Social Cognitive Variables Related to Physical Activity Following Total Knee Arthroplasty: An Application of the Health Action Process Approach

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signature:

Date: 21 October 2014

Abstract

Background: Approximately 80% of people make an optimal functional recovery following total knee arthroplasty (TKA), but little is known about psychological variables that influence this recovery. The Health Action Process Approach (HAPA) is a behaviour change model which has been used to investigate variables related to physical activity.

Aim: To investigate the relationships between the HAPA variables and physical activity at one to two years following TKA.

Methods: Fifty-four adults who had undergone a TKA one to two years previously were recruited from three orthopaedic clinics. Participants completed activity-related questionnaires on: perceived risk; outcome expectation; task, maintenance and recovery self-efficacy; behavioural intentions; action and coping plans; and social support. Further questionnaires assessed co-morbidities, current pain, knee function and physical activity participation. Spearman's correlations investigated relationships amongst the variables under study.

Results: Moderate to weak correlations occurred amongst variables of interest. In the motivation phase, both task self-efficacy and risk perception were weakly related to intention to exercise. In the volitional phase, moderate relationships occurred between task self-efficacy and action planning and between task self-efficacy and coping planning. Intention to exercise was moderately related to action planning and weakly related to coping planning. Weak relationships were found between maintenance self-efficacy and action planning and between maintenance self-efficacy and coping planning. Social support was weakly related to coping planning and coping planning was weakly related to physical activity. Co-morbidities and function were weakly inversely related to physical activity.

Conclusion: The variables of the HAPA show some ability to explain the participation in regular physical activity following TKA. Future research should evaluate the effectiveness of action and coping plans on improving the participation in physical activity amongst people following TKA.

Chapter 1. Introduction

1.1 Statement of the Problem

Arthritis is a leading cause of disability in New Zealand (NZ) which is estimated to affect 15% of the population over the age of 15, with total financial costs in 2010 of approximately $3.2 billion or 1.7% of gross domestic product (GDP) (Access Economics, 2010). Osteoarthritis (OA) affects the joints of the lower limb such as the hips and the knees (Goldring & Goldring, 2010). OA of the knee can cause marked pain and loss of function which can be treated surgically with a total knee arthroplasty (TKA) (Hawker et al., 1998; Jones, Voaklander, Johnston, & Suarez-Almazor, 2000). The number of TKA performed in NZ in 2010 was 6,107, which is double the number of TKA performed in 2000 (New Zealand National Joint Registry, 2011). Ninety-four percent of these surgeries were performed for knee OA (New Zealand National Joint Registry, 2011). With an ageing population in NZ the number of people over the age of 65 is expected to reach 1.44 million in 2061, or 2.6 times the 2009 total (Statistics New Zealand, 2012). This will further increase the demand for TKA surgery as the mean age for a TKA in NZ is over 65 years of age (Horne, Miles, & Lamb, 2003; New Zealand National Joint Registry, 2011).

While most patients benefit from TKA, 8 to 30% experience on-going pain or decreased function post-surgery (Brander et al., 2003; Franklin, Li, & Ayers, 2008; Kim, Chang, Kang, Kim, & Seong, 2009; Wylde, Hewlett, Learmonth, & Dieppe, 2011). Various pre- and post-operative factors and surgical factors can contribute to outcome following TKA (Dieppe, Lim, & Lohmander, 2011). Several studies have investigated the relationship between psychological states and outcomes, such as pain and function, following TKA (Vissers et al., 2012). Few studies have assessed social cognitive variables that are associated with positive outcomes, such as high levels of physical activity following TKA (Naal & Impellizzeri, 2010). The Health Action Process Approach (HAPA) is a behaviour change model which has been used to investigate the relationships between social cognitive variables, such as self-efficacy, and physical activity (Lippke, Ziegelmann, & Schwarzer, 2004a; Scholz, Sniehotta, & Schwarzer, 2005; Schwarzer, 2008a). The aim of the current research is to investigate the utility of the HAPA model to explain physical activity at one to two years following TKA.

1.2 Research Question and Aims

The research question: Is the HAPA a viable theoretical model for identifying social cognitive variables related to the participation in physical activity following TKA? The aim of the study was to investigate the relationships among the HAPA variables (risk perception; task, maintenance and recovery self-efficacy; outcome expectation; intention; action and coping planning, social support) and physical activity at one to two years following TKA. The relationships among treatment outcomes (pain and function), co-morbidities and physical activity were also investigated.

1.3 Hypotheses

The following hypotheses are predicted by the HAPA:

1. Risk perception, outcome expectation for exercise and task self-efficacy will be positively related to intention to exercise following TKA.
2. Intention to exercise, task self-efficacy and maintenance self-efficacy will be positively related to exercise planning.
3. Social support for exercise will be positively related to intention and to exercise planning.
4. Planning, maintenance self-efficacy and recovery self-efficacy will be positively related to physical activity.
5. Task self-efficacy and recovery self-efficacy will be positively related to maintenance self-efficacy.
6. Social support for exercise will be positively related to physical activity and co-morbidities, and pain and function will be negatively related to physical activity.

1.4 Significance of the Study

The results of this study will inform clinicians about variables related to physical activity following TKA. Physiotherapists and other health professionals could use the HAPA framework to identify which variables, such as task or maintenance self-efficacy need strengthening in people who are reluctant to undertake regular physical activity following TKA. Should the results of this study be in the anticipated direction, this could enable clinicians to trial behaviour change interventions that may result in increased levels of physical activity for TKA patients. The risk of morbidity associated with physical inactivity may be reduced if activity levels are increased.

Chapter 2. Literature Review

2.1 Introduction

This chapter is divided into four sections. The first section outlines TKA surgery in NZ and reviews outcomes following surgery and variables related to these outcomes. The second section introduces the HAPA model and its application to engagement in physical activity. The third section reviews the literature that has investigated the relationships among the HAPA variables and physical activity in people undergoing orthopaedic rehabilitation.

2.2 Total Knee Arthroplasty

TKA surgery involves the resection and replacement of the degenerative articular surfaces of the distal end of the femur and the proximal end of the tibia, usually with prosthetic metal implants with a polyethylene spacer between the metal components (Carr et al., 2012; Clatworthy, 2012). People are typically in their seventh decade when undergoing a TKA in NZ. The mean age of people undergoing TKA in NZ from 1999 to 2011 was 68 years and the percentage of females was 52% (New Zealand National Joint Registry, 2011). The most common type of TKA surgery in NZ is the unilateral TKA where both medial and lateral compartments are replaced (New Zealand National Joint Registry, 2011). The prosthetic implants can either be cemented in place or uncemented, where the bone grows into the prosthesis, or they can be a hybrid mixture of both (Nakama et al., 2012). Several different types of prostheses are used in NZ. The five most common types used in 2011 were the Triathalon, Nexgen, PFC sigma, Genesis II and the LCS, with the majority of these prostheses cemented in place (New Zealand National Joint Registry, 2011).

