale for it as an intervention. In this PhD, a number of possible theoretical frameworks were identified which may be applied to this area (social cognitive theory, the EXSEM, a model of exercise-induced feelings, and the tripartite model of anxiety and depression). These included the tripartite model of anxiety and depression (Clark & Watson, 1991), which has not been previously suggested. The application of this theory, and especially the suggested potential role of change in the PA dimension of depression, represents one of the unique contributions of this thesis to this field of knowledge.

From the theoretical frameworks identified, the role of PA, NA, exercise-induced feelings, self-efficacy, self-esteem and physical self-concept as potential mediators was examined in a quantitative, longitudinal study. A second, qualitative study aimed to identify further hypothesised mediators outside of the identified theoretical frameworks, and aimed to complement the quantitative findings by gaining a richer, more contextualised understanding of the process of change. The insights gained from the longitudinal study and from the participants’ accounts in the qualitative study

informed the design of a final, cross-sectional study which examined the potential mediators within a multiple mediation analysis.

A strength of the design of the quantitative studies was the examination of a number of potential mediators drawn from different theoretical frameworks within the same study (Kazdin & Nock, 2003). To the author's knowledge, only one previous study (Craft, 2005) in this area has used such a design. Thus, this represented another novel contribution of this thesis - the exploration of unique combinations of potential mediators within the same studies. This allowed some insight into the relative importance of each purported mediator and insight into the utility of the theoretical frameworks from which they were derived. A further methodological strength was the explicit inclusion of the temporal precedence criteria. This has not previously been given much consideration in the limited number of studies in this area and represents another novel contribution of this thesis.

The qualitative analysis offered insight into the *meaning* of physical activity in the lives of people experiencing feelings of depression – it was experienced as a forward movement into life. The participants' accounts emphasised the importance of this being an enjoyable, engaging or pleasant experience for benefit to be perceived for depression. The analysis also suggested that embodied experience and knowledge may be an important part of the process of change. These are new insights which make a new contribution to this field.

Overall, the findings in this thesis contribute towards moving the potential psychological mediators of the physical activity-depression link out of the realm of speculation and into the realm of empirical evidence. Next, the main findings of each of the studies and how they may be integrated to form an overall picture are considered. The combined findings have resulted in a proposed, tentative theoretical model for understanding the process of change. Physical activity may not, after all, be an atheoretical intervention for depression.

### 8.3 Main Findings

#### 8.3.1 Positive and Negative Affect

Based on the tripartite model (Clark & Watson, 1991), it was proposed that physical activity may alleviate depression through increased PA and decreased NA. Distinction

between these two independent mood dimensions of depression was considered to be important, as it was hypothesised that PA may be a stronger candidate mediator than NA. The role of PA and NA as potential mediators was supported by both the longitudinal and cross-sectional studies, providing support for the application of the tripartite model (Clark & Watson, 1991) to this area. In both studies, these factors consistently emerged as stronger candidate mediators than other potential mechanisms. The insights from the qualitative study complemented these quantitative findings and helped contextualise the *meaning* of such changes. The participants' accounts suggested that benefit was mainly experienced to be through state mood changes from a greater sense of pleasurable engagement and involvement in life (for those who found it beneficial). This included experiencing increased feelings of enjoyment, pleasure, energy, and motivation to do other activities – feelings commensurate with the high PA dimension of mood (Watson & Tellegen, 1985). The accounts and insight into the meaning of physical activity for these individuals appeared to support the proposal that physical activity may particularly help depressed people move away from feelings of anhedonia.

Despite PA being theoretically more associated with physical activity than NA (Watson, 1988), the findings in this PhD provided only limited support that an increase in PA may be a stronger candidate mechanism. In the longitudinal study, there were larger effect sizes for change in PA than NA (or any other potential mechanism) at weeks 1 and 3. However, in the cross-sectional study there was no indication of a stronger effect of PA than NA. The longitudinal and cross-sectional studies offer complementary methodological advantages in understanding the potential role of PA and NA as mediators. The longitudinal study provided insight into the timeline of change, while the cross-sectional analysis allowed the associations with exercise and depression to be statistically examined in a larger sample within a multiple mediation analysis (which was not possible with the smaller sample in the longitudinal study). The integration of the cross-sectional and longitudinal findings suggest that physical activity may equally benefit PA and NA, but that an increase in PA may be (marginally) more important during the early stages of increased activity. This hypothesis could be examined in future research. In particular, the finding should ideally be replicated in a larger sample, as the sample size was small and effect sizes may have been more sensitive to individual influence.

Even if PA and NA equally mediate, the findings suggest that distinguishing between the independent PA and NA dimensions of depression as described by the tripartite model (Clark & Watson, 1991) may still be important. The insights from the qualitative study, in conjunction with the literature, and the cross-sectional study suggest that factors proximal to the physical activity context may be differentially associated with PA and NA. PA may especially be more sensitive to psychosocial factors, such as enjoyment and self-efficacy, than NA. Based on the complementary findings of the studies, the distinction between PA and NA forms a fundamental aspect of the proposed new model for understanding the process of change.

### 8.3.2 *Self-efficacy*

Support for self-efficacy as a potential mechanism was obtained in the longitudinal and cross-sectional studies, supporting the application of social cognitive theory (Bandura, 1977, 1997) to this area. In chapter 3, it was suggested that, theoretically, self-efficacy may either be a direct or indirect mediator (i.e. through PA, NA or self-esteem / self-concept) and may be operationalised as either physical activity-specific self-efficacy or coping self-efficacy. More support for the role of physical activity-specific self-efficacy than coping self-efficacy was obtained in the present research. Further, the results suggest that physical self-efficacy may be an indirect mediator specifically through increased PA. Next, the results are discussed in more detail.

The longitudinal study suggested that change in physical self-efficacy, in addition to PA and NA, may potentially mediate effects during the early stages of increased activity (i.e. physical self-efficacy significantly increased at weeks 1 and 3). One possibility discussed in section 5.4, chapter 5 was that increased physical self-efficacy may have been associated with the early changes (i.e. weeks 1 and 3) in state mood, particularly PA (i.e. an indirect mediation effect). This hypothesised pathway was investigated further in the *post-hoc* analyses in the cross-sectional study, as the multiple mediation analysis revealed that there was not a direct mediation association for physical activity self-efficacy. The *post-hoc* analysis suggested an indirect mediation role specifically through increased PA rather than decreased NA. In an experiment, Bodin and Martinsen (2004) similarly found that increased self-efficacy resulted in significant improvements in PA but not NA among clinically depressed individuals during a one-off exercise session. It may be hypothesised that an increase in physical self-efficacy may indirectly mediate response in depression through increased PA



rather than decreased NA. Future research might further examine this hypothesis, particularly in longitudinal designs. If this is the case, distinction between PA and NA in understanding the process of change may be further supported.

The findings also support the operationalisation of self-efficacy as physical activity-specific self-efficacy when examining mediators of the physical activity-depression link. In chapter 3, it was commented that in measuring self-efficacy or proposing it as a mediator, few previous investigators have considered *in what way* an increase in self-efficacy may be a mediator. In terms of *in what way*, the present findings suggest that increased confidence in abilities to perform physical activity may alleviate depression through increased feelings of pleasurable engagement (i.e. PA).

In terms of the operationalisation of physical self-efficacy, one of the limitations in interpreting the findings of the longitudinal study was that the measure used has recently been shown to be more a measure of self-esteem than self-efficacy (Hu et al., 2005). Therefore, it is possible that the change observed in this measure at weeks one and three may have actually represented an improvement in self-esteem rather than self-efficacy. This is a problematic complication in the light that the other results indicated that change in self-esteem and self-concept may be less important potential mechanisms of change. It is possible that the PPA may have been more sensitive to self-esteem change than the PSPP or RSE. The possibility that the findings reflected change in self-esteem rather than self-efficacy cannot be ruled out. This highlights the importance of selecting measures of self-efficacy that adequately reflect the propositions made by Bandura (1997) when examining self-efficacy in mechanisms research.

The operationalisation of self-efficacy as coping self-efficacy is also relevant to the domain of physical activity and depression, although less support was found for this as a potential mediator. The insights from the participants' accounts in the qualitative study, along with the literature (i.e. Craft, 2005), generated the hypothesis that an increase in coping self-efficacy may be a potential mediator. This was then quantitatively tested in the multiple mediation analysis in the cross-sectional study, but it did not emerge as a significant mediator. Among the reasons for this considered in section 7.4.4, chapter 7 was that the mediating role of coping self-efficacy may be moderated by the length of time people have been physically active. One of the

benefits of accessing the lived experience in the qualitative study was that the accounts contextualised the potential role of coping self-efficacy. It was only with direct experience of mood benefit from physical activity over time that some people gradually *made the connection* for themselves and then, in some cases, began to purposely use physical activity to self-manage their moods. This suggests that embodied experiences of benefit may be important, and that becoming conscious of the benefits may take time. This understanding presented a potential explanation for why coping self-efficacy may not have been a significant mediator in the cross-sectional study as it may depend upon the extent to which the mood benefits are 'known' by the individual, which may come with greater experience. The contextualised understanding from the qualitative study also offered insight that it may be naïve to suggest that physical activity per se will lead to an increase in coping self-efficacy. People's movement towards taking greater control of their depression was influenced by the greater context of embodied experiences and knowledge gained from their depression experience over time, of which physical activity was only a part.

### *8.3.3 Self-esteem and Physical Self-concept*

One of the benefits of taking the temporal precedence criteria into account in the longitudinal study was that the relative effect sizes for change in each of the purported mechanisms could be examined at three time points during the period of increased physical activity. This design offered new insights into the potential relative importance of each of the mediators, especially during the early stages (i.e. up to week 3), which a simple pre- to post-design could not offer. The results suggested that change in PA, NA and physical self-efficacy were stronger candidate mediators than change in self-esteem or self-concept. Although there were larger effect sizes for change in self-esteem than PA, NA and physical self-efficacy at week 8, much of the change in self-esteem and some of the self-concept variables occurred after there was no further significant change in depression. In a pre- to post-design, it may have been concluded that self-esteem represented a stronger candidate mediator, so this finding highlights the value of taking into account the temporal precedence criteria. As noted in section 5.4, chapter 5, change in self-esteem and physical self-concept cannot be discounted as potential mediators from these findings – for instance, it is possible that they mediate longer-term effects. However, from the present findings it may be concluded that they present weaker candidate mediators of at least the short-term effects of physical activity. Notably, issues relating to feelings about the self or self-

esteem were not a dominant aspect of the accounts in the qualitative study. Instead, the accounts suggested that the main perceived benefit of physical activity was state mood change from actively *just doing something* – taking a forward movement into life. Although it should be noted that from a constructivist perspective, a different researcher more sensitive to issues relating to the self or beginning the study with an intention to focus exploration on the effects of physical activity on perceptions of the self, may have made a different interpretation of the data. An inherent part of adopting the constructivist perspective is the acknowledgement that an interpretation of reality offered by a qualitative researcher is just that – an *interpretation* – which may be influenced by the theoretical perspectives and sensitivities that the researcher brings to the research process (Charmaz, 2006). Based on the findings of these two studies, self-esteem and self-concept were not included in the multiple mediation model in the cross-sectional study.

#### *8.3.4 Exercise-induced Feelings*

Although Gauvin and Rejeski (1993) argue that the EFI may be more sensitive to affective responses to physical activity than the PANAS and that the feeling states measured may mediate mental health outcomes, the studies in this PhD found no evidence to support either claim. The findings conceptually support the use of a dimensional approach to mood measurement rather than a categorical approach when looking at mediators. The findings also suggested a number of problems with employing the EFI to explore the physical activity-depression link.

First, inclusion of the EFI-A in the longitudinal study provided little useful information regarding potential mediators. The aim had been to capture affective responses (retrospectively) to the acute physical activity context, but as feeling states prior to a session were not measured, there was no information about how these changed pre- and post-session. This was a limitation of the design of the study. Further, there was not a conceptual framework available for methodologically establishing how acute feeling states may be related to psychological outcomes (i.e. depression) from chronic physical activity. In section 8.4.1.1 below, a possible methodological framework for resolving this issue is suggested.

Second, to overcome the limitation of using the acute version of the EFI in the longitudinal study, the chronic version (the EFI-C) – claimed to still retain some

specificity to the physical activity context (Rejeski et al., 1999) – was employed in the cross-sectional study. Yet, the results suggested that the EFI-C may be no more sensitive to the physical activity context than the PANAS. Therefore, the use of this measure within this area of research was not supported.

### *8.3.5 Embodied Experience and Knowledge*

One of the unique contributions of this PhD is the insight from the qualitative analysis that individuals' embodied experiences and, consequently, embodied knowledge of physical activity may be an important part of the process of change. The accounts in the qualitative study suggested that experiencing benefit for depression may be associated with individuals' direct experiences of feelings and bodily sensations within the physical activity context. This included enjoyment, experiencing pleasure, experiencing feelings of energy or calm immediately after physical activity, or finding that it felt 'good'. These accounts complement the quantitative findings, as they suggest that higher-order, chronic changes in factors such as PA, NA or depression may be associated with direct (bodily) experiences of the physical activity context.

Not only may embodied experiences of physical activity influence experience of benefit, but the qualitative analysis suggested that such experiences may be an important part of people keeping it up over time. The qualitative analysis particularly complements the quantitative findings by showing the dynamic nature of change and the variation of experience within individuals over time – elements of the process of change that are less accessible by quantitative methods. The analysis offered insight that a variety of non-physical activity- or depression-related motivations often brought people to start increasing their physical activity (i.e. having to, starting by chance). Often there was no sense of personal engagement with physical activity when people started. However, with positive embodied experiences – particularly feelings of enjoyment, pleasure or experiencing mood improvement – some individuals began to develop a personal engagement and more intrinsic motivations. This change was also apparent among people who had had previously negative experiences once they encountered more positive experiences. Physical activity eventually became a self-reinforcing activity, performed for the enjoyment and feelings derived from it. This understanding complements the quantitative findings as it suggests that change in potential mediators such as PA and enjoyment may be embodied experiences that become part of a self-reinforcing system perpetuating future physical activity behaviour

through embodied knowledge. This may be an important part of the process of change if physical activity needs to be maintained to obtain continuing benefit.

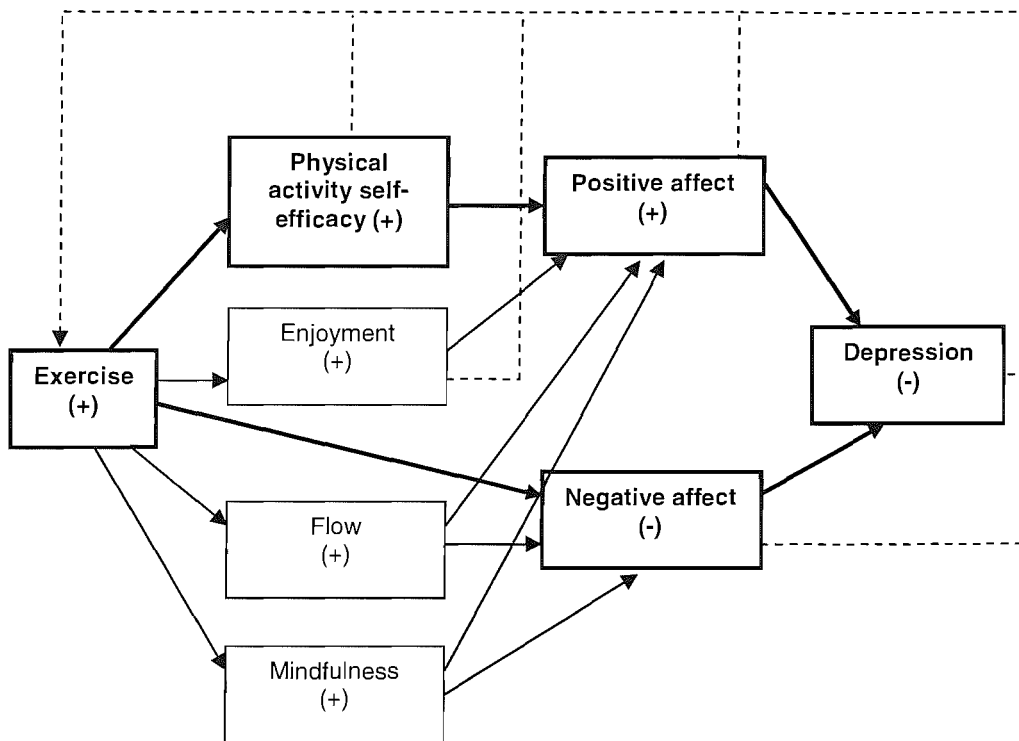
Research has mainly focused on cognitive, behavioural and environmental determinants of physical activity, rather than affect (Williams et al., 2008). While these factors may all have a role, the qualitative analysis suggests that affect and other embodied experiences (and, consequently, embodied knowledge) may warrant greater consideration. Based on the principle of hedonic theory, Williams et al point out that affective responses to a behaviour will determine future engagement in that behaviour. Studies have found that affective responses to exercise predict adherence over time (Annesi, 2005; Williams et al., 2008). An increase in self-efficacy – although a cognitive variable, it may be conceived as potentially another facet of the embodied experience of physical activity – has also been found to predict future exercise behaviour (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003). These findings suggest that improvement in the potential mediators, such as PA, NA, enjoyment and self-efficacy, may not only be associated with improvement in depression, but may also represent embodied experiences that perpetuate future physical activity.

The understanding gained from the qualitative analysis further complemented the quantitative findings by emphasising that depression is a physical, as well as a mental experience. Therefore, the body may be a theoretically important target of intervention in depression. This complements the findings relating to the role of PA and NA, because dimensional theories of mood emphasise bodily experiences and sensations in affective experience (Thayer et al., 1994). The embodied experience of physical activity forms a fundamental part of the proposed theoretical framework below.

#### *8.4 Proposed Theoretical Framework*

I propose a tentative theoretical model for understanding the potential mechanisms and process of change in the physical activity-depression link (see Figure 6). The model combines the findings from the quantitative and qualitative studies, and incorporates related findings from the literature regarding potential pathways.

Both quantitative studies suggested that it may be important to distinguish between the PA and NA dimensions of depression in understanding the process of change (i.e. there may be differential change in these components over time and different processes may



*Figure 6: Distinguishing between positive affect and negative affect: A conceptual framework for understanding the embodied, dynamic process of change in physical activity for depression. Bold lines represent the model developed from the multiple mediation analysis in the cross-sectional study. Normal weight lines represent further hypothesised mediators and pathways derived from the qualitative study in conjunction with the literature. Dashed lines represents self-reinforcing feedback loops.*

mediate the effects of physical activity on PA and NA). The distinction between the PA and NA dimensions of depression in the tripartite model (Clark & Watson, 1991) forms a fundamental basis of the model. The quantitative studies also suggested that a combination of the tripartite model (Clark & Watson, 1991) and social cognitive theory (Bandura, 1997) theoretical frameworks may be the most useful of those originally proposed in chapter 3 in understanding potential mediators, at least of outcomes during the early stages of increased activity. The model derived from the cross-sectional study reflects the integration of these theories (see figure 6, section 7.3.5, chapter 7). The model from the cross-sectional study is further expanded in the new proposed model to include the hypothesised change mechanisms (from outside the theoretical frameworks proposed in chapter 3) which were generated from the qualitative analysis - namely enjoyment, mindfulness and flow.

It is proposed that physical activity may alleviate depression through improvement in PA and NA (that is, both an increase in pleasurable engagement, and a decrease in feelings of tension and distress). It is also proposed that processes more proximal to the physical activity context may differentially or equally mediate change in PA and NA. The cross-sectional study suggested that an increase in physical self-efficacy may be an indirect mediator through increased PA. Based on the literature, an increase in enjoyment is also hypothesised to be related to PA but not NA responses (Raedeke, 2007). No specific predictions are made regarding mindfulness or flow, as there is no indication in the literature as to whether these factors may be differentially related to PA and NA (e.g. Brown & Ryan, 2003; Karageorghis et al., 2000). It is worth noting that some authors have argued that exercise enjoyment may be operationalised as feelings of flow (Kimiecik & Harris, 1996), so these two concepts may not be distinct. Based on the qualitative and longitudinal studies, it may be hypothesised that the model may only describe mediation effects of shorter-term outcomes (i.e. the initial stages of increased activity).

An essential component of the model is the importance of embodied experiences and knowledge in the process of change. Direct, embodied experiences of the physical activity context may lead to change in proximal mediators (i.e. physical self-efficacy, enjoyment etc.) which may indirectly mediate change in depression through more distal mediators (i.e. PA and NA). Therefore, an individual's positive or negative embodied experiences form the basis for higher level change (i.e. in depression).

Note that the specification of physical self-efficacy, enjoyment, flow and mindfulness does not mean that these are the only proximal mediators. These factors are derived from the present findings, but by no means exclude other possible mediators. The model is tentative and open to further modification. Ekkekakis' (2003) 'dual-mode model' for understanding affective responses to physical activity, for instance, proposes that both cognitive (e.g. self-efficacy, goals) and physiological (e.g. heart rate, bodily temperature, muscular sensations) processes may influence affective responses. Although only 'cognitive' variables (which here are argued to be inherently embodied) are proposed in my model, the assumption of *embodied* experiences is compatible with the dual-mode model and physiological parameters may mediate or moderate affective outcomes.

The importance of embodied experience and knowledge is further incorporated by the feedback loop proposing a self-reinforcing role for change in affect, physical self-efficacy, enjoyment and a decrease in depression for reinforcing future physical activity, as suggested by the literature and the participants' accounts in the qualitative study. The feedback loop may represent a movement towards more intrinsic motivations, as suggested by the qualitative analysis. The understanding gained from the qualitative analysis was particularly useful for informing the hypothesised dynamic nature of the process of change. Theoretically, there may be further feedback loops within the model, such as from affect to self-efficacy, as Bandura (1997) proposes a reciprocal relationship.

Based on the present findings, self-esteem, physical self-concept and coping self-efficacy were not incorporated into the model as potential mechanisms. These factors cannot be ruled out, though, and might be subject to further research. It may be found that they operate in parallel with PA or NA, or that they may indirectly mediate through PA and / or NA. Also, they may potentially be mediators of longer-term change (e.g. maintenance), rather than shorter-term outcomes.

#### *8.4.1 Issues for Development*

*8.4.1.1 Distinguishing change processes and change mechanisms.* In the psychotherapy process research literature, Doss (2004) presents a framework for distinguishing between change processes and change mechanisms in understanding processes of change. 'Client change processes' are changes that occur within the client within a therapy session, while 'change mechanisms' are changes that occur within the client outside the session. Change processes are hypothesised to temporally precede change in change mechanisms, which, in turn, precede change in the outcome. It may be useful to apply Doss' (2004) framework to understanding the process of change in physical activity for depression. In my model in Figure 6, distinction is not made between which variables may be 'change processes' and which may be 'change mechanisms', as it is not possible to draw firm conclusions from the present data. It may also be premature when the change mechanisms are yet to be better understood. Future expansions of the model could make this distinction, however, and Doss' (2004) framework might be used as a way of understanding how changes from acute physical activity may relate to outcomes of chronic activity. Increased feelings of enjoyment,



flow or physical self-efficacy within a physical activity session, for instance, may be 'change processes', while improvements in PA and NA outside of the session may be 'change mechanisms'. Of course, the same concepts may be both change processes and change mechanisms. For example, an increase in physical self-efficacy may occur both within session and distal to the session.

One of the limitations in understanding affective responses to chronic physical activity is that there is presently no framework for understanding how acute changes may relate to longer-term changes (Taylor, in press). Although affective experiences related to acute exercise may be proposed to mediate longer-term changes (Gauvin & Rejeski, 1993), the EFI was methodologically problematic in the present studies for investigating this. Doss' (2004) framework could be employed to resolve this and understand how acute changes relate to chronic changes. Within this framework, one possible study design could be to measure affect (i.e. PA) pre- to post- in a one-off session and examine how change in this 'change process' prospectively predicts change in the 'change mechanism' (i.e. change in PA outside of the session).

*8.4.1.2 Moderators.* Further expansion of the model could also incorporate moderators of the physical activity-depression relationship and moderators of the mediation pathways. For example, as well as being a potential mediators, physical self-efficacy (Bozoian et al., 1994) and exercise enjoyment may moderate affective outcomes to exercise. (See section 3.9.4, chapter 3 for other potential moderators).

### *8.5 Future Research*

Delineating mediators of change is inherently complex, and, as Kazdin and Nock (2003) point out, evidence for a mediator will come from a number of studies rather than just one. The present studies demonstrate how three distinct methodological approaches may contribute to a complementary understanding. Each approach had a number of limitations and strengths, but when combined contributed to the development of a new model which may enhance understanding and generate further research. I have already considered above some directions for future research directly arising from the findings of the present studies. The suggestions for future research I make below focus on methodological issues that may need to be considered when designing studies and the implications of different methodological approaches for developing knowledge in this area.

Methodologically and conceptually a number of distinctions may need to be made when examining mediators. First, as outlined above, it may be helpful to distinguish between ‘change processes’ and ‘change mechanisms’ (Doss, 2004). Second, distinction may need to be made between mechanisms related to outcomes of acute sessions and mechanisms related to outcomes of chronic physical activity. An acute perspective may elucidate within session processes that affect mood responses during and after a session. A chronic perspective may elucidate the processes underlying more enduring changes. This may be important, as different mechanisms may be found to determine outcomes of acute and chronic physical activity. For example, while there was limited support for distraction as a mechanism within the context of a chronic intervention in the Craft (2005) study, distraction may be a process that is related to mood outcomes of a single session. Doss’ (2004) framework could then be applied to understanding how such acute changes may relate to longer-term changes.

Third, distinction could be made between identifying mediators of short-term (i.e. outcomes during the early stages of increased activity) and long-term effects (i.e. maintenance of benefit or further changes after an initial reduction in depression). This distinction may determine the time points at which investigators measure mediators and measurement might ideally take into account the temporal relation of change. For instance, if physical activity is found to have a ‘rapid response’ effect (as suggested in section 5.4.2, chapter 5), identification of mediators of this may require frequent, multiple measurement during the early stages of increased activity. This may even require session-by-session measurement (Doss, 2004). Time course could be assessed both in terms of weeks and dose of physical activity (i.e. number of sessions) (Doss, 2004). Further exploration of the temporal relation of change would be aided by further research offering insight into the timeline of change in depression, particularly during the early stages.

In addition to making these distinctions, there are a number of methodological designs that future research might use to investigate mechanisms that were not used in the present research. Research could examine individual trajectories of change (Faulkner & Carless, 2006) rather than just mean change across a group. Examining mean changes presumes that all individuals may change in the same way (Tang & DeRubeis, 1999) and may be misleading if there is heterogeneity. A limitation of the findings in

the longitudinal study is that they were based on mean changes, and findings (e.g. the role of self-esteem) may be different when examined on an individual basis. As Fox (1999) points out, different mechanisms may be at work for different people. Also, change in the outcome and mechanisms may occur at different time points for different individuals.

Research could also take a case study approach. For instance, repeated assessment of potential mediators may be labour intensive and demanding, and may be more pragmatic when looking at single cases (although generalisability will be limited). Examination of the trajectories of both responders and non-responders may be insightful (Steketee & Chambless, 1992).