The unilateral TKA prostheses can be mobile bearing, with a rotating platform, or fixed bearing (Smith, Jan, Mahomed, Davey, & Gandhi, 2011). The mobile bearing prosthesis allows for some rotation of the polyethylene spacer in the tibial tray to occur, which is thought to cause less wear of the polyethylene and replicate the normal kinematics of the knee joint (Smith et al., 2011). The fixed bearing prosthesis is more commonly used in NZ (New Zealand National Joint Registry, 2011). Similar functional outcomes have been found on the Knee Society Score for the fixed and mobile bearing prostheses (Insall, Dorr, Scott, & Scott, 1989; Shemshaki, Dehghani, Eshaghi, & Esfahani, 2012).

Rehabilitation after TKA can take up to a year following surgery as quadriceps strength is markedly reduced in the early post-operative phase (Mizner, Petterson, & Snyder-Mackler, 2005; Mizner, Stevens, & Snyder-Mackler, 2003). The resultant loss in strength, which may be up to 65%, can affect post-operative function, with reduced ability to perform tasks such as stair climbing or walking (Byrne, Gage, & Prentice, 2002; Greene & Schurman, 2008; Mizner & Snyder-Mackler, 2005; Rossi, Hasson, Kohia, Pineda, & Bryan, 2006; Walsh, Woodhouse, Thomas, & Finch, 1998). Quadriceps strength of the operative limb returns to approximately 90% of the non-operative limb by 12 months following surgery and tends to plateau after that time (Farquhar & Snyder-Mackler, 2010; Harman, 2012; Yoshida, Mizner, Ramsey, & Snyder-Mackler, 2008).

A large number of studies have investigated outcomes such as pain and function following TKA (Beswick, Wylde, Gooberman-Hill, Blom, & Dieppe, 2012; Brandes, Ringling, Winter, Hillmann, & Rosenbaum, 2011; Kennedy, Stratford, Riddle, Hanna, & Gollish, 2008; Wylde et al., 2011). Numerous factors have been identified as being associated with these outcomes (Dieppe et al., 2011). These factors can be categorised into demographic, surgical, clinical and psychosocial factors. Demographic factors that have been shown to be related to better outcomes are younger age, male gender and low body mass index (BMI) (Bade, Wolfe, Zeni, Stevens-Lapsley, & Snyder-Mackler, 2012; Franklin et al., 2008; Singh, Gabriel, & Lewallen, 2008). Pre-operative clinical factors related to improved outcome are better quadriceps strength, less pain, greater function and fewer co-morbidities (Bade et al., 2012; Escobar et al., 2007; Fortin et al., 2002; Franklin et al., 2008; Harden et al., 2003; Lingard, Katz, Wright, & Sledge, 2004; Santaguida et al., 2008; Singh et al., 2008; Wylde, Dieppe, Hewlett, & Learmonth, 2007). Surgical factors related to good outcome are less blood loss (Kotzé, Carter, & Scally, 2012) and surgical expertise. Patients operated on by surgeons who have performed high volumes of TKA surgeries have better outcomes (Lau, Perruccio, Gandhi, & Mahomed, 2012).

A number of studies have also investigated the relationship between psychological states and outcome following TKA (Vissers et al., 2012). Depression, anxiety and distress have been linked to poor functional outcome, and pain catastrophising has been associated with higher pain levels following TKA (Ayers, Franklin, Ploutz-Snyder, & Boisvert, 2005; Brander, Gondek, Martin, & Stulberg, 2007;

Forsythe, Dunbar, Hennigar, Sullivan, & Gross, 2008; Lingard & Riddle, 2007; Sullivan et al., 2009). Other factors that have been found to be related to lower pain and greater functional outcomes following TKA are higher self-efficacy and more social support (Engel, Hamilton, Potter, & Zautra, 2004; Khan et al., 2009; Lopez-Olivo et al., 2011; Moon & Backer, 2000; van den Akker-Scheek, Stevens, Groothoff, Bulstra, & Zijlstra, 2007; Waldrop, Lightsey Jr, Ethington, Woemmel, & Coke, 2001; Wylde, Dixon, & Blom, 2012). Few studies have investigated social cognitive variables that are associated with positive outcomes following TKA, such as increased level of physical activity.

Levels of physical activity are reduced in people with OA and remain lower than the general population one year after TKA (Brandes et al., 2011; I. B. de Groot, J. B. Bussmann, H. J. Stam, & J. A. Verhaar, 2008b; Naal & Impellizzeri, 2010; Shih, Hootman, Kruger, & Helmick, 2006; Stevens, Reininga, Bulstra, Wagenmakers, & van den Akker-Scheek, 2012; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010; White et al., 2013). Physical inactivity is a modifiable risk factor for chronic diseases that are associated with morbidity and mortality, such as cardiovascular disease, diabetes, obesity, and hypertension (Nocon et al., 2008). Regular physical activity reduces the risk of all-cause mortality and is also recommended for the non-pharmacological management of psychological conditions such as anxiety and depression (Mead et al., 2009; Phillips, Kiernan, & King, 2003).

The guidelines for physical activity for adults aged 18 to 65 as set by the American College of Sports Medicine and the American Heart Association recommend a minimum of 30 minutes of moderate intensity exercise five days per week for adults aged 18 to 65, or vigorous intensity physical activity for a minimum of 20 minutes three days per week (Haskell et al., 2007; Nelson et al., 2007). While high impact activities are discouraged following TKA because of risk of prosthetic wear, low impact activities such as walking, cycling or swimming are considered acceptable (Papalia, Del Buono, Zampogna, Maffulli, & Denaro, 2012; Swanson, Schmalzried, & Dorey, 2009). With the known health benefits of physical activity and the NZ government's prioritisation of ageing well, enhancing physical activity in this patient population is of health and economic importance (Gluckman et al., 2013; Warburton, Nicol, & Bredin, 2006).

2.3 Health Action Process Approach

Various health behaviour change theories have been developed to explain factors related to health promoting behaviours, such as increased levels of physical activity. One such behaviour change theory is the HAPA, which has been used to explore factors related to physical activity in adults (Parschau et al., 2012; Renner, Spivak, Kwon, & Schwarzer, 2007; Scholz, Keller, & Perren, 2009; Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008; Scholz et al., 2005). This section introduces the HAPA and discusses its application to engagement in physical activity in adult populations.

2.3.1 Search strategy.

A systematic search was undertaken to locate papers outlining the HAPA, as well as papers which have used the HAPA to investigate variables related to adult engagement in physical activity, as opposed to other health promoting health behaviours. This review aimed to outline the HAPA and to determine if there was support for and against the application of this model. Papers outlining the HAPA were included, as well as cohort studies, randomised clinical trials, cross sectional studies or randomised controlled trials that have used the HAPA in relation to physical activity in adult populations. Studies were excluded if they were not written in the English language, or if they included neurological conditions. A manual search of the reference lists was also undertaken to identify further papers that were relevant.

The search strategy for this review used the following key phrases:

1. HAPA OR “health action process approach” OR
2. Schwarzer, R. (author)

The search was conducted on electronic databases subscribed to by the Auckland University of Technology (AUT) library. The following databases were searched: Cumulative Index to Nursing and Allied Health Literature (CINAHL) (from 1969), MEDLINE (from 1969), SPORTDiscus (from 1969), Health Source: Nursing/Academic Edition, Psychology and Behavioral Sciences Collection, Biomedical Reference Collection via EBSCO and SCOPUS (from 1960). The search was undertaken between June 2012 and December 2012.