Once change processes and mechanisms are better understood, research may move to a confirmatory stage where the hypotheses are tested in dismantling studies or experiments in which potential mediators are manipulated (Doss, 2004; Hollon et al., 1987; Kazdin & Nock, 2003). Experimental data adds strength to the evidence that a proposed mechanism may play a causal role (Kazdin & Nock, 2003). 'Change processes' may be more amenable to experimental manipulation than 'change mechanisms' (Doss, 2004).

Future research may also endeavour to examine a number of potential mediators within the same study to gain insight into the relative importance of and relationships between each. Although the design of the present studies took this into account, SEM was not used to analyse any of the data and may be especially useful in this context. Future research may usefully employ SEM, as a theoretical model may be specified and the fit to the data tested. An exploratory approach may lead to theoretical developments, as SEM can offer insight into parameters that may be adapted to improve the fit. My proposed model above could subject to such an analysis.

Future research could include another treatment comparison group (i.e. an antidepressant group) to examine whether change in the potential mechanisms (e.g. increased PA) represent specific or non-specific effects of physical activity. Even if treatments are equally effective, exploring specific effects across treatments may help identify whether physical activity may result in particular benefits that other treatments do not offer.

The qualitative analysis suggested that exercise may be a form of behavioural activation. Future research could explore this possibility further by comparing the effectiveness and outcome of physical activity with behavioural activation. Research might also examine whether similar mechanisms are responsible for response in both approaches (e.g. increased PA).

### *8.6 Clinical Implications*

An understanding of the mediators of the physical activity-depression link can offer insight into 'how' and 'why' physical activity may alleviate depression. Clinically, this understanding is important in its own right. A more definitive answer to this question will evolve over time from accumulated evidence, rather than any one or set of studies. However, the present findings suggest that, at least in the short-term, physical activity may alleviate depression through improvements in PA, NA and self-efficacy, rather than improvement in self-esteem and physical self-concept. It may also provide depressed patients or clients with a greater sense of pleasurable engagement in life, which appeared to be an important concern of the participants in the qualitative study. It may also offer a way of actively self-managing symptoms in the longer-term. However, patients may need to develop knowledge of the benefits from their own experience, rather than being merely 'told' it will help, to move them towards this.

Clinically, the role of physical activity in promoting PA as well as decreasing NA should not be taken for granted. The results suggest at least an equal role for improvement in PA and NA, and the possibility that PA may be a stronger mediator in the initial stages. Good mental health is characterised by more than the absence of distress. Indeed, subjective well-being is characterised by experiencing higher levels of PA than NA (Diener, 1984). In treating depression, it may be important to focus on how to make people more happy rather than just less sad (Seligman & Csikszentmihalyi, 2000). Therefore, if physical activity does partly alleviate depression through an increase in PA, this may have important clinical implications. For instance, 28 – 55% of patients taking SSRIs do not respond (Nutt et al., 2006). Nutt et al. (2006) suggests that this may be because serotonergic antidepressants may be less associated with PA than NA, and low PA may be a more dominant symptom in some patients. Physical activity may offer the benefit of tackling both the symptom profiles of high NA and low PA.

The identification of mechanisms is important not just in understanding a specific therapeutic approach, but may also tell us something about the broader context and the factors in everyday life that may play a role in positive mental health (Kazdin, 2001). If physical activity ‘works’ partly through increasing PA (in addition to decreasing NA), this may have wider implications for the management of depression. For instance, other experiences or activities in life that are related to PA may play a role in alleviating depression. Watson (1988) found that physical activity and social contact were specific correlates of PA but not NA. If increased PA partly mediates the depression response, social contact may also be beneficial.

The role of taking ‘a forward movement into life’ may also extend beyond the substantive area of physical activity. The wider implication of this may be that movement away from depression either temporarily or in the long-term may involve facilitating a greater sense of engagement in life and the immediate situation. Indeed, the participants in the qualitative study did not just perceive benefit from physical activity, but generally from *just doing something*. Activity theory cites that human happiness is derived from the inherent process – rather than reaching the ultimate goal – of performing an activity. ‘Activities’ encompass social interaction, hobbies and exercise (Deiner & Emmons, 1984). Happiness is derived from individuals being “involved in interesting and involving activities” (Diener, 1984, p. 564). Physical activity may form a part of this, and in treating depression encouraging behaviours that involve an active engagement in life may be important.

An understanding of the processes that mediate change in PA, NA and, indirectly, depression (as per the proposed model) means that physical activity interventions may potentially be made more effective by targeting these factors. The literature and the post-hoc analyses in the cross-sectional study suggest that PA responses to physical activity may be particularly sensitive to psychosocial factors proximal to the physical activity context, such as increased enjoyment and physical self-efficacy. This has implications for the design of interventions or for exercise counselling. If an increase in physical self-efficacy is shown in the future to be an important mediator, interventions may be optimised by targeting and including sources of self-efficacy (i.e. mastery experiences, vicarious experience, verbal persuasion, and physiological and affective information). For example, the mastery experience may be facilitated by

setting patients or clients graded, achievable tasks or goals for their physical activity. Encouraging patients to be physically active with an active friend or to consult a fitness professional may facilitate self-efficacy by providing a source of modelling (vicarious experience) or verbal persuasion. The inherently embodied experience of physical activity may also provide a number of sources of physiological or affective information which could be manipulated to facilitate increased self-efficacy – such as recommending an optimal intensity tailored to the individual.

Relatedly, the present research suggests that embodied experiences of physical activity may be important determinants of response. The insights suggest that practitioners may particularly need to consider the importance of patients taking part in physical activities that they find enjoyable, engaging or pleasant. This could be explicitly considered when promoting physical activity with depressed patients or clients. An understanding of the role of embodied experiences may also help practitioners understand why some patients may respond while others do not. However, the findings suggest that even if physical activity is not initially 'liked' or enjoyed, in another context the individual may come to enjoy it and may experience benefit. Therefore, if enjoyment is found to moderate and / or mediate affective benefit, practitioners perhaps should not seek to prescribe physical activity only to individuals who may enjoy it, but seek to facilitate the individual finding an enjoyable and pleasant activity.

The insights from the qualitative analysis also suggested that embodied knowledge of the depression experience and the things that help manage depression (i.e. taking a forward movement into life) was an important part of individuals taking more control over time. Greater self-agency in self-managing depression may evolve from embodied knowledge. Although the role of embodied knowledge was not investigated beyond the substantive area, it may be an important part of patient's self-management of and movement away from depression over time – an insight which may be useful for practitioners. While practitioners may endeavour to help patients manage symptoms, ultimately movement away from depression may come with time through the patient's own experience and, consequently, embodied knowledge.

If physical activity needs to be maintained for continuing mood benefit, as the accounts in the qualitative study suggested, then physical activity counselling may need to focus on developing patients' motivations for regular physical activity. Initially, extrinsic

motivations and prompts may help maintain activity. But the qualitative analysis and my proposed model suggest that patients may benefit from moving to a stage where physical activity becomes a self-reinforcing activity and they begin to develop more intrinsic motivations (i.e. it becomes more self-regulated). The model suggests that improvement in the mediators may help facilitate this, as well as response in depression. Therefore, interventions or counselling may need to be designed or tailored to the individual so that improvement in the mediators occurs (as discussed above). Further, drawing on self-determination theory (Ryan & Deci, 2000), a physical activity context that enhances feelings of relatedness, competence and autonomy may also foster intrinsic motivation. These factors may need to be targeted. Satisfaction of these hypothesised basic psychological needs may also lead to improved psychological well-being (Ryan & Deci, 2000). A further implication of the findings relating to extrinsic and intrinsic motivations is that patients or clients with initially extrinsic motivations may require more support for increasing physical activity than those with intrinsic motivation. Exercise referral schemes, for instance, may be a particularly useful starting point for these individuals – as long as the experience is enjoyable or pleasant!

### *8.7 Limitations*

Within the resources available for this PhD, conducting research into mechanisms of change proved to be a difficult endeavour. Decisions about study designs and sampling were based in part on practicality and feasibility. This meant that both the quantitative studies were based on convenience sampling, which resulted in a bias towards individuals recruited from universities. Also, participant recruitment for the longitudinal and qualitative studies attracted more active people than non-active people or people who were more negative about physical activity. As a result, the generalisability of the findings is limited.

Although the longitudinal study was designed as a pilot study to assess feasibility and inform the later development of a controlled study, in retrospect it would have benefited greatly from the inclusion of a control group. While consideration of the temporal precedence criterion was a strength of the design, in the absence of a control group it was not possible to ascertain whether any of the changes observed may have been due to the increase in physical activity, natural changes over time or expectancy effects. In particular, as depression changed at week 1, it was difficult to gain insight relating to the temporal precedence in the absence of a control condition.

An attempt to address this limitation was made by the design of a controlled longitudinal study with a number of early measurement points (see section 4.3.6.2, chapter 4). However, the study proved infeasible, which meant that the temporal precedence criterion could not be addressed further in this PhD. Therefore, the results offer only limited insight into this, despite it being an important part of the initial aims of the PhD. The design of such a controlled, longitudinal study with multiple measurement points may be better suited to funded clinical trials where greater time, physical activity and financial resources are available. One possible solution to the difficulties of conducting a controlled longitudinal study for this PhD may have been to conduct a remote (e.g. postal or via the internet) observational study instead. Participants with elevated depression scores and similar baseline physical activity behaviour could have been recruited. Then natural variations in physical activity, the potential mediators and depression could have been monitored at multiple measurement periods over time (i.e. longitudinally for three weeks) – rather than assigning participants to an ‘increased physical activity’ or control group.

A further limitation of the longitudinal work was incomplete participant retention. There was a 61.5% participant retention rate, which does not compare favourably with other studies in this area. For instance, a meta-analysis by Stathopoulou et al found a mean 19.9% participant drop-out rate for exercise and depression studies. The greater drop-out rate in the present study may be due to a) the fact that a formal intervention and support was not employed and b) the four phase measurement design may have been too demanding for participants. This meant that the completing sample consisted of individuals who had been more active at baseline, and so the results are limited to these individuals.

Although an adequate number of participants were recruited in the cross-sectional study to carry out the bootstrap multiple mediation analysis, in retrospect a design with the aim of using SEM and thus an intention to recruit a larger number of participants may have been better. SEM may have offered greater insight into the associations between the variables in the cross-sectional study and would have been a more parsimonious method of analysis. For example, multiple statistical tests were conducted in the *post-hoc* analyses to test whether physical activity self-efficacy may have been an indirect mediator, and SEM would have avoided multiple testing. With SEM, parameters



which may be respecified to improve the fit of the model could have been identified and the fit of the model assessed. This may also have resulted in identification of other relationships not tested in the multiple mediation analysis and thus may have potentially resulted in a different model. However, recruitment for the cross-sectional study was limited by time constraints due to the controlled longitudinal study proving infeasible. It was also limited by the postal questionnaire design, so an adequate number of participants may not have been obtained even if SEM had been the aim.

One of the advantages of using qualitative methods in mixed methods research is that further hypotheses outside established theory may be generated for examination in quantitative research. Although hypotheses were generated from the qualitative study for examination in the cross-sectional study (i.e. coping self-efficacy, PA), these factors were still derived from the theoretical frameworks identified in chapter 3. The qualitative work did go beyond the originally identified theoretical frameworks, particularly by offering insight into the meaning of physical activity for depressed individuals, but the way the findings were operationalised for the cross-sectional study was still within the originally identified frameworks. Although the concept of ‘a forward movement into life’ was proposed to be assessed by inclusion of PA in the cross-sectional study, inclusion of other measures, such as anhedonia - which is conceptually distinct from PA (Franken, Rassin, & Muris, 2007) – or even physical anhedonia (Loas et al., 1992) may have enabled exploration of this hypothesis more fully. Likewise, the qualitative analysis generated the hypotheses that increased feelings of enjoyment, flow and mindfulness may be potential mechanisms, and a further limitation is that these factors were not measured in the cross-sectional study. Grounded theory is an iterative and inherently reflective process, and an analysis continues to evolve across the whole process from open coding to writing up the results (Charmaz, 2006). The design for the cross-sectional study was generated after saturation was deemed to have been reached and after data collection for the qualitative study, but the analysis and theory generated from the qualitative study continued evolving through the iterative writing-up phase after the start of the cross-sectional study. Hence, ideas in their infancy at the end of data collection and formal analysis evolved further during write-up (Charmaz, 2006). This accounts for why these factors were not measured in the cross-sectional study. This also shows the difficulty of conducting mixed methods research within the time limitations of a PhD, particularly when using grounded theory.

Finally, it may be argued that as PA and NA theoretically form two symptom profiles of depression (Clark & Watson, 1991) that any effects found for change in these variables over time or their mediating associations may be due to substantial shared variance with depression. One limitation in interpreting the findings relating to these factors is that they may logically respond / be related to physical activity in a similar fashion to depression, and this may be why they emerged as stronger candidate mediators. However, when designing the studies care was taken to ensure that measures of these factors were conceptually distinct from the depression measure. Further, the results do indicate the value of distinguishing between PA and NA for understanding the process of change.

### *8.8 Conclusions*

Improvement in PA, NA and physical self-efficacy may be stronger candidate mediators of the physical activity-depression relationship than improved self-esteem or physical self-concept, at least in the early stages of an increase in physical activity. Increased physical self-efficacy may be an indirect mediator (rather than a direct mediator) through improved PA but not NA. There may also be greater changes in PA than NA during the initial stages. The process of change may be fundamentally viewed as embodied. Embodied experiences and knowledge of physical activity, such as enjoyment, may be associated response, may reinforce future physical activity and may be differentially related to PA and NA. It may therefore be important to distinguish between the PA and NA mood dimensions of depression as per the tripartite model of depression and anxiety (Clark & Watson, 1991) in understanding the process of change. The need to distinguish between PA and NA and their relative mediating associations might be subject to further research. This may contribute towards furthering our understanding of how “what we do with our bodies may ... affect how we think and feel” (Mutrie, 2002, p. 412).

## APPENDICES

**Feeling down and unhappy? Feel unable  
to shake it off?**

**Consider exercise**

**Research study into the psychological effects of exercise**



This is a study that is seeking to recruit individuals who feel they are suffering from low mood or depression to take part in pilot research work examining the psychological effects of exercise.

The study asks individuals to take part in an eight-week exercise routine entirely of their own choice, and to complete psychological measures at intervals during this period.

Exercise offers many benefits to the individual, both physically and mentally.

***This study may present a good opportunity for an incentive to begin an exercise routine and a chance to get some benefit from any unused gym or SportRec membership!***

**A maximum of £50 reimbursement  
is available to fund the exercise**

If you are interested in taking part in this research, please contact the researcher Karen White (Research Training Fellow, Primary Medical Care, School of Medicine, and Research Student, School of Psychology), by e-mail [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or phone 023 8024 1064 for more information.

Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Research Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064
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Appendix B: Participant recruitment e-mail for longitudinal study

**[Participant recruitment e-mail – to be sent to undergraduate / postgraduate / staff mailing lists]**

Physical Activity and Depression Study

I am seeking to recruit individuals who feel they are suffering from low mood or depression to take part in a study looking at physical activity and depression. People who take part in the study will be asked to increase their level of exercise for a three week period, in their own time, doing any kind of exercise that they like, and they will be asked to complete psychological measures at intervals during the study. A maximum of £10 reimbursement is available to fund the exercise, and everyone taking part will be paid £5 for the return of questionnaires.

Exercise offers many health benefits. This study may present a good incentive for you to exercise more and a chance to get some benefit from any unused gym or SportsRec membership!

This research study has been approved by the School of Psychology Ethics Committee, Ref: PG/03/38.

If you are interested in taking part in this research or would like further information, please feel free to contact me by e-mail [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or phone 023 8024 1064.

TO AID CONFIDENTIALITY, PLEASE DO NOT REPLY TO THE PERSON WHO SENT YOU THIS E-MAIL, BUT CONTACT KAREN WHITE ON THE E-MAIL ADDRESS ABOVE.

Kind regards  
Karen

Karen White  
Research Training Fellow (Primary Medical Care, School of Medicine) and Research Student (School of Psychology)

Primary Medical Care  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
Southampton  
SO16 5ST

This research is supervised by Prof Tony Kendrick (Primary Medical Care, School of Medicine) and Prof Lucy Yardley (School of Psychology)

Appendix C: The Positive Affect and Negative Affect Schedule (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past few days. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

interested	_____	irritable	_____
distressed	_____	alert	_____
excited	_____	ashamed	_____
upset	_____	inspired	_____
strong	_____	nervous	_____
guilty	_____	determined	_____
scared	_____	attentive	_____
hostile	_____	jittery	_____
enthusiastic	_____	active	_____
proud	_____	afraid	_____

Appendix D: Exercise-Induced Feeling Inventory (EFI) adapted for retrospective recall and incorporating Psychological Distress (PD) scale of the Subjective Exercise Experiences Scale (SEES), as used in the longitudinal study

Please use the following scale to indicate the extent to which each word below describes how you have generally felt immediately after any exercise sessions over the past few days. If you have not exercised over the past few days, base your answers on the last time that you did. Use the following scale to record your answers:

0	1	2	3	4
Did not feel	Felt slightly	Felt moderately	Felt strongly	Felt very strongly

Refreshed	_____	Happy	_____
Calm	_____	Tired	_____
Fatigued	_____	Revived	_____
Enthusiastic	_____	Peaceful	_____
Relaxed	_____	Worn-out	_____
Energetic	_____	Upbeat	_____
Awful	_____	Crummy	_____
Discouraged	_____	Miserable	_____

Appendix E: Rosenberg's Global Self-Esteem Scale (RSE)

Below is a list of statements dealing with your general feelings about yourself. Use the following scale to record your answers:

	Strongly Disagree				Strongly Agree
I feel that I'm a person of worth, at least on an equal plane with others	1	2	3	4	5
I feel that I have a number of good qualities	1	2	3	4	5
All in all, I am inclined to feel that I am a failure	1	2	3	4	5
I am able to do things as well as most other people	1	2	3	4	5
I feel I do not have much to be proud of	1	2	3	4	5
I take a positive attitude toward myself	1	2	3	4	5
On the whole, I am satisfied with myself	1	2	3	4	5
I wish I could have more respect for myself	1	2	3	4	5
I certainly feel useless at times	1	2	3	4	5
At times I think I am no good at all	1	2	3	4	5



Appendix F: The Physical Self-Perception Profile (PSPP)

These are statements that allow people to describe themselves. For each line:

1. Decide which **one** of the two statements best describes you (left **or** right statement).
2. On that side put a **CROSS** in the correct box for you (“sort of true” **or** “really true”).

**Please do not put a cross on both sides!**

**EXAMPLE**

Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
		Some people are very competitive	BUT	Others are not quite so competitive	<b>X</b>	

Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
		Some people feel that they are not very good when it comes to playing sports	BUT	Others feel that they are really good at just about every sport		
		Some people are not very confident about their level of physical conditioning and fitness	BUT	Others always feel confident that they maintain excellent conditioning and fitness		
		Some people feel that compared to most, they have an attractive body	BUT	Others feel that compared to most, their body is not quite so attractive		
		Some people feel that they are physically stronger than most people of their sex	BUT	Others feel that they lack physical strength compared to most others of their sex		
		Some people feel extremely proud of who they are and what they can do physically	BUT	Others are sometimes not quite so proud of who they are physically		
		Some people feel that they are among the best when it comes to athletic ability	BUT	Others feel that they are not among the most able when it comes to athletics		
		Some people make certain they take part in some form of regular vigorous physical exercise	BUT	Others don't often manage to keep up regular vigorous physical exercise		
		Some people feel that they have difficulty maintaining an attractive body	BUT	Others feel that they are easily able to keep their bodies looking attractive		

Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
		Some people feel that their muscles are much stronger than most others of their sex	BUT	Others feel that on the whole their muscles are not quite so strong as most others of their sex		
		Some people are sometimes not so happy with the way they are or what they can do physically	BUT	Others always feel happy about the kind of person they are physically		
		Some people are not quite so confident when it comes to taking part in sports activities	BUT	Others are among the most confident when it comes to taking part in sports activities		
		Some people do not usually have a high level of stamina and fitness	BUT	Others always maintain a high level of stamina and fitness		
		Some people feel embarrassed by their bodies when it comes to wearing few clothes	BUT	Others do not feel embarrassed by their bodies when it comes to wearing few clothes		
		When it comes to situations requiring strength some people are one of the first to step forward	BUT	When it comes to situations requiring strength some people are one of the last to step forward		
		When it comes to the physical side of themselves some people do not feel very confident	BUT	Others seem to have a real sense of confidence in the physical side of themselves		
		Some people feel that they are always one of the best when it comes to joining in sports activities	BUT	Others feel that they are not one of the best when it comes to joining in sports activities		
		Some people tend to feel a little uneasy in fitness and exercise settings	BUT	Others feel confident and at ease at all times in fitness and exercise settings		
		Some people feel that they are often admired because their physique or figure is considered attractive	BUT	Others rarely feel that they receive admiration for the way their body looks		
		Some people tend to lack confidence when it comes to their physical strength	BUT	Others are extremely confident when it comes to their physical strength		
		Some people always have a really positive feeling about the physical side of	BUT	Others sometimes do not feel positive about the physical side of		

		themselves		themselves		
Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
		Some people are sometimes a little slower than most when it comes to learning new skills in a sports situation	BUT	Others have always seemed to be among the quickest when it comes to learning new sports skills		
		Some people feel extremely confident about their ability to maintain regular exercise and physical condition	BUT	Others don't feel quite so confident about their ability to maintain regular exercise and physical condition		
		Some people feel that compared to most, their bodies do not look in the best of shape	BUT	Others feel that compared to most their bodies always look in excellent physical shape		
		Some people feel that they are very strong and have well developed muscles compared to most people	BUT	Others feel that they are not so strong and their muscles are not very well developed		
		Some people wish that they could have more respect for their physical selves	BUT	Others always have great respect for their physical selves		
		Given the chance, some people are always one of the first to join in sports activities	BUT	Other people sometimes hold back and are not usually among the first to join in sports		
		Some people feel that compared to most they always maintain a high level of physical conditioning	BUT	Others feel that compared to most their level of physical conditioning is not usually so high		
		Some people are extremely confident about the appearance of their body	BUT	Others are a little self-conscious about the appearance of their bodies		
		Some people feel that they are not as good as most at dealing with situations requiring physical strength	BUT	Others feel that they are among the best at dealing with situations which require physical strength		
		Some people feel extremely satisfied with the kind of person they are physically	BUT	Others sometimes feel a little dissatisfied with their physical selves		

Appendix G: The Perceived Physical Ability (PPA) subscale of the Physical Self-Efficacy Scale (PSE)

This scale assesses your competence in performing tasks involving physical skills. Please circle your answer.

	Strongly disagree					Strongly agree
I have excellent reflexes	1	2	3	4	5	6
I am not agile and graceful	1	2	3	4	5	6
My physique is rather strong	1	2	3	4	5	6
I can't run fast	1	2	3	4	5	6
I don't feel in control when I take tests involving physical dexterity	1	2	3	4	5	6
I have poor muscle tone	1	2	3	4	5	6
I take little pride in my ability in sports	1	2	3	4	5	6
My speed has helped me out of some tight spots	1	2	3	4	5	6
I have a strong grip	1	2	3	4	5	6
Because of my agility, I have been able to do things which many others could not do	1	2	3	4	5	6

Appendix H: Baseline measure of physical activity used in the longitudinal study

Please recall and record any physical activity that you have taken part in over the past seven days. This includes formal exercise (ie running, swimming) and cycling or brisk walking as a means of transport (this should make your heart beat faster and make you feel warmer), but only if you cycle or walk **for 15 minutes or longer in one go**.

The Past Seven Days		
Day	Type of exercise	Duration (minutes)
Mon		
Tues		
Weds		
Thurs		
Fri		
Sat		
Sun		
Total number of <i>minutes</i> spent exercising:		
Total number of <i>days</i> on which you exercised this week:		

## Exercise Diary Instructions

### INSTRUCTIONS

- Complete this week's exercise record **on any days that you exercise.**
- You are asked to record the **type of exercise** you have done and the number of **minutes** that you spent exercising.
- You should record any exercise that you take part in, **including cycling or brisk walking** (this should make your heart beat slightly faster and make you feel warmer) as a means of transport, but only **if you cycle or walk for 15 minutes or longer in one go.**
- If you do more than one type of exercise in one day, include this in the record as shown in the example below.
- Please write the start date in the space provided.
- At the end of the week, add up the total number of minutes spent exercising, and record this in the box provided.
- Also add up the total number of days on which you exercised during the week.

### EXAMPLE:

WEEK X Start Date ...31.05.04...		
Day	Type of exercise	Duration (minutes)
Mon	<b>Walking</b> <b>Swimming</b>	<b>15</b> <b>25</b>
Tues		
Weds	<b>Yoga</b>	<b>60</b>
Thurs		
Fri		
Sat	<b>Swimming</b>	<b>20</b>
Sun		
Total number of <i>minutes</i> spent exercising:		<b>120</b>
Total number of <i>days</i> on which you exercised this week:		<b>3</b>

## Appendix J: Participant information sheet and informed consent form for the longitudinal study

### Information Sheet – Informed Consent Form

#### The Psychological Effects of Exercise

##### Research Outline

I am Karen White, a Research Training Fellow based in Primary Medical Care, School of Medicine, and a registered Research Student in the School of Psychology, University of Southampton. I am requesting your participation in a study regarding the psychological effects of exercise among individuals suffering from low mood or depression. This study will involve your participation in an eight-week exercise routine that is entirely of your own choice and preference. You will be asked to exercise in your own time, 2 – 3 times a week for 30 minutes per session and record any activity that you do in an exercise diary. It is not compulsory that you exercise, and any exercise that you do is a valid contribution to the study. At four intervals throughout the study, you will be asked to complete a booklet of questionnaires that ask you questions about your feelings and how you see yourself. These questionnaires will need to be completed at baseline (i.e. before you start your exercise routine) and at the end of Week 1, Week 3 and Week 8 of the exercise period. The questionnaires will take approximately 15 minutes to complete each time. Prior to beginning the study, you will be invited to attend an informal, 30-minute session to discuss the research. At this meeting, you will be asked to complete a screening form that assesses whether or not it is suitable for you to take part in this research. If you match the inclusion criteria for the study, we will then discuss the type of exercise routine that you could do and you will also be asked to complete a short baseline questionnaire. Two further meetings will be arranged with you: one for mid-point (20 minutes) during the study to discuss how you are finding the exercise routine, and another at the end of the study (20 minutes) to provide you with a full-debriefing about the purposes of the study. A maximum of £50 is available per participant for the reimbursement of exercise costs during the study period (receipts will be required).

##### Confidentiality

Personal information will not be released to or viewed by anyone other than the researcher involved in this project. Results of this study will not include your name or any other identifying characteristics. Your confidentiality will be ensured by the generation of a participant number that will be used to match your responses from each data collection interval. A list of names and numbers will be filed separately from your responses and will be locked away.

##### Risks to the participant

There are no anticipated discomforts or major risks to you from taking part in this research. However, there is a small risk of minor injuries while exercising and you should take care to ensure your own health and safety when taking part in physical activity. If you are uncertain whether or not you are healthy enough to exercise, you should consult your GP before beginning a new exercise routine.

##### Withdrawal

Your participation is entirely voluntary and you may withdraw your participation at any time without consequence and without giving a reason.

**Use of findings**

This is a pilot study of similar future research, and the results of this study will be used to inform the design and focus of further studies. The research will eventually be submitted as part of a thesis for a PhD research degree.