2.3.2 Results.

Eleven hundred articles were reviewed by title and abstract to determine suitability for inclusion and a manual search of the bibliographies was undertaken to determine further papers suitable for inclusion. Sixty-eight records met the inclusion criteria and were included in this part of the review (see Figure 1).

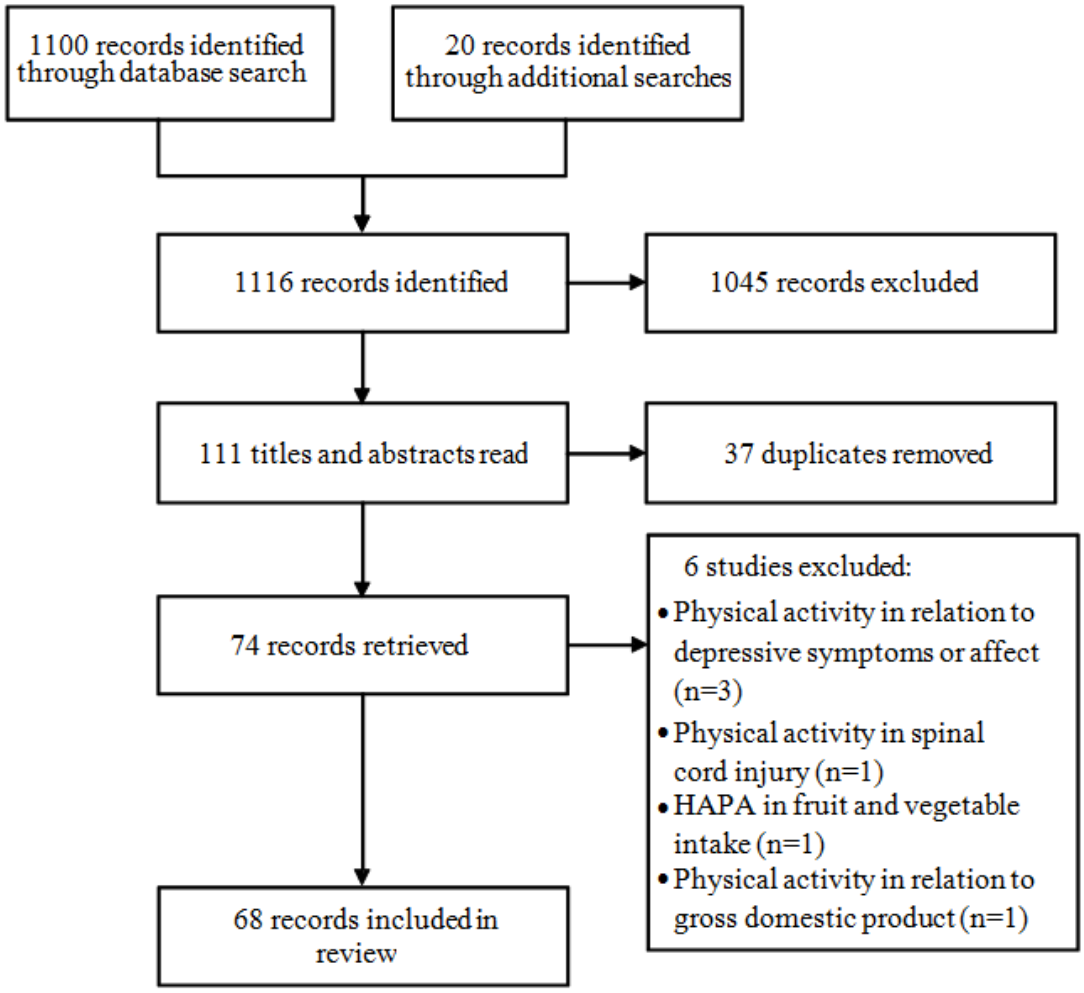

Figure 1. Search strategy for literature on the HAPA.

2.3.3 The development and underlying theory of the HAPA.

The HAPA was developed by Schwarzer in 1988 by combining the Social Cognitive Theory, the Theory of Reasoned Action, and the volitional theories of Heckhausen and Gollwitzer (Bandura, 1982, 1997; Fishbein & Ajzen, 1975; Heckhausen & Gollwitzer, 1987; Schwarzer, 1992; Schwarzer, Lippke, & Luszczynska, 2011; Schwarzer & Luszczynska, 2008). Behaviour theories such as the Social Cognitive Theory or the Theory of Reasoned Action propose that the most important predictor of behaviour is an intention to perform that behaviour (Bandura, 1982;

Fishbein & Ajzen, 1975). Social Cognitive Theory is a widely used behaviour change theory (see Figure 2) (Bandura, 1997; Luszczynska & Schwarzer, 2005; Schwarzer, 1992; Schwarzer & Fuchs, 1995). Key constructs of the Social Cognitive Theory are self-efficacy and outcome expectancies, which are considered influential in the adoption and maintenance of health behaviours (Bandura, 1977, 2001, 1995). A limitation of theories such as the Social Cognitive Theory is that intention has been shown to explain a relatively small amount of variance in actual behaviour (Sheeran, 2002; Webb & Sheeran, 2006).

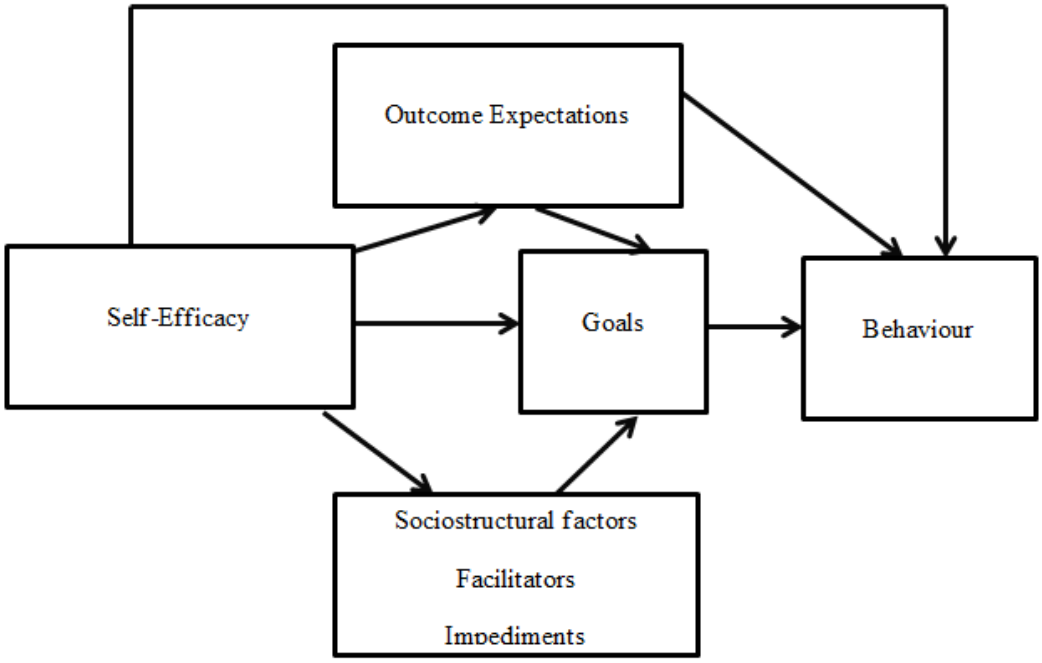

Figure 2. Social cognitive theory. Adapted from Luszscynska and Schwarzer (2005).

Heckhausen and Gollwtizer (1987) identified a transition in thinking after an intention has been formed that focusses on when and how to act to implement the intention. The HAPA framework combines these previous theories by distinguishing between the motivational processes involved in forming an intention to undertake a health promoting behaviour and the volitional processes involved in the translation of that intention into actual behaviour (Schwarzer & Luszczynska, 2008). The first principle of the HAPA suggests that the framework be divided into two phases; a motivational or pre-intentional phase and a volitional phase, which is the action phase (see Figure 3) (Schwarzer, 1999, 2001; Schwarzer et al., 2011).

2.3.4 Motivational phase.

The motivational phase is when an individual develops an intention to perform a health enhancing behaviour (Schwarzer, 2008a; Schwarzer et al., 2011). Perception of risk is considered to be a distal antecedent of intention formation (Bandura, 2004; Schwarzer, 1992, 2008a; Schwarzer et al., 2011). Risk perception is the threat that a person believes is likely to happen to their health if the health promoting behaviour is not undertaken. For example, a person may perceive there is increased risk of developing cardiovascular disease if they do not exercise regularly (Schwarzer et al., 2011). Risk perception has been shown to be weakly related to intention to exercise in cardiac rehabilitation and retired people (Caudroit, Stephan, & Le Scanff, 2011; Scholz et al., 2005; Sniehotta, Scholz, & Schwarzer, 2005). Risk perception alone is not considered sufficient for intention formation, but sets the stage for contemplation about the consequences of action and the competence required for such an action (Schwarzer & Fuchs, 1995; Schwarzer et al., 2011; Schwarzer et al., 2007).

Risk perception is considered to be a precursor of outcome expectancy, which in turn leads to contemplation about self-efficacy (Sutton, 2005). Outcome expectancies refer to the perceived consequences that are thought to occur if a certain behaviour is undertaken (Bandura, 1995; Schwarzer & Luszczynska, 2008). An example of positive outcome expectancy would be a person's belief that regular exercise will reduce their risk of cardiovascular disease (Schwarzer et al., 2011).

Self-efficacy is thought to work in concert with outcome expectancies to contribute to intention formation (Bandura, 2004; Schwarzer et al., 2011; Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008). Self-efficacy refers to a person's judgement in their capability to organise and execute the actions required to undertake a certain behaviour (Bandura, 1986). A person may recognise the benefits of undertaking behaviour, such as physical activity, but he or she may not have confidence in their ability to be physically active. The measurement of self-efficacy needs to be context specific; self-efficacy for physical activity should measure the confidence one has in the ability to be physically active (Bandura, 1995).

Self-efficacy, outcome expectation and risk perception are all considered predictors of intention formation in the motivational phase of the HAPA (Schwarzer, 1992; Schwarzer et al., 2011; Sutton, 2005). This is supported by studies that have investigated physical activity in cardiac rehabilitation patients and in older adults and

found task self-efficacy, outcome expectation and risk perception were all predictors of intention to exercise (Renner et al., 2007; Scholz et al., 2005; Sniehotta, Scholz, & Schwarzer, 2005). People undergoing cardiac rehabilitation who had greater intentions to exercise had higher levels of task self-efficacy and outcome expectation (Dohnke, Nowossadeck, & Müller-Fahrnow, 2010). Self-efficacy and outcome expectation were also joint predictors of intention to be physically active in diverse populations such as middle aged women, university students and Thai adults (Barg et al., 2012; Poomsrikaew, 2011; Scholz et al., 2009). Similarly, Caudroit et al. (2011) found self-efficacy and risk perception were positively related to intention in older adults.

The HAPA differs from the Social Cognitive Theory in that self-efficacy is divided into three types; task, maintenance and recovery self-efficacy (Bandura, 1977; Schwarzer, 2008a). Task self-efficacy is the confidence one has in the ability to undertake a certain behaviour (Schwarzer, 2008a; Schwarzer & Luszczynska, 2008). Maintenance self-efficacy is the confidence one has in the ability to overcome obstacles that interfere with the behaviour (Schwarzer & Luszczynska, 2008; Schwarzer et al., 2003). Recovery self-efficacy is confidence in the ability to get back to the behaviour after stopping it for some reason (Schwarzer & Luszczynska, 2008). In studies involving older adults and middle aged women, task self-efficacy was a predictor of intention formation and maintenance self-efficacy was a predictor of physical activity (Barg et al., 2012; Caudroit et al., 2011). Maintenance self-efficacy and recovery self-efficacy are important predictors of the maintenance of regular running (Luszczynska, Mazurkiewicz, Ziegelmann, & Schwarzer, 2007; Mazurkiewicz & Luszczynska, 2004). Recovery self-efficacy and planning have been shown to be predictors of physical activity in cardiac rehabilitation (Schwarzer et al., 2008).

2.3.5 Volitional phase.

In the volitional phase of the HAPA, the intention to undertake the health promoting behaviour has already been formed (Schwarzer et al., 2011). The second principle of the HAPA is based on the premise that intention does not always translate into action (Schwarzer et al., 2011; Sheeran, 2002). This principle indicates that there are two groups of people in the volitional phase; those who have formed an intention but have not yet acted on that intention (intenders) and those who have acted out their intention (actors) (Schwarzer et al., 2011). The HAPA can be viewed as being both a stage model, with people being classified as non-intenders, intenders or actors, or a

continuum model (Lippke, Ziegelmann, Schwarzer, & Velicer, 2009; Schwarzer, 2008b, 2008c; Schwarzer & Luszczynska, 2008). The continuum model identifies mediators between intention and behaviour, such as planning and self-efficacy (Schwarzer & Luszczynska, 2008).

The use of implementation intentions or planning has been shown to have a positive effect on translating intentions into actions, which may be helpful for those people who have formed an intention but have not yet acted on it (Gollwitzer & Brandstätter, 1997; Gollwitzer & Sheeran, 2006). Implementation intentions specify plans of when, where and how people will respond to situational cues to facilitate the intended behaviour (Gollwitzer, 1999). The third principle of the HAPA asserts that planning is important to help translate intention into action and suggests it is a key strategy for people who are motivated to change (Schwarzer et al., 2011). The fourth principle of the HAPA states that planning is divided into action planning, which is the when, where and how of intended action, and coping planning, which are strategies designed to overcome anticipated barriers to action (Scholz et al., 2008; Schwarzer et al., 2011; Sniehotta, Scholz, & Schwarzer, 2006).