**Debriefing**

A debriefing statement detailing the specific research objectives will be supplied to you at the end of the study and you will be given the opportunity to request a copy of the results.

**Further questions and information**

If you have any questions or would like further information about this research, please feel free to contact me, Karen White, at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or 023 8024 1064.

This research is supervised by Prof Tony Kendrick (Primary Medical Care, School of Medicine) and Prof Lucy Yardley (School of Psychology).



**Statement of Consent**

*Please complete both copies below*

*Participant copy:*

I \_\_\_\_\_ [participants name] have read the above informed consent form.

I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. I understand that data collected as part of this research project will be treated confidentially. In signing this consent letter, I am not waiving my legal claims, rights, or remedies. A copy of this consent letter will be offered to me.

I give consent to participate in the above study (circle Yes or No) Yes      No

Signature ..... Date .....

I understand that if I have questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 8059 3995.

**Please keep this part of the Statement of Consent and the Information Sheet for your own reference.**

.....  
*Researcher copy:*

I \_\_\_\_\_ [participants name] have read the above informed consent form.

I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. I understand that data collected as part of this research project will be treated confidentially. In signing this consent letter, I am not waiving my legal claims, rights, or remedies. A copy of this consent letter will be offered to me.

I give consent to participate in the above study (circle Yes or No) Yes      No

Signature ..... Date .....

I understand that if I have questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 8059 3995.

Appendix K: Screening form used in longitudinal study

<b>Study Inclusion Form</b>
-----------------------------

*The study is seeking to recruit participants with particular characteristics. This form asks questions that assess whether or not it is suitable for you to be included in this research. There are no right or wrong answers.*

1. Have you any major medical condition which would make it difficult for you to walk 100 yards (e.g. severe heart failure, severe joint problems)? *Please put a cross in the box next to your answer.*

Yes	<input type="checkbox"/>
-----	--------------------------

No	<input type="checkbox"/>
----	--------------------------

2. Do you get tightness or pain in the chest when you exercise, or cramp/pain in the legs when exercising (which goes off when you stop)? (If so you should consult a doctor.)

Yes	<input type="checkbox"/>
-----	--------------------------

No	<input type="checkbox"/>
----	--------------------------

3. Are you currently taking antidepressants, seeing a counsellor or receiving any other treatment for depression or low mood?

Yes	<input type="checkbox"/>
-----	--------------------------

No	<input type="checkbox"/>
----	--------------------------

4. How many times over the course of an average week do you typically take part in exercise or sport (ie swimming, cycling, running, gym, badminton, walking etc) for 30 minutes a session? NB. This includes walking and cycling as a form of transport.

Twice a week or more	<input type="checkbox"/>
Once a week	<input type="checkbox"/>
Less than once a week	<input type="checkbox"/>
Never	<input type="checkbox"/>

5. Do you anticipate that you will be available for the next 8 weeks and able to make the time for exercise (ie exercising on 2 – 3 days a week for 30 minutes)?

Yes	<input type="checkbox"/>
-----	--------------------------

No	<input type="checkbox"/>
----	--------------------------

Appendix L: Physical activity guidelines given to all participants as part of the study pack in the longitudinal study

## Exercise Guidelines

Summary		
Exercise period		8 Weeks
Number of exercise sessions per week		2 – 3
Duration of each session	Week 1	15 – 20 mins
	Week 2	20 – 30 mins
	Weeks 3 – 8	30 mins

### **How many weeks of exercise are involved in the study?**

The aim is for you to exercise regularly over the next eight weeks. An exercise diary is provided for you to record any physical activity that you do during this period.

### **How often should I exercise?**

Aim to exercise 2 – 3 times a week.

### **What happens if I do not always exercise 2 – 3 times a week?**

Do not worry or feel guilty if you do not always manage this. Any exercise that you do counts and should be recorded in the exercise diary. Even if you miss a whole week, still persevere and try to consider how you can fit physical activity into your everyday routine. If you stop exercising, please try to complete the questionnaires, anyway; your responses will still be of interest to the research. However, if you no longer wish to take part in the study, you are free to leave at any time without giving a reason.

### **How long should I exercise for in a single session?**

To start with, aim to exercise for 15 – 20 minutes a session in the first week, then build to 20 – 30 minutes in the second week. During the following 6 weeks, aim to do 30 minutes each time that you exercise.

### **What type of exercise should I do?**

Any form of exercise that you like (except for team sports). It is important that you choose something that you like and that you will enjoy. For instance, you might choose to swim, run, attend the gym, walk, cycle, or take up an exercise class such as aerobics etc.. More information on the types of exercise that you can do and the exercise resources available at the University and locally is available on the sheet called Exercise Resources. You can also try to fit exercise into your daily life by walking to University or work rather than taking the bus. This type of exercise counts too and can be recorded in your exercise diary.

### **Do I have to stick to one type of exercise?**

No. You can choose any form of exercise that suits you, do more than one type of exercise over the course of the 8 weeks of the study if you like and change the exercise as you go along.

### **Planning exercise into your week**

Many people feel that it is difficult to make time for exercise or have difficulty knowing what type of exercise suits them. Take a moment to consider the type of exercise that you feel you would like to do and how you can fit this into your week. Complete the table below for your own reference and use it to guide your weekly exercise routine. Pencil-in activities and times for exercise that you feel suit your schedule on 2 – 3 days of the week. This, of course, can change as your needs change. You may find the sheet Exercise Resources useful to help you decide on the type of activity you could do.

<b>Your Exercise Plan</b>		
Day	Activity	Time (E.g. Morning, Lunch, Afternoon, Evening or specific times ie 2.30pm)
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

### **Ensuring that you are safe**

- When exercising work at a gentle pace to start with and gradually increase the intensity over 10 minutes until you have reached a level that you can maintain for the rest of the exercise session. At the end of the session decrease your level of activity over 5 – 10 minutes to allow your heart to slow down gradually.
- You should wear appropriate clothing and footwear for your chosen activity.
- If you have any medical concerns or are unsure if you can exercise safely contact your GP.
- Do not run or walk on your own in any areas or at any times where you feel unsafe.
- If you experience any unusual physical discomfort during exercise, such as dizziness or pains in your chest, stop exercising immediately and seek medical advice.

**Costs of exercising**

If you already have SportRec membership at the University, a number of the sports facilities are free as part of the membership. Or, alternatively, you may already have a gym membership. However, other exercise costs (excluding travel and exercise clothing) will be reimbursed up to a maximum of £50 per participant. Receipts will need to be obtained and retained to make a claim. Reimbursement will be made to you upon completion of the study or at any point that you decide to withdraw from the study.

Appendix M: List of local physical activity resources given to each participant as part of the study pack in the longitudinal study

## **Exercise Resources**

*You can fit exercise into your everyday routine by walking or cycling to University / work / the shops, for instance, or by exercising during your leisure time*

### **Suggestions for types of exercise that you could consider**

Walking, running / jogging, gym, swimming, aerobics classes, dance classes, circuits, yoga, cycling, badminton, squash, aqua aerobics, anything that you like!

### **Take a friend**

It may help you to exercise if you exercise with a friend. You can encourage and help each other to keep it up. It may also help you if you have not exercised much before and you are anxious about starting.

### **Sports facilities available at the University of Southampton**

The Sport and Recreation Centre can provide details about sport and exercise facilities at the University. See <http://www.sportrec.soton.ac.uk/home/index.shtml> or contact the Reception on 023 8059 2119 for more details. Those who already hold SportRec membership can use a number of the University sports facilities for free. Membership for this academic year costs £135 for staff and £80 for students. Application forms can be obtained from the Jubilee Sports Centre (or see the link above for more details on how to apply). Nonmembers can use some of the University sports facilities for a small cost each time (ie £2.30 (students) / £2.80 (staff) / £3.50 (member of public) to use the swimming pool). Leaflets about sport and exercise classes at the University are available from the Jubilee Sports Centre on the Highfield campus. The Sport and Recreation Centre also organise lunch time walks on Southampton Common on Tuesdays and Thursdays at 12.30 that all staff and students can join. The starting point for these walks is at Jubilee Sports Centre (see the website for details).

### **Other local exercise facilities**

See the Southampton City Council website [www.southampton.gov.uk](http://www.southampton.gov.uk) and follow the Leisure link. If you select 'Sport and leisure activities', you can then click on 'Leisure centres' which gives you links to information about Bitterne Leisure Centre, Chamberlayne Leisure, Oaklands Pool, St Mary's Leisure and The Quays.

### **Walking**

You can take a walk on your own or with friends anywhere. Perhaps you could choose an interesting and relaxing area to walk (such as a green and open space). It's free and easy! Also, Southampton City Council run Health Walks as part of the Walking the Way to Health initiative. These walks are held in various interesting, green places around Southampton and are led by guides. Everyone is welcome to take part in the led walks and it is free of charge. Alternatively, you can follow the walks in your own time and the

Council can provide free cards outlining the locations and routes. Contact The Quays on 023 8072 0920 for more information.

### **Swimming**

The University swimming pool is located at the Jubilee Sports Centre on the Highfield campus. A timetable and costs can be found at <http://www.sportrec.soton.ac.uk/facilities/indoor.shtml> . Other swimming pools in the area include The Quays (City centre) and Bitterne Leisure Centre (please see [www.southampton.gov.uk](http://www.southampton.gov.uk) following the leisure links for more details).

### **Gym**

The Fitness Suite is available free to SportRec members at the University. These facilities are not available to nonmembers. Any new members are required to attend a gym induction before they can use the facilities. See [http://www.sportrec.soton.ac.uk/facilities/fitness\\_suite.shtml](http://www.sportrec.soton.ac.uk/facilities/fitness_suite.shtml) .

### **Aquafit classes**

Available at the University to SportRec members and nonmembers. See <http://www.sportrec.soton.ac.uk/courses/swimming.shtml> for details.

### **Aerobics, Circuits, Step Classes, and other fitness classes**

Details of these classes that run at the University <http://www.sportrec.soton.ac.uk/courses/fitness.shtml> . Leaflets about the classes can be picked up from the Jubilee Sports Centre.

Appendix N: A list of support sources for depression given to each participant as part of the study pack in the longitudinal study

### **SUPPORT SOURCES FOR DEPRESSION**

Listed below are sources of support and advice on depression. Please note that provision of this information does not constitute an endorsement of these services or organisations by the University of Southampton.

**Your own GP is the best person to ask for advice on depression and its treatment.**

#### **Samaritans (help / information line)**

08457 90 90 90

#### **Samaritans (Southampton)**

64 St. Andrew's Road, Southampton SO14 0BA

Usual hours open for people to drop in to the office: 10am-10pm

Branch office phone: 023 8063 2888

Or dial 08757 90 90 90 for the cost of a local call

#### **MindinfoLine**

0845 766 0163

An information service for mental health issues, open Monday to Friday 9.15am to 5.15pm.

#### **NHS Direct**

0845 46 47

A 24 hour nurse telephone advice and health information service, part of the National Health Service.

### **INTERNET RESOURCES**

<http://www.depressionalliance.org/>

<http://www.mind.org.uk/>

<http://www.mindsotonnf.org.uk>

<http://www.mhf.org.uk>

<http://www.samaritans.org.uk>

<http://www.nhsdirect.nhs.uk>

<http://www.wellminds.soton.ac.uk>

Depression Alliance

Mind

Southampton and New Forest Mind

Mental Health Foundation

Samaritans

NHS Direct

A resource for University of Southampton staff and students concerned about mental health issues.



Appendix O: Participant recruitment poster for qualitative study

**Have you ever used exercise as a way of managing depression or low mood?**



**Research study:  
'Understanding the experience of  
using exercise for depression'**



This is a study that is seeking to recruit individuals who have experience of using exercise as a way of managing depressive feelings or low mood.

We are interested in talking to people who have current or previous experiences of depression, and who have, at any time, used exercise as a way of helping their mood. We are equally interested in speaking to people who have found exercise to help them and also to those who have **not** found exercise to be helpful.

This study involves a 1:1 informal interview with the researcher. Your involvement in the study will be treated confidentially.

If you are interested in taking part in this research or would like more information, please contact the researcher Karen White (Research Training Fellow, Primary Medical Care, School of Medicine, and Research Student, School of Psychology, University of Southampton), by e-mail [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or phone 023 8024 1064.



Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064	Exercise Interview Study Karen White <a href="mailto:K.T.White@soton.ac.uk">K.T.White@soton.ac.uk</a> 023 8024 1064
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## Appendix P: Participant recruitment e-mail for non-clinical sample in qualitative study

I am a researcher working in Primary Medical Care, School of Medicine, and a research student in the School of Psychology, and I am currently trying to recruit participants for a research study that is seeking to explore the experiences of individuals who have tried using exercise as a way of coping with / managing depressive feelings or low mood. I am interested in talking to people who have current or previous experiences of depression or low mood, and who have, at any time, used exercise for their mood. I am equally interested in speaking to those who have found exercise to help and also to those who have **not** found exercise to be helpful. The study involves a 1:1 informal interview with me. Your involvement in the study will be treated confidentially.

If you are interested in taking part in this research or would like further information, please feel free to contact me by e-mail [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or phone 023 8024 1064.

TO HELP ENSURE YOUR CONFIDENTIALITY, PLEASE DO NOT PRESS THE REPLY BUTTON TO THE PERSON WHO SENT YOU THIS E-MAIL, BUT CONTACT ME DIRECTLY AT [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or the phone number above.