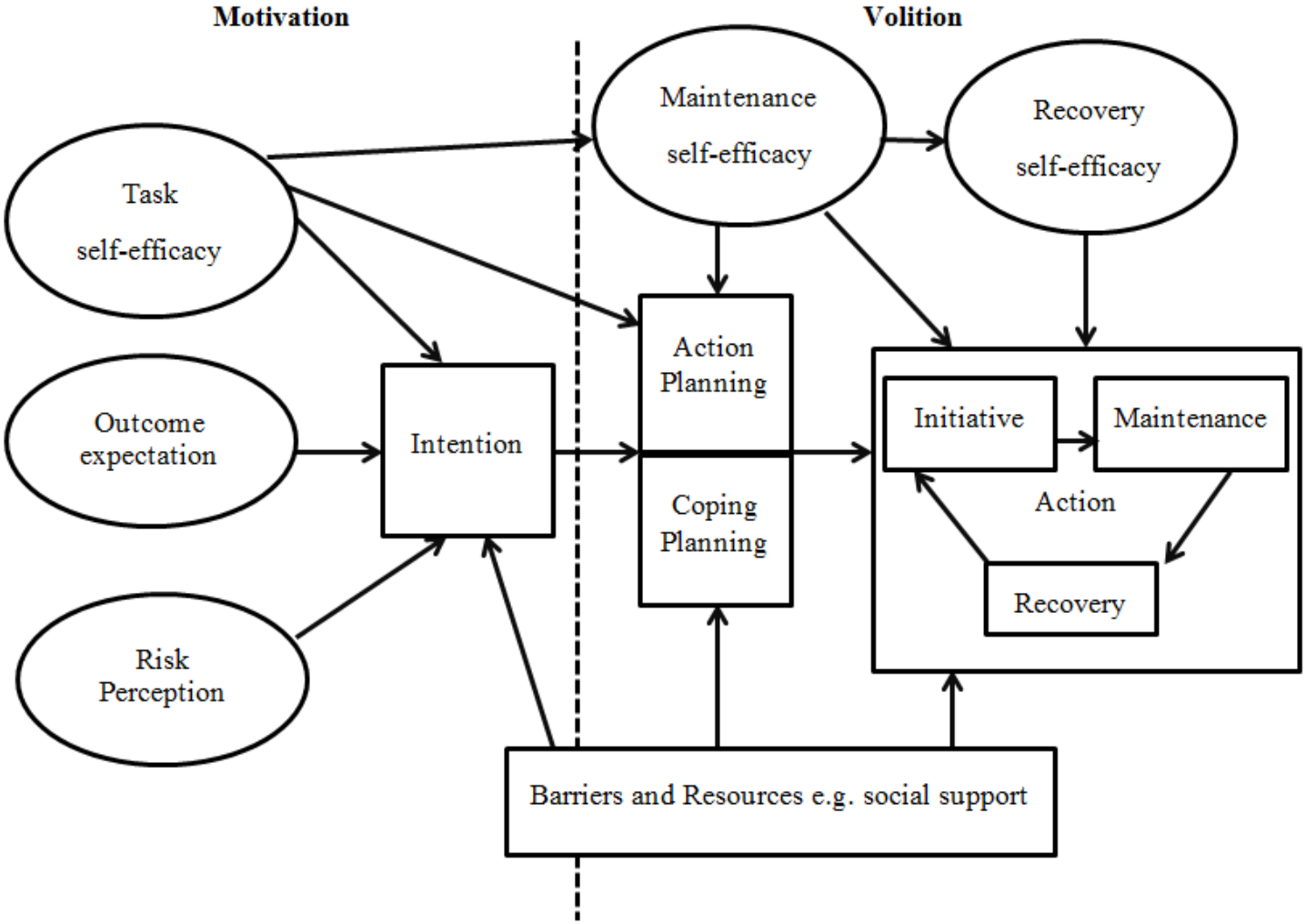

Figure 3. HAPA model adapted from Schwarzer (2008) and Schwarzer, Lippke and Luszczynska (2011).

Four studies investigating physical activity in adults found intentions were partially translated into behaviour by planning (Gellert, Ziegelmann, Lippke, & Schwarzer, 2012; Koring, Richert, Lippke, et al., 2012; Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009; Schwarzer et al., 2007). Studies investigating physical activity in German people and in cardiac rehabilitation found action planning predicted behaviour when intentions were high, and coping planning was a mediator of the intention-behaviour relationship and was important for the maintenance of physical activity (Evers, Klusmann, Schwarzer, & Heuser, 2012; Scholz et al., 2008; Sniehotta, Schwarzer, Scholz, & Schüz, 2005; Wiedemann, Schuz, Sniehotta, Scholz, & Schwarzer, 2009). Interventions involving action and coping plans to increase physical activity in cardiac rehabilitation had greater effect than just action planning or standard care (Scholz, Sniehotta, Burkert, & Schwarzer, 2007; Sniehotta et al., 2006; Sniehotta, Scholz, Schwarzer, et al., 2005). Planning interventions have been shown to be more effective in intenders than non-intenders (Lippke, Schwarzer, Ziegelmann, Scholz, & Schüz, 2010). Changes in levels of physical activity are related to changes in self-efficacy and planning (Reuter et al., 2010). Adults who are more active have higher levels of planning and a combined planning and self-efficacy intervention has also been shown to increase levels of physical activity in adults (Koring, Richert, Parschau, et al., 2012; Parschau et al., 2012).

The fifth principle of the HAPA indicates that self-efficacy is required across all phases of the model (Schwarzer, 2001; Schwarzer et al., 2011). In the motivational phase, task self-efficacy is important for intention formation and for planning. In the volitional phase, once an action has been initiated it has to be maintained and this requires confidence in the ability to maintain the action even in the face of barriers. Recovery self-efficacy, or confidence in the ability to return to exercise, is necessary if a person stops the action for a period of time. The role of phase specific self-efficacy has been explored in cardiac rehabilitation with maintenance self-efficacy being identified as important for people maintaining their exercise levels and recovery self-efficacy important for people who have to resume exercise after taking a break from exercise (Luszczynska & Sutton, 2006; Scholz et al., 2005). Self-efficacy may act as a moderator of the planning-behaviour relationship (Luszczynska, Schwarzer, Lippke, & Mazurkiewicz, 2011).

2.3.6 Barriers and resources.

The HAPA also includes barriers and resources (Schwarzer, 1992; Schwarzer et al., 2011). Barriers are impediments to action, whereas resources facilitate the undertaking of an action. For example, social support may be considered a resource. Social support can come from spouses, friends, neighbours or relatives and can be divided into different types such as emotional, instrumental or informational support (Schwarzer & Leppin, 1988). Higher levels of social support have been shown to be positively related to the initiation and maintenance of physical activity in older people and to the amount of physical activity undertaken (Gellert, Ziegelmann, Warner, & Schwarzer, 2011; van Stralen, de Vries, Mudde, Bolman, & Lechner, 2009; Warner, Ziegelmann, Schüz, Wurm, & Schwarzer, 2011). A lack of social support may be a barrier to action. A spouse or partner who actively discourages participation in a health enhancing behaviour may have a negative impact on the initiation and maintenance of that behaviour.

2.4 Utilisation of the HAPA in Orthopaedic Rehabilitation

Ten articles which investigated physical activity in patients undergoing orthopaedic rehabilitation were identified from the first search strategy for this review. A second search strategy was then undertaken, which incorporated search terms relevant to orthopaedic rehabilitation or TKA, to ensure that all articles relevant to orthopaedic surgery or TKA were included in this review.