Kind regards  
Karen

---

Karen White  
Research Training Fellow (Primary Medical Care) and Research Student (School of Psychology)  
Primary Medical Care  
School of Medicine  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
SO16 5ST

Telephone: 023 8024 1064

Appendix Q: Covering invitation letter from GP to patient used to recruit clinical sample  
in qualitative study

**BATH LODGE PRACTICE**

P. J. Gray MB.BS.MRCGP  
N. R. Hayes MB.BS.MRCGP  
A. McKay MB.BS.MRCGP  
D. S. Godwin BM.DCH  
C. J. Budge BM.BSc.MRCGP  
F. Mackay BM.MRCGP  
A. Kendrick BSc.MD.FRCGP.FRCPsych.  
A. Budge BM.BSc.DRCOG

Bitterne Health Centre  
Commercial Street  
Bitterne  
Southampton

SO18 6BT  
Tel: 023 8044 2111  
Fax: 023 8042 1316

**Date:**

**University of Southampton Study: Exercise to help overcome the feelings of depression**

Local Research Ethics Committee Reference Number: 05/Q1701/100

Dear

**Have you ever tried using exercise to help feelings of depression?**

This practice is participating in a study on people's experiences of using exercise for depression, carried out by a researcher from the University of Southampton. The study has been approved by the local research ethics committee. I am writing on behalf of the researcher to ask whether you would like to take part in the study. The researcher would like to find out about people's experiences of using exercise for depression. **She is interested in talking to people who have any experience of using exercise for feelings of depression. This may include exercising on the recommendation of your doctor, referral to an exercise scheme or use of exercise as a self-help strategy. She is equally interested in talking to both people who have found that exercise has helped their depression and to people who have NOT found exercise to be helpful.**

The discussion would be tape recorded and typed out but all identifying details would be removed so that anyone reading it would not know who you are or where you live. The information will not be shared with anyone, including me.

It is hoped that the study will lead to a better understanding of people's experiences of using exercise for depression, which can inform the way that exercise may be used as a treatment for people with depression in the future. Whether or not you take part is completely up to you. Whatever you decide, your medical or legal rights will not be affected in any way. Enclosed with this letter you will find an information sheet, reply slip

and self-addressed envelope. The information sheet describes the study in greater detail. It also includes the researcher's telephone number and e-mail address if you have any questions about the study.

If you decide to take part in the study, please fill out your contact details on the tear-off section at the end of the information sheet. You can place this in the self-addressed envelope, and post it free of charge. The researcher will then contact you. You may also contact the researcher directly by e-mail or telephone if you would like to take part (contact details are in the information sheet). We very much hope that you will accept this invitation to participate in the study.

Yours sincerely

[GP name]



School of Medicine  
Primary Medical Care

Primary Medical Care  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
Southampton SO16 5ST  
United Kingdom

Tel +44 023 8024 1064  
Fax +44 023 8070 1125  
Email K.T.White@soton.ac.uk

## INFORMATION SHEET

### Exercise to help overcome the feelings of depression

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

#### **What is the purpose of the study?**

The purpose of the study is to explore and understand the experiences of people who have tried using exercise to help overcome the feelings of depression. To do this, we will be asking you about your thoughts, beliefs and experiences of exercise in a one-off interview. The interview will take around one hour of your time. We are interested in talking to people who have any experience of using exercise to help overcome the feelings of depression. We are interested in talking to people who feel that exercise has helped their depression and also to people who feel that exercise has **not** helped their depression.

#### **Why have I been chosen?**

Your GP has sent this to you because your records show you have suffered feelings of depression or stress in the past two years. We will be talking to approximately 10-15 patients for this study altogether.

#### **Do I have to take part?**

It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive.

#### **What will happen to me if I take part?**

If you decide to take part, the researcher will arrange a meeting with you to hear your thoughts about and experience of using exercise to help overcome the feelings of depression. You can choose to have this interview either at your doctor's surgery, if this is possible, or at the researcher's office. If you go to the researcher's office, your travel costs will be refunded. The interview will take around one hour. The researcher will tape-record the interview. You can stop the interview at any time. If you decide at the end of the interview you have changed your mind about taking part, you can withdraw from the study at that point and the tape will be wiped clean.

#### **What are the possible disadvantages and risks of taking part?**

Some people may become upset when talking about their experiences relating to depression. However, you can stop the interview at any time and you do not have to answer any questions that you are not comfortable with. We can provide you with contact details of professional support agencies should you wish to seek help.

#### **What are the possible benefits of taking part?**

You may not receive any direct benefit from taking part in this study. However, the information obtained during the study may help us to understand people's experience of using exercise to help overcome the feelings of depression, which can inform the way that exercise is used as a treatment for people with depression in the future.

#### **What if something goes wrong?**

If you are harmed by taking part in this research project, there are insurance arrangements in place including no-fault compensation where payment is made if you can show that on balance of probability participation in the project caused the harm. Professional indemnity insurance for the interviewer is provided by the University of Southampton. If you are harmed due to someone's negligence, then you may have grounds for a legal action but you may have to pay for it. Regardless of this, if you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms should be available to you.

#### **Will my taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. The tape-recording will be typed out, but your name, address and any other personal or identifying information will be removed. This means that you will be anonymous and unrecognisable to other people. The type-out of the interview and the tape-recording will be stored securely and kept for 15 years, at the University. Only the researcher will know your identity and this information will not be shared with anyone else.

#### **Disclosure of any serious risks to self or others**

The only exception to this complete confidentiality would be if the interview revealed anything which posed immediate risk to you or to others, in which case information about this risk might be fed back to your doctor, but only after discussion with you.

#### **What will happen to the results of the research study?**

The study is being conducted by the researcher as part of the work towards a PhD research degree registered in the School of Psychology, University of Southampton, which is looking at exercise for depression. The results of the study will be written up as part of her PhD thesis. The findings of the study may also be presented at conferences and may be submitted for publication in academic journals. A final report about the study

will be submitted to the funders of the research. You will not be identifiable in any reports or publications that result from the study.

**Who is organising and funding the research?**

The study is being carried out by a researcher, Karen White, from the University of Southampton. The study is funded by a grant from the Royal College of General Practitioners Scientific Foundation Board.

**Contact for Further Information**

Please feel free to contact the researcher, Karen White (Research Training Fellow, Primary Medical Care, and Research Student, School of Psychology) if you have any questions about this research or would like further information. Telephone: 023 8024 1064, E-mail: [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk).

You can get independent information or advice about your rights as a research participant or about being involved in this study from Southampton City Primary Care Trust Research and Development Department, 1st Floor, University Dept of Psychiatry, Royal South Hants Hospital, Brintons Terrace, Southampton S014 0YG.

**If you would like to take part:**

If you are interested in taking part in the study, please fill out your contact details below. Tear off the slip and place it in the freepost addressed envelope provided. Seal and post the envelope. The envelope will only be opened by Karen White, who will call you to arrange a time and date for the meeting. Alternatively, you can telephone or e-mail her directly (details above) to make an appointment. At the meeting, before the interview begins, you will be given this information again and you will be asked for your consent to take part in the research. A copy of this information sheet and a copy of the consent form will be given to you to keep.

*Thank you for taking the time to read this*

*Tear Off*-----

**Participant interview response slip**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

---

Telephone Number: \_\_\_\_\_

E-mail: \_\_\_\_\_

Appendix S: Informed consent form used for clinical participants in qualitative study



**University  
of Southampton**

**School of Medicine  
Primary Medical Care**

*Primary Medical Care  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
Southampton SO16 5ST  
United Kingdom*

*Tel +44 0238024 1064  
Fax +44 023 8070 1125  
Email K.T.White@soton.ac.uk*

Participant Identification Number/Pseudonym for this study:

**CONSENT FORM**

**Title of Project:** An exploration of the experiences of individuals using exercise as a means of managing depression within and outside the primary care context: A grounded theory approach

**Name of Researcher:**

**Please initial boxes**

1. I confirm that I have read and understand the participant information sheet dated 19<sup>th</sup> September 2005 (version 2) for the above study and I have had the opportunity to ask questions.
2. I understand my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical or legal rights being affected.
3. I understand that all information collected about me will be kept strictly confidential, **unless** the interview reveals anything which poses an immediate risk to me or others, in which case information might be fed back to my doctor, but only after discussion with me.
4. I agree to take part in the above study.
5. I agree to have my interview tape-recorded.
6. I hereby consent to processing of my personal data by the University of Southampton for the purposes described in the participant information sheet dated 19<sup>th</sup> September 2005 (version 2) for the above study.



_____ Name of Participant	_____ Date	_____ Signature
_____ Name of person taking consent (if different from researcher)	_____ Date	_____ Signature
_____ Researcher	_____ Date	_____ Signature

1 for participant, 1 for researcher



Appendix U: E-mail to recruit nonclinical participants with negative experiences of physical activity for qualitative study

I am conducting an interview study exploring the experience of exercise among individuals who have experienced depression or low mood. Having spoken to a number of people who have had positive experiences of exercise, I REALLY NEED to speak to people who have found exercise to be a negative experience at any time, or who feel that exercise makes them feel bad or who feel that it has no effect on their mood. If you would like further information or would be willing to take part in this study, please contact me, Karen White, by e-mail, [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or telephone 023 8024 1064.

TO ENSURE YOUR CONFIDENTIALITY, PLEASE DO NOT REPLY TO THE PERSON WHO SENT YOU THIS E-MAIL, BUT REPLY TO MY E-MAIL ADDRESS ABOVE.

This study has been approved by the School of Psychology Ethics Committee, Ref: PG/03/67. Participant recruitment for the study is ongoing and will end in July 2006.

Karen White  
Research Training Fellow (Primary Medical Care) and Research Student (School of Psychology)

## INTERVIEW TOPIC GUIDE AND PROTOCOL

### 'Understanding the experience of using exercise to help depression'

**Date of interview:**

**Participant code / pseudonym:**

#### **Briefing and Introduction**

- Thank you for agreeing to take part
- Introduce self: researcher from the University of Southampton and a registered PhD student, looking at exercise for depression.
- Aim of interview: would like to find out about your experiences of using exercise for your mood.
- If at any time during the interview you do not wish to answer a question that's okay.
- There are no right or wrong answers to the questions, and do not worry about talking too much.
- I would like to tape record our conversation. The tape recording will be typed out but everything you say will be anonymised. Your name and any names you mention, and any places you mention will be taken out, so that if someone heard or read your interview they would not know who you are or where you live. It will remain confidential to me; parts of your answers may be quoted in papers or reports but they will not be identifiable as coming from you.
- If, at any stage, you wish to stop the tape recorder, please let me know.
- You can stop the interview at any time, if you no longer wish to continue.
- Are there any questions?
- If this is okay with you, could you please sign the consent form.

Areas for exploration:

- **The management of exercise in everyday life**
- **The emotional, physical and mental experience of exercise**
- **Thoughts and beliefs about the role that exercise has played in the management of depression**

Can you tell me about your exercise?

PROMPTS: The sort of exercise that you do  
How long you have been exercising  
Whether you are regularly exercising at the moment

[Can you tell me about your use of exercise for your mood?]

Can you tell me about how you came to try exercise as a way for dealing with your mood?

PROMPT: What prompted you to use exercise?  
Why did you try exercise?

How did you feel about exercising at first?

PROMPT: What were your initial thoughts and feelings about exercise?

It what ways did you think that exercise might help with your mood?

How was that related to the causes of your low mood (or what was going on in your life)?

How did you decide what to do as your exercise?

Did you discuss exercise with anyone? Tell me about that.

How did you find beginning your exercise?

PROMPTS: Was there anything that made it difficult for you?  
Was there anything that helped you?

Can you describe to me how exercise makes / made you feel?

PROMPTS: During and after  
Physically, emotionally and mentally  
What did you find / do you find to be the effects of exercise, for you?  
Has it affected your thoughts or feelings about yourself? In what way?

How have you found / how did you find doing the exercise over time?

Have you continued with it?  
How do you feel about exercise?  
Have you changed the sort of exercise that you do? Tell me about that / Why?

In what ways do you feel that exercise has / has not helped you?

What kind of effect do you feel that exercise has had on your mood? Why do you think that?

What do you feel that exercise has done for you? How do you think that exercise has helped / not helped you in this way?

**Personal details:**

*Gender:* Male / Female

*Age:* \_\_\_\_\_

*Relationship status:*

Single

Married

Co-habiting

In long-term relationship

In short-term relationship

Separated

Divorced

Widowed

*Employment status:*

In paid employment/self-employed?

Yes / No

Full-time student

Yes / No

Unemployed

Yes / No

Permanently unable to work because of long term sickness/disability

Yes / No

Looking after home or family

Yes / No

Other (please specify) \_\_\_\_\_

*Occupation / Job Title:* \_\_\_\_\_

*Highest level of education:* \_\_\_\_\_

*Self-defined ethnicity:*

White

Black Caribbean

Black African

Black Other

Indian

Pakistani

Bangladeshi

Chinese

Other Asian Group

Other (please specify) \_\_\_\_\_

*Would you describe yourself as currently depressed?*

Yes / No

*How long would you say that you have been / were depressed?*

---

*How did you come to use exercise as a way of managing your depression?*

GP recommended

Self-motivated

Referral scheme

Other \_\_\_\_\_

*How long have you been involved in exercise?*

---

*How long have you been exercising to specifically help your depression?*

---

*How often do you typically exercise?*

---

*Are you currently regularly exercising?* Yes / No

*Do you feel that, on the whole, exercise has helped your depression?* Yes / No

*Are you receiving any other form of treatment for your depression?* Yes / No

Antidepressants

Counselling / Psychotherapy

Other \_\_\_\_\_

**Conclusion:**

- **Any other issues** - Are there any other issues we haven't addressed that you would like to mention?
- **Any questions for the researcher?** Are there any questions you would like to ask me?
- **Copy of transcript?** Would you like to be sent a copy of the interview transcript when it is available? Yes / No  
[If yes, make sure have note of address]
- **Debriefing** [verbal and give participant copy of Debriefing Sheet].
- **Copy of results?** Would you like a copy of the results of the study when they are available? [Take address / e-mail address]
- **Thank you** very much for taking the time to speak with me. Your participation is very much appreciated.

Recruitment method:

Location of interview:

Rapport (and reasons):

Non-verbal communication:

Clarificatory comments:

Themes:

Topics to be explored in future interviews:

Other issues:



Appendix W: Information sheet and consent forms for the nonclinical sample in the qualitative study

**Information Sheet – Informed Consent Form**

**‘Understanding the experience of using exercise for depression’**

**Research Outline**

I am Karen White, a Research Training Fellow based in Primary Medical Care, School of Medicine, and a registered Research Student in the School of Psychology, University of Southampton. I am requesting your participation in a study that aims to explore people’s experiences of exercise and depression. We are interested in talking to people who have any experience of using exercise for depression. We are equally interested in talking to people who feel that exercise has helped their depression and also to people who feel that exercise has **not** helped their depression. We are interested in hearing from adults who are aged 18 – 65. This study will involve your participation in a one-to-one informal interview with the researcher to discuss your experiences of exercise for depression. The interview will last for approximately one hour. You can choose to have this interview either at the researcher’s office (Aldermoor Health Centre), in the School of Psychology, University of Southampton, Highfield campus, at your support group’s premises (where possible), or, under some circumstances, it may be possible to arrange for an interview to take place in your own home. If you travel to the researcher, your travel costs will be refunded. If you are interested in taking part in the study, you will be invited to attend the interview meeting with the researcher. Before the interview begins, you will be given an opportunity to decide whether or not you agree to take part in the research. The interview will be tape-recorded and later typed out for the purposes of analysis.

**Confidentiality**

Personal information will not be released to or viewed by anyone other than the researcher involved in this project. Results of this study will not include your name or any other identifying characteristics. The tape-recording will be typed out, but your name, address and any other personal or identifying information will be removed. This means that you will be anonymous and unrecognisable to other people. The tape will be wiped clean at the end of the project.

**Risks to the participant**

Some people may become upset when talking about their experiences relating to depression. However, you can stop the interview at any time and you do not have to answer any questions that you do not want to. We can provide you with contact details of professional support agencies should you wish to seek help.

**Withdrawal**

Your participation is entirely voluntary and you may withdraw your participation at any time without consequence and without giving a reason. You can stop the interview at any time. If you decide at the end of the interview that you have changed your mind about taking part, you can withdraw from the study at that point and the tape will be wiped clean and not typed out.

**Use of findings**

The study is being conducted as part of the work towards a PhD research degree registered in the School of Psychology, University of Southampton, which is looking at exercise for depression. The results of the study will be written up as part of the PhD thesis. The findings of the study

may also be presented at conferences and may be submitted for publication in academic journals. You will not be identifiable in any reports or publications that may result from the study.

**Debriefing**

You will be told about the aims of the study at the end of the interview and a debriefing statement will also be supplied to you. You will be given the opportunity to request a copy of the results.

**Further questions and information**

If you have any questions or would like further information about this research, please feel free to contact me, Karen White, at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or 023 8024 1064.

This research is supervised by Prof Tony Kendrick (Primary Medical Care, School of Medicine) and Prof Lucy Yardley (School of Psychology). This research is supported by a grant from the Royal College of General Practitioners Scientific Foundation Board.

**Statement of Consent**

*Please complete both copies below*

*Participant copy:*

I \_\_\_\_\_ [participants name] have read the above informed consent form.

I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. I understand that data collected as part of this research project will be treated confidentially. In signing this consent letter, I am not waiving my legal claims, rights, or remedies. A copy of this consent letter will be offered to me.

- I give consent to participate in the above study (circle Yes or No)    Yes    No
- I give consent to be audiotaped    Yes    No
- I understand that these audiotapes will be destroyed after analysis    Yes    No
- I give consent for anonymised quotes from my interview to be used in reports and publications resulting from the study    Yes    No

Signature ..... Date .....

I understand that if I have questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 8059 3995.

**Please keep this part of the Statement of Consent and the Information Sheet for your own reference.**

.....  
*Researcher copy:*

I \_\_\_\_\_ [participants name] have read the above informed consent form.

I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. I understand that data collected as part of this research project will be treated confidentially. In signing this consent letter, I am not waiving my legal claims, rights, or remedies. A copy of this consent letter will be offered to me.

- I give consent to participate in the above study (circle Yes or No)    Yes    No
- I give consent to be audiotaped    Yes    No
- I understand that these audiotapes will be destroyed after analysis    Yes    No
- I give consent for anonymised quotes from my interview to be

used in reports and publications resulting from the study                      Yes    No

Signature .....                      Date .....

I understand that if I have questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. Phone: (023) 8059 3995.

## Appendix X: Transcription protocol

### Transcription Protocol

KW:	Speech of Karen White, the interviewer
P:	Speech of participant / interviewee
-	Speech broken off due to interruption
(KW: xxx)	Interviewer speaking, but not causing participant to stop talking
<u>Underline</u>	Speaker's emphasis in speech
CAPITALS	Loud speech
[material in square brackets]	Researcher's / transcriber's clarificatory comments, or information inserted in place of names or geographical locations etc to preserve confidentiality.
[]	Some transcript deliberately omitted
[...]	Some transcript omitted in presentation of quote (but not omitted in original, raw data transcript)
xxx	Untranscribable
(xxx)	Indistinct/doubtful transcription
...	Short pause in speech

Code No.:

## Physical activity and feelings of depression survey

We are interested in finding out about how much physical activity you do and how you have been feeling recently. This questionnaire also asks you for some other information relating to personal details (i.e. your age, how much social support you have, recent difficult life events). It should take about 25 – 35 minutes to complete this questionnaire. If there are any questions that are not relevant to you or that you find upsetting, please feel free not to answer these. If any of the questions cause you distress, a list of support sources for depression is available at the back of this questionnaire which details organisations that provide information about depression and people who you can contact (including your own doctor) to discuss how you are feeling. You can also obtain further information about depression and its treatment from the listed sources. **Please post the questionnaire back to us in the freepost envelope.**

### Section 1

*Please tick the appropriate boxes or write your answers in the space provided.*

1. Do you currently have a disabling or limiting physical problem or problems which prevent(s) you from exercising or being physically active?

Yes  No

If so, what? \_\_\_\_\_

**If you have ticked 'Yes' to this question, there is no need for you to answer the other questions. Please DO NOT complete the remainder of the questionnaire and please DO post the questionnaire to us in the freepost envelope.**

*Please turn the page*

## Section 2 - How you have been feeling recently

This section asks you some questions about how you have been feeling recently. Please answer all of the questions as accurately and honestly as possible. There are no right or wrong answers.

2a) *This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past few days. Use the following scale to record your answers.*

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

interested _____	irritable _____
distressed _____	alert _____
excited _____	ashamed _____
upset _____	inspired _____
strong _____	nervous _____
guilty _____	determined _____
scared _____	attentive _____
hostile _____	jittery _____
enthusiastic _____	active _____
proud _____	afraid _____

2b) *Please think about the past week and rate the extent to which you have felt each of the following moods. Read each item and then mark the appropriate answer in the space next to that word.*

0	1	2	3	4	5
none of the time	a little of the time	some of the time	a good bit of the time	most of the time	all of the time

refreshed _____	happy _____
calm _____	tired _____
fatigued _____	revived _____
enthusiastic _____	peaceful _____
relaxed _____	worn out _____
energetic _____	upbeat _____

2c) *When things aren't going well for you, or when you're having problems, how confident are you that you can do the following (please circle the appropriate number):*

i) Make unpleasant thoughts go away:

0	1	2	3	4	5	6	7	8	9	10
cannot do at all					moderately certain can do					certain can do

ii) Take your mind off unpleasant thoughts:

0	1	2	3	4	5	6	7	8	9	10
cannot do at all					moderately certain can do					certain can do

iii) Stop yourself from being upset by unpleasant thoughts:

0	1	2	3	4	5	6	7	8	9	10
cannot do at all					moderately certain can do					certain can do

iv) Keep from feeling sad:

0	1	2	3	4	5	6	7	8	9	10
cannot do at all					moderately certain can do					certain can do



2d) *How confident are you right now that you could be physically active at least 3 times per week for 20 minutes at a moderate intensity (activity that requires moderate physical effort and makes you breathe somewhat harder than normal) if: (please circle the appropriate number)*

	<b>Not confident</b>					<b>Very confident</b>				
1. the weather was bothering you	1	2	3	4	5	6	7	8	9	10
2. you were bored by the activity or programme	1	2	3	4	5	6	7	8	9	10
3. you felt pain when doing the activity	1	2	3	4	5	6	7	8	9	10
4. you had to do the activity alone	1	2	3	4	5	6	7	8	9	10
5. you did not enjoy it	1	2	3	4	5	6	7	8	9	10
6. you were too busy with other activities	1	2	3	4	5	6	7	8	9	10
7. you felt tired	1	2	3	4	5	6	7	8	9	10
8. you felt stressed	1	2	3	4	5	6	7	8	9	10
9. you felt depressed	1	2	3	4	5	6	7	8	9	10

**[Beck Depression Inventory-II inserted here]**

### Section 3

#### INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

\_\_\_\_\_ **days per week**

No vigorous physical activities → **Skip to question 3**

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

\_\_\_\_\_ **days per week**

No moderate physical activities → *Skip to question 5*

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

\_\_\_\_\_ **days per week**

No walking → *Skip to question 7*

6. How much time did you usually spend **walking** on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

## LEISURE TIME EXERCISE QUESTIONNAIRE

Considering the last seven days, how many times did you do the following kinds of exercise for more than 15 minutes during your **free time** (write in each box the appropriate number – **do not** include the activities you do as part of your house or yard work, to get from place to place or the activities you do at work):

TIMES PER WEEK

- |    |   |                      |
|----|---|----------------------|
| a. | STRENUOUS EXERCISE<br>(HEART BEATS RAPIDLY)<br>(i.e. running, jogging, hockey, football, soccer, squash, basketball, cross-country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling) | <input type="text"/> |
| b. | MODERATE EXERCISE<br>(NOT EXHAUSTING)<br>(i.e. fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)   | <input type="text"/> |
| c. | MILD EXERCISE<br>(MINIMAL EFFORT)<br>(i.e. yoga, archery, fishing from river bank, bowling, golf, easy walking)   | <input type="text"/> |

2. Considering a 7-day period (a week), during your **leisure time**, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

OFTEN        SOMETIMES        NEVER   

### Section 4

To look at the relationship between physical activity and depression, we need to take into account some other factors that may affect people's feelings. For this reason, we would like your answers to the following questions.

1. Are you currently taking medication for feelings of depression?  
Yes  No
2. Are you currently receiving any other form of treatment for depression (e.g. counselling, seeing a psychologist / psychiatrist, taking St John's Wort)?  
Yes  No
3. *Have any of the following life events or problems happened to you **during the last 6 months?** (Please tick all which apply to you.)*
- You yourself suffered a serious illness, injury or an assault
- A serious illness, injury or assault happened to a close relative
- Your parent, child or spouse died
- A close family friend or another relative died (aunt, cousin, grandparent) died
- You had a separation due to marital difficulties
- You broke off a steady relationship
- You had a serious problem with a close friend, neighbour or relative
- You became unemployed or you were seeking work unsuccessfully for more than a month
- You were sacked from your job
- You had a major financial crisis
- You had problems with the police and a court appearance
- Something you valued was lost or stolen

*Please turn the page*



No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

d) How satisfied?

6	5	4	3	2	1
very	fairly	a little	a little	fairly	very
satisfied	satisfied	satisfied	dissatisfied	dissatisfied	dissatisfied

e) Who accepts you totally, including both your worst and your best points?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

f) How satisfied?

6	5	4	3	2	1
very	fairly	a little	a little	fairly	very
satisfied	satisfied	satisfied	dissatisfied	dissatisfied	dissatisfied

g) Whom can you really count on to care about you, regardless of what is happening to you?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

h) How satisfied?

6	5	4	3	2	1
very	fairly	a little	a little	fairly	very
satisfied	satisfied	satisfied	dissatisfied	dissatisfied	dissatisfied

i) Whom can you really count on to help you feel better when you are feeling generally down-in-the-dumps?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

j) How satisfied?

6	5	4	3	2	1
very	fairly	a little	a little	fairly	very





5. What is the highest level of education that you have completed:

- Secondary school
- GCSEs / equivalent
- A-levels / equivalent
- Diploma / HND
- Degree
- Postgraduate degree (e.g. MA, MSc, PhD)
- Other
- Please state: \_\_\_\_\_

5. How would you describe your ethnicity?

- White
- Indian
- Pakistani
- Bangladeshi
- Black Caribbean
- Black African
- Black other
- Chinese / South East Asian
- Other
- If other, please state:* \_\_\_\_\_

14. How long have you been physically active to the point that you regularly do at least moderate intensity physical activity (activity that requires moderate physical effort and makes you breathe somewhat harder than normal) at least 3 times per week for at least 20 minutes in one go?

- I have not been physically active to this level
- One month or less
- Two to three months
- Four to six months
- Seven months to a year
- More than one year

15. On how many days of the week do you *usually* do some kind of physical activity at a moderate intensity (activity that requires moderate physical effort and makes you breathe somewhat harder than normal) for total of at least 30 minutes (only include bouts of activity that last for 10 minutes or more)?