2.4.1 Search strategy.

A systematic search was undertaken to review the literature that has used the HAPA to investigate variables related to physical activity in orthopaedic rehabilitation. The review aimed to determine if there was support for or against the application of this model in this population. Studies were included if they used the HAPA in a sample of people undergoing orthopaedic rehabilitation. The types of studies that were included were cohort studies, randomised clinical trials, cross sectional studies or randomised controlled trials. Studies were excluded if they were not written in the English language. Systematic reviews were excluded however their reference lists were searched to ensure relevant studies were included.

The search strategy for this review used the following key phrases:

1. HAPA OR “health action process approach” OR
2. Schwarzer, R. (author) AND
3. “physical activ*” OR exercise AND
4. “orthop* rehab*” OR “knee arthroplasty” OR TKA OR “knee replacement” OR TKR OR “knee joint replacement” OR TKJR

The search was conducted on electronic databases subscribed to by the Auckland University of Technology (AUT) library. The following databases were searched: Cumulative Index to Nursing and Allied Health Literature (CINAHL) (from 1969), MEDLINE (from 1969), SPORTDiscus (from 1969), Health Source: Nursing/Academic Edition, Psychology and Behavioral Sciences Collection, Biomedical Reference Collection via EBSCO and SCOPUS (from 1970). The search was undertaken between June 2012 and December 2012.

2.4.2 Results.

Three hundred and thirty-one articles were reviewed by title and abstract to determine suitability for inclusion and a manual search of the bibliographies was undertaken to determine further papers suitable for inclusion. Two hundred and fourteen records were excluded as they did not meet the inclusion criteria. Nineteen full papers were retrieved, after which a further eight papers were excluded. Eleven studies were identified (see Figure 4) in which the HAPA had been used to assess social cognitive variables related to physical activity in participants undergoing orthopaedic rehabilitation (Fleig, Lippke, Pomp, & Schwarzer, 2011; Jackson, Lippke, & Gray, 2011; Lippke, Fleig, Pomp, & Schwarzer, 2010; Lippke et al., 2004a; Lippke, Ziegelmann, & Schwarzer, 2004b, 2005; Reuter, Ziegelmann, Lippke, & Schwarzer, 2009; Schwarzer et al., 2008; Ziegelmann & Lippke, 2007; Ziegelmann, Lippke, & Schwarzer, 2006; Ziegelmann, Luszczynska, Lippke, & Schwarzer, 2007). The orthopaedic rehabilitation typically included people who had either undergone surgery for conditions affecting a joint, muscle or ligament or were rehabilitating from pathologies affecting those structures.

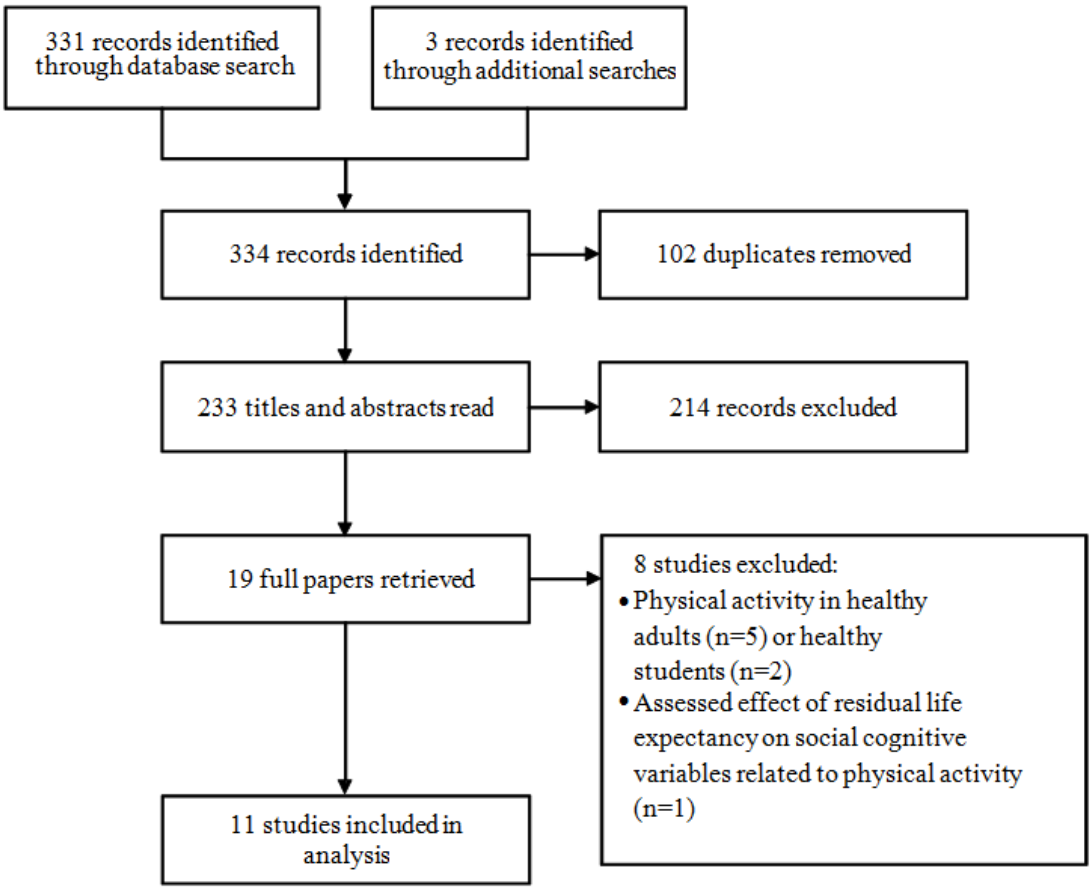

Figure 4. Search strategy of studies using the HAPA with orthopaedic conditions.

2.4.3 Findings of the studies that have utilised the HAPA in orthopaedic rehabilitation.

The results of the studies largely support the use of the HAPA model to explain physical activity in people undergoing orthopaedic rehabilitation. Seven studies found support for the variables in the motivational phase of the HAPA in orthopaedic rehabilitation. Four studies classified people as non-intenders, intenders or actors through a series of questions asking about the level of exercise they had undertaken in the past week or month (Jackson et al., 2011; Lippke, Fleig, et al., 2010; Lippke et al., 2004b, 2005). Levels of intention to exercise were lower in non-intenders (Lippke, Fleig, et al., 2010; Lippke et al., 2004a). Lippke et al. (2005) identified risk perception and self-efficacy as being important for intention formation in people who were non-intenders. Self-efficacy and outcome expectation at the start of the orthopaedic rehabilitation were joint predictors of intention formation by the end of three weeks of rehabilitation (Lippke et al., 2004a). Ziegelmann and Lippke (2007) found task self-efficacy, but not risk perception or outcome expectation, was significantly correlated to

intention to exercise. By comparison, Jackson et al. (2011) found non-intenders were more likely to become intenders if they perceived positive outcome expectations. Non-intenders were also more likely to transition to become actors if they perceived more risk and had more intention to exercise (Jackson et al., 2011). In contrast, Schwarzer et al. (2008) found that although risk perception and outcome expectation were not significantly related to intention, self-efficacy was significantly related to intention.