- |                                 |                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| 0 days <input type="checkbox"/> | 2 days <input type="checkbox"/> | 4 days <input type="checkbox"/> | 6 days <input type="checkbox"/> |
| 1 day <input type="checkbox"/>  | 3 days <input type="checkbox"/> | 5 days <input type="checkbox"/> | 7 days <input type="checkbox"/> |

16. How long have you been experiencing your current feelings of depression or low mood?

- 1 – 2 weeks
- 3 – 4 weeks
- 5 weeks – 3 months
- 4 – 6 months
- 7 months – 1 year
- Longer than a year

*End of questionnaire.*

*Please turn the page to find out what this research is trying to find out.*

### **What is this research trying to find out?**

We are trying to find out more about the relationship between physical activity and depression. We know that people who are more physically active experience lower levels of depression and that physical activity can help reduce feelings of depression. We are interested in why physical activity may help feelings of depression. Currently, very little is known about this. In this study we are looking at a few possible explanations: 1) exercise or physical activity may offer people a way of coping with how they are feeling and increase their confidence in their ability to cope with unpleasant thoughts and emotions; 2) experiences of engaging in physical activity can increase people's confidence in their ability to be physically active and this higher level of confidence may be related to lower levels of depression; 3) physical activity may result in particular mood benefits (e.g. feelings of calmness, revitalisation, energy) which may be related to lower levels of depression; and 4) depression is characterised by a high level of negative mood (e.g. feelings of distress) and a low level of positive mood (e.g. loss of pleasure and low energy). Exercise and physical activity is more associated with positive mood than negative mood, so physical activity may particularly tackle depression through increasing positive mood. Your answers will help us to understand whether any of these explanations offer insight into why physical activity may help depression. Once again the results of this study will not include your name or any other identifying characteristics. The research did not use deception. If you would like to keep the information on this page, please feel free to tear it off for your own reference before returning the questionnaire.

**If you have any further questions** please contact me, Karen White, at 023 8024 1064 or [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk)

**If you are interested in hearing about the results of this study**, we can send you a summary of the findings when they are available. For a summary of the findings, please send your request with your name and address to Karen White at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or write to Karen White, Primary Medical Care, University of Southampton, Aldermoor Health Centre, Aldermoor Close, Southampton, SO16 5ST.

**If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk**, you may contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ.  
Phone: (023) 8059 3995.

***If any of the questions in this questionnaire have caused you distress or you would like to find out more about depression and its treatment, a list sources of support for depression are available on the next page. Please***

*feel free to tear off this list and keep it for your own reference if you would like to.*

**PLEASE POST THE COMPLETED QUESTIONNAIRE BACK TO US IN THE FREEPOST ENVELOPE.**

*End of questionnaire. Thank you for your time and help.*

## **SUPPORT SOURCES FOR DEPRESSION**

Listed below are sources of support and advice on depression. Please note that provision of this information does not constitute an endorsement of these services or organisations by the University of Southampton.

**Your own GP is the best person to ask for advice on depression and its treatment.**

### **Samaritans (help / information line)**

08457 90 90 90

### **Samaritans (Southampton)**

11 College Place, London Road, Southampton SO15 2FE

Usual hours open for people to drop in to the office: 10am-10pm

Phone 08457 90 90 90 for the cost of a local call

### **MindinfoLine**

08457 660163

An information service for mental health issues, open Monday to Friday 9.15am to 9.15pm.

### **SANELINE**

0845 767 8000

Saneline is a "helpline offering practical information, crisis care and emotional support to anybody affected by mental health problems." Open 1pm – 11pm everyday.

**Sanemail:** [sanemail@sane.org.uk](mailto:sanemail@sane.org.uk) – e-mail support service, which is "an additional channel of support for those affected by mental health problems."

### **NHS Direct**

0845 46 47

A 24 hour nurse telephone advice and health information service, part of the National Health Service.

## INTERNET RESOURCES

<http://www.depressionalliance.org/>

<http://www.mind.org.uk/>

<http://www.mhf.org.uk>

<http://www.samaritans.org.uk>

<http://www.nhsdirect.nhs.uk>

<http://www.sane.org.uk/>

<http://www.wellminds.soton.ac.uk>

Depression Alliance

Mind

Mental Health Foundation

Samaritans

NHS Direct

SANE

A resource for University of  
Southampton staff and students  
concerned about mental health issues.

Appendix Z: Participant recruitment e-mail (A) used in cross-sectional study

**[Participant recruitment e-mail – i.e. to be sent to members of depression support groups / forums, staff and students at universities, other members of the general public / community]**

**Survey about depression – we would like your help**

I am a researcher at the University of Southampton and I am seeking people aged 18 – 65, who feel that they are currently experiencing feelings of depression or low mood, to take part in a survey about depression. We are trying to find out whether there is a link between physical activity and depression. Taking part in the study involves completing a confidential, one-off questionnaire in your own time which asks you questions about how much physical activity you do and how you have been feeling recently. We would like to hear from a variety of people for the survey, including people who are physically active at any level and people who do not do much (or any) physical activity.

If you would like to take part in the study, please request a copy of the questionnaire and/or further information by contacting me, Karen White, on 023 8024 1064 or at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) with your name and address. Your communication will be kept confidential. Please feel free to pass this e-mail onto anyone else you know who may be interested in taking part in the survey.

I am recruiting participants between April 2007 and July 2007 for this study.

This research study has been approved by the University of Southampton, School of Psychology Ethics Committee, Ref: PG/04/44.

TO AID CONFIDENTIALITY, PLEASE DO NOT REPLY TO THE PERSON WHO SENT YOU THIS E-MAIL, BUT CONTACT KAREN WHITE ON THE E-MAIL ADDRESS ABOVE.

Kind regards  
Karen

Karen White  
Research Training Fellow (Primary Medical Care, School of Medicine) and Research Student (School of Psychology)

Primary Medical Care  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
Southampton  
SO16 5ST

This research is supervised by Prof Tony Kendrick (Primary Medical Care, School of Medicine) and Prof Lucy Yardley (School of Psychology)

Appendix AA: Participant recruitment e-mail (B) used in cross-sectional study

**[Participant recruitment e-mail – i.e. to be sent to sport / exercise club members]**

**Physical activity and feelings of depression survey**

I am a researcher at the University of Southampton and I am seeking people aged 18 – 65, who feel that they are currently experiencing feelings of depression or low mood, to take part in a survey about physical activity and depression. Taking part in the study involves completing a confidential, one-off questionnaire in your own time which asks you questions about how much physical activity you do and how you have been feeling recently. We would like to hear from a variety of people for the survey, including people who are physically active at any level and people who do not do much (or any) physical activity.

If you would like to take part in the study, please request a copy of the questionnaire and/or further information by contacting me, Karen White, on 023 8024 1064 or at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) with your name and address. Your communication will be kept confidential. Please feel free to pass this e-mail onto anyone else you know who may be interested in taking part in the survey.

I am recruiting participants between April 2007 and July 2007 for this study.

This research study has been approved by the University of Southampton, School of Psychology Ethics Committee, Ref: PG/04/44.

TO AID CONFIDENTIALITY, PLEASE DO NOT REPLY TO THE PERSON WHO SENT YOU THIS E-MAIL, BUT CONTACT KAREN WHITE ON THE E-MAIL ADDRESS ABOVE.

Kind regards  
Karen

Karen White  
Research Training Fellow (Primary Medical Care, School of Medicine) and Research Student (School of Psychology)

Primary Medical Care  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
Southampton  
SO16 5ST

This research is supervised by Prof Tony Kendrick (Primary Medical Care, School of Medicine) and Prof Lucy Yardley (School of Psychology)

Appendix AB: Short notice (A) to recruit participants for the cross-sectional study

Short advert (i.e. for electronic notice boards, the Bulletin, newspapers, other media)

Researchers at the University of Southampton are seeking people aged 18 – 65, who feel that they are currently experiencing feelings of depression or low mood, to take part in a survey about depression. The study is exploring whether there is a link between physical activity and depression. Taking part in the study involves completing a confidential, one-off questionnaire in your own time which asks you questions about how much physical activity you do and how you have been feeling recently. The researchers would like to hear from a variety of people, including people who are physically active at any level and people who do not do much (or any) physical activity. If you would like to take part in the study, please request a copy of the questionnaire and/or further information by contacting Karen White on 023 8024 1064 or at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) with your name and address.

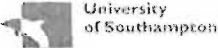


## Appendix AC: Short notice (B) to recruit participants for the cross-sectional study

Short advert (i.e. for electronic notice boards, the Bulletin, newspapers, other media)

Researchers at the University of Southampton are seeking people aged 18 – 65, who feel that they are currently experiencing feelings of depression or low mood, to take part in a survey about physical activity and depression. Taking part in the study involves completing a confidential, one-off questionnaire in your own time which asks you questions about how much physical activity you do and how you have been feeling recently. The researchers would like to hear from a variety of people, including people who are physically active at any level and people who do not do much (or any) physical activity. If you would like to take part in the study, you can request a copy of the questionnaire and/or further information by contacting Karen White on 023 8024 1064 or at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) with your name and address.

AD: Participant recruitment poster (A) for cross-sectional study



# Depression Survey

Have you been experiencing feelings of depression or low mood recently?

THEN WE WOULD LIKE YOUR HELP WITH OUR RESEARCH

We are conducting a survey at the University of Southampton about depression and we are seeking people aged 18 – 65, who feel that they are currently experiencing feelings of depression or low mood, to take part in the survey. We are trying to find out whether there is a link between physical activity and depression. Taking part in the study involves completing a confidential, one-off questionnaire in your own time that asks you questions about how much physical activity you do and how you have been feeling recently. We would like to hear from a variety of people for the survey, including people who are physically active at any level and people who do not do much (or any) physical activity.

If you would like to take part in the study, please request a copy of the questionnaire and/or further information by contacting Karen White (Research Training Fellow, Primary Medical Care, School of Medicine, and Research Student, School of Psychology, University of Southampton), by e-mail [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or phone 023 8024 1064 with your name and address. Your communication will be treated confidentially.

**This research study has been approved by the University of Southampton, School of Psychology Ethics Committee, Ref: PG/04/44**

Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064
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# Physical activity and depression survey

**Have you been experiencing feelings of depression or low mood recently?**

**THEN WE WOULD LIKE YOUR HELP WITH OUR RESEARCH**

We are conducting a survey at the University of Southampton about physical activity and depression and we are seeking people aged 18 – 65, who feel that they are currently experiencing feelings of depression or low mood, to take part in the survey. Taking part in the study involves completing a confidential, one-off questionnaire in your own time that asks you questions about how much physical activity you do and how you have been feeling recently. We would like to hear from a variety of people for the survey, including people who are physically active at any level and people who do not do much (or any) physical activity.

If you would like to take part in the study, please request a copy of the questionnaire and/or further information by contacting Karen White (Research Training Fellow, Primary Medical Care, School of Medicine, and Research Student, School of Psychology, University of Southampton), by e-mail [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or phone 023 8024 1064 with your name and address. Your communication will be treated confidentially.

This research study has been approved by the University of Southampton, School of Psychology Ethics Committee, Ref: PG/04/44

Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064	Physical Activity Survey Karen White K.T.White@soton.ac.uk 023 8024 1064
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University  
of Southampton

School of Medicine  
Primary Medical Care

Primary Medical Care  
University of Southampton  
Aldermoor Health Centre  
Aldermoor Close  
Southampton SO16 5ST  
United Kingdom

Tel +44 023 8024 1064  
Fax +44 023 8070 1125  
Email [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk)

## Information Sheet - Physical Activity and Feelings of Depression Survey

### Research Outline and Procedure

I am Karen White, a Research Training Fellow based in Primary Medical Care, School of Medicine, and a Research Student in the School of Psychology, University of Southampton. I am inviting you to participate in a study about physical activity and depression. Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Talk to others about the study if you wish. The purpose of this study is to find out more about the relationship between physical activity and depression. To do this, we need people who are aged 18-65 and who are currently experiencing feelings of depression or low mood to take part in this research. If you decide to take part in this study, you will need to complete the questionnaire attached to this sheet. The questionnaire asks you questions about how much physical activity you do and how you have been feeling recently. It also asks you for some other information such as your age, social support available to you and recent difficult life events. **The questionnaire takes 25-35 minutes to complete.** Once the questionnaire has been completed, it needs to be sent back to us in the freepost envelope provided (you do not need a stamp). Taking part in this study is entirely voluntary.

If you decide to take part, you need to complete the questionnaire that is enclosed with this sheet and post it to us (return of the completed questionnaire indicates that you are giving your consent to take part). **If you decide not to take part, do not complete the questionnaire and post the uncompleted questionnaire to us in the freepost envelope. This ensures that you will not be contacted again about the study.** Please post the questionnaire back to us within three weeks of receiving this pack. If you do not post back the first questionnaire you are sent, we will send you a second, reminder questionnaire after three weeks. After this reminder, you will not be contacted again about the study. Your participation is entirely voluntary and you may withdraw your consent to participate at any time without consequence and without giving a reason.

### Confidentiality

Personal information will not be released to or viewed by anyone other than the researcher involved in this project. Results of this study will not include your name or any other identifying characteristics. Your confidentiality will be ensured by the generation of a code number. This code number will be used to track whether or not you have returned the questionnaire so that a reminder questionnaire can be sent to you if necessary. A list of names, addresses and code numbers will be kept secure, separate from your questionnaire responses.

### Risks to the participant

There are no anticipated discomforts or major risks to you from taking part in this research. However, some people may become upset when answering questions about their current feelings, social support available to them and recent life events. You do not have to answer any questions that you find upsetting or difficult. If any of the questions cause you distress, a

list of support sources for depression and people you can contact to discuss how you are feeling is provided at the end of the questionnaire.

### **Use of findings**

This research will eventually be submitted as part of a thesis for a PhD research degree in Psychology, and may be presented at academic conferences and submitted for publication in academic journals.

### **Further questions and information**

If you have any questions or would like further information about this research, please feel free to contact me, Karen White, at [K.T.White@soton.ac.uk](mailto:K.T.White@soton.ac.uk) or 023 8024 1064. This research is supervised by Prof Tony Kendrick (Primary Medical Care, School of Medicine) and Prof Lucy Yardley (School of Psychology).

**If you have questions about your rights as a participant in this research, or if you feel that you have been placed at risk**, you may contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ.

Phone: (023) 8059 3995.

This research study has been approved by the University of Southampton, School of Psychology Ethics Committee, Ref: PG/04/44

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