Support was also evident across the studies for the variables in the volitional phase of the HAPA in orthopaedic rehabilitation. Task self-efficacy was significantly higher in people who were classified as actors compared to intenders (Lippke, Fleig, et al., 2010). Intenders were more likely to become active if they reported higher self-efficacy and actors were more likely to revert if they reported more barriers and had lower self-efficacy (Jackson et al., 2011). Lippke et al. (2005) identified self-efficacy as being important across all three stages of the model. Intention and recovery self-efficacy accounted for significant variance in planning, and planning and recovery self-efficacy accounted for significant variance in physical activity (Schwarzer et al., 2008). Ziegelmann et al. (2007) found that planning was a better predictor of exercise than intention. Lippke et al. (2004b) also investigated levels of planning, with intenders scoring higher on action planning than non-intenders. Self-efficacy was identified as predictive of planning and levels of intention and planning were predictive of exercise levels (Lippke et al., 2004a). Ziegelmann et al. (2006) also found intention and self-efficacy to be predictive of action planning.

Two studies assessed barriers or facilitators to exercise (Jackson et al., 2011; Lippke, Fleig, et al., 2010). Lippke, Fleig et al. (2010) investigated social support for exercise using a one item scale. They found that people who participate in physical activity (Actors) had more social support than people who intend to undertake physical activity (Intenders) (Lippke, Fleig, et al., 2010). Jackson et al. (2011) measured social support with a ten item scale and found that people were more likely to become active if they perceived they had more social support.

Three experimental studies reviewed included a planning intervention designed to increase levels of physical activity (Fleig et al., 2011; Lippke et al., 2004b; Ziegelmann et al., 2006). Ziegelmann et al. (2006) investigated a self-administered planning intervention compared to interviewer assisted planning. The latter led to more complete action plans, which in turn led to a greater duration of activities performed six

months after discharge. This study also investigated the effects of action planning versus coping planning, with action plans having a major role in the initiation and maintenance of exercise, whereas coping planning was important for the maintenance of exercise (Ziegelmann et al., 2006). Lippke et al. (2004b) investigated the effect of an action and coping planning intervention on non-intenders, intenders and actors. They found that the planning intervention had a greater beneficial effect on physical activity in intenders compared to non-intenders. Fleig et al. (2011) used a combination of goal setting, action planning, positive reflection and action control which led to an increase in exercise behaviour.

Overall, there was some support for the HAPA in orthopaedic rehabilitation patients. While there was support for the HAPA there were a number of methodological issues that need to be taken into account when interpreting the findings. The majority of the studies had a large number of participants (range from 282 to 560), suggesting the likelihood that these studies were sufficiently statistically powered. The average age of the participants across the studies was in the fifth decade with the gender ranging from 54 to 63% female. It is apparent from the participant descriptions and the author groups that a number of the studies were based on data from the same participant group (for example Jackson et al., 2011; Lippke et al., 2004a, 2004b; Lippke et al., 2005; Schwarzer et al., 2008; Ziegelmann et al., 2006). Therefore, the large numbers of participants mentioned above is likely to be less than it infers.

All of the studies included a heterogeneous sample of participants undergoing orthopaedic rehabilitation for various injuries or conditions. This included arthritis; surgery for joints, muscles or ligaments; chronic pain and back pain. Two studies indicated that the participants had orthopaedic conditions but included stroke as one of the conditions (Lippke et al., 2004b, 2005). Given the array of conditions that were listed in the studies, the rehabilitation for each participant is also likely to be varied according to their condition (Brewer, 1999). The HAPA was largely supported even with these heterogeneous samples, suggesting the model is robust across many orthopaedic conditions. Several studies identified the need for replication of their study in samples of patients undergoing different types of rehabilitation, or with larger sample sizes (Fleig et al., 2011; Jackson et al., 2011; Lippke et al., 2004b; Ziegelmann & Lippke, 2007; Ziegelmann et al., 2006; Ziegelmann et al., 2007).

Assessment time frames varied across the studies. Assessments of patients in most of the studies took place before and after a three week rehabilitation programme with further follow up time frames of up to 36 months after rehabilitation. Two studies had a short follow up time-frame of up to four weeks following rehabilitation (Jackson et al., 2011; Lippke et al., 2004b) and one cross-sectional study (Lippke, Fleig, et al., 2010) assessed participants once. Variations in follow up period may mean that participants were at different stages of their recovery or rehabilitation at the time of assessment. Five of the studies, however, had at least a 12 month follow up (Lippke et al., 2005; Reuter et al., 2009; Schwarzer et al., 2008; Ziegelmann & Lippke, 2007; Ziegelmann et al., 2007), providing good evidence that the HAPA model is supported in this time-frame.

All of the studies measured some or all of the HAPA variables (risk perception, outcome expectation, self-efficacy, intention and planning). The reliability of the scales used to assess the HAPA variables varied across the studies. While most of the studies reported an acceptable Cronbach alpha of .70 or greater (Pallant, 2007) for some of the scales, seven studies reported having a Cronbach alpha below .70 for at least one scale (Jackson et al., 2011; Lippke, Fleig, et al., 2010; Lippke et al., 2004a, 2004b, 2005; Schwarzer et al., 2008; Ziegelmann & Lippke, 2007). The scales that were reported as having low reliability across the studies were the outcome expectation, intention and self-efficacy scales. Some studies omitted to report the reliability of the scales that they used or they only reported the inter-rater reliability, which may affect the accuracy of the findings (Ziegelmann et al., 2006; Ziegelmann et al., 2007).

Physical activity or physical exercise was measured in all of the studies through the use of self-report questionnaires. Two studies used a generic measure for exercise based on three domains: fitness activities, muscle strengthening and sporting activities (Lippke et al., 2004a; Ziegelmann et al., 2007). A single question was used by three studies to assess level of physical activity (Jackson et al., 2011; Schwarzer et al., 2008; Ziegelmann & Lippke, 2007). Four studies used either the Godin Leisure Time Exercise Questionnaire (Godin & Shephard, 1985) or the Kaiser Physical Activity Survey (Ainsworth, Sternfeld, Richardson, & Jackson, 2000) (Fleig et al., 2011; Lippke, Fleig, et al., 2010; Lippke et al., 2004b; Reuter et al., 2009). Three different domains of physical activity were assessed in two studies; locomotion, daily activities and scheduled exercise (Lippke et al., 2005; Ziegelmann et al., 2006). Few studies identified

the reliability or validity of the measures to assess physical activity, which could be considered a limitation as physical activity was a key outcome measure.

2.5 Discussion

The HAPA is a behaviour change model with two phases; a motivational phase and a volitional phase, which is supported across various samples of people. In the motivational phase there is support for the relationships between variables related to intention formation, in particular task self-efficacy. There is also support for the effectiveness of variables in the volitional phase of the HAPA, such as planning on the initiation and maintenance of physical activity. Of the eleven studies that investigated social cognitive factors related to physical activity in orthopaedic populations, most provided support for the HAPA. All of the studies had sufficient sample sizes to be adequately powered. There was support for the HAPA even though the studies had heterogeneous populations at various time points of rehabilitation. In the motivational phase of the HAPA, there was support for the predictive value of self-efficacy for exercise and outcome expectation for exercise intention. There was less support for the predictive value of risk perception on intention. In the volitional phase of the HAPA, intention and self-efficacy were important predictors of planning, and planning and self-efficacy were important predictors of physical activity. Self-efficacy was identified as being important across both phases of the HAPA in orthopaedic rehabilitation. There was limited evidence for interventions that involve action or coping planning, although planning appears to be beneficial for the initiation and maintenance of exercise and may be of benefit to people that intend to exercise. The reliability of the intention, outcome expectation and self-efficacy scales was poor in some studies. Few studies identified the validity and reliability of the physical activity scales used to measure physical activity. It was also difficult to draw conclusions about the role of social support in the model as only two studies assessed social support. As the HAPA has not been trialled with people who have had a TKA, it would be opportune to test with this group of people to establish whether it can explain the social cognitive factors associated with the participation in regular physical activity. This could be undertaken in a cross sectional observational study, one to two years after TKA surgery. Variables related to the motivational and volitional phases of the HAPA could be assessed as well as physical activity to investigate the relationships between these variables and physical activity.

Chapter 3. Methodology

3.1 Study Design

This study was an observational study using the HAPA model to explore the relationships between the HAPA variables and level of physical activity following TKA (Schwarzer, 2004). The study was a cross sectional design with questionnaires being answered at one time point by people who had undergone a TKA one to two years previously (Carter, Lubinsky, & Domholdt, 2011). Information on demographics, co-morbidities and social support for exercise were obtained. The variables within the HAPA model studied were: risk perception; outcome expectation for exercise; task, maintenance and recovery self-efficacy for exercise; behavioural intentions; and action and coping planning for exercise. Other variables that were assessed were the level of physical activity measured with the Physical Activity Scale for the Elderly (PASE), co-morbidities with the Self-Administered Co-morbidity Questionnaire (SACQ) and pain and function were measured using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988).

3.2 Study Participants

Fifty-four participants were consecutively recruited from theatre lists of three orthopaedic surgeons between July 25, 2012 and February 12, 2013. The orthopaedic surgeons worked at a private hospital in Auckland, NZ. They were approached by the researcher and the purpose of the research project explained and permission sought from them to undertake the research on the patients in their clinic.

3.2.1 Inclusion and exclusion criteria.

People were included if they had undergone a unilateral TKA for OA 12 to 24 months previously. OA was determined according to the American College of Rheumatology (ACR) classification criteria (Altman, 1991). People were excluded if they had undergone a bilateral TKA, had a BMI greater than 40 affecting physical function, symptomatic OA on the contralateral knee (pain greater than 4/10 on the visual analogue scale), any neurological or cardiovascular pathology affecting lower limb function, an inability to understand the English language, or any disability that might impede their understanding of the questionnaires.

3.2.2 Sample size.

A required sample size of 50 was calculated using GPower 3.1 software (Faul, Erdfelder, Lang, & Buchner, 2007) and data from a previous study that measured the following exercise related variables: risk perception, outcome expectation, self-efficacy, intention, planning and level of exercise (Lippke et al., 2004a) (see Appendix A). With the alpha level set at 0.05, a power calculation based on the reported correlation of .26 between outcome expectation and intention requires a sample size of 50 to achieve statistical power of .99 with an effect size of .50.

3.3 Ethics and Cultural Considerations

The research project was designed and implemented using the principles of partnership, participation and protection from the Treaty of Waitangi. People interested in the study were entitled to a support person when receiving verbal or written explanations about the study or when participating in the study. An information sheet (see Appendix B) was provided to each prospective participant informing them about the study, that participation was voluntary and that if they chose not to participate or to withdraw from the study at any time, it would not affect any future health care treatment. A consent form (see Appendix C) was given to each participant, which they signed prior to commencement in the study. Privacy of information was protected through the use of a confidential numerical coding system for each participant. Data were securely stored in a locked filing cabinet in the Physiotherapy Department on the premises of AUT University and will be destroyed (shredded) after 10 years. Only the principal investigator or the research supervisors have access to the information.

3.4 Measures

3.4.1 Demographic information.

The participant's age, gender, height, weight and BMI were recorded as well as the characteristics of the participant's analgesic and anti-inflammatory medication use in the previous 24 hours (see Appendix D). BMI was calculated from the participant's recorded height and weight using the United States Department of Health and Human Services, National Heart Lung and Blood Institute BMI calculator (United States Department of Health and Human Services, 2012). The type of surgery and surgeon was recorded from the medical notes with a numerical coding system used for the surgeon to avoid identification.

3.4.2 Co-morbidities.

Co-morbidities were assessed using the SACQ (see Appendix E), which asks the respondent to indicate if they have any of 13 listed medical conditions and whether they currently receive treatment or are limited functionally by these conditions. The questionnaire also allows for the addition of two other co-morbidities. A total possible score of 45 is derived from the presence of the co-morbidity, whether they receive treatment for it and whether they are functionally limited by the co-morbidity (Sangha, Stucki, Liang, Fossel, & Katz, 2003). The SAQC has criterion validity with the Charlson Comorbidity Index (Spearman r_s = .55) (Sangha et al., 2003).

3.4.3 Social support.

Social support for exercise was measured with a three item scale previously used by Warner et al. (2011) (see Appendix F). This scale was a shortened version of a 15 item social support scale (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). Each item commenced with the stem, "In the last three months friends, acquaintances and neighbours…" and was followed by "exercised with me", "gave me encouragement to stick with my exercise programme" or "helped me organise my exercise". These items assessed emotional and instrumental support (Sherbourne & Stewart, 1991). The Cronbach's alpha for this scale in the study by Warner et al. (2011) was .78.

3.4.4 HAPA variables.

Risk perception, outcome expectation for exercise, behavioural intention and action planning, task, maintenance and recovery self-efficacy for exercise and coping planning were measured. All items in the questionnaires for the HAPA variables were scored using a Likert scale with a response range from 1 (very strongly disagree) to 7 (very strongly agree). The following variables were measured using scales previously used by Scholz et al. (2005): risk perception; outcome expectation for exercise; behavioural intentions; action planning; task, maintenance and recovery self-efficacy. Coping planning was measured using a scale previously used by Scholz et al. (2008). The Cronbach alpha for these scales in these two studies ranged from .73 to .94 (Scholz et al., 2008; Scholz et al., 2005).

3.4.4.1 *Risk perception.*

Risk perceptions or the awareness of negative outcomes for the TKA, if people do not exercise routinely post-operatively, were measured using a three item scale. For

example, “If I don’t exercise regularly it may make my new knee joint become stiff” (see Appendix G). This scale was modified to suit the purpose of the current study from the scale used by Scholz et al. (2005).

3.4.4.2 *Outcome expectation.*

Outcome expectation for exercise in the current study was related to the participants’ beliefs about the consequences of undertaking exercise and was measured using an eight item scale (see Appendix H). This scale was a modified version of that used by Scholz et al. (2005) to incorporate the wording developed by Resnick (2005). An example of an item on this scale was, “If I exercise on a regular basis it will make me feel better physically”.

3.4.4.3 *Behavioural intention.*

Behavioural intention in this study was related to the participants’ goals as to whether or not they were going to undertake physical activity and was measured with a three item scale (see Appendix I). Each stem started with, “I intend to…” followed by an item such as, “…be physically active for a minimum of 20 minutes at least three times a week”.

3.4.4.4 *Action planning.*

Action planning involved the where, when and how exercise would be undertaken and was measured in this study with a four item scale (see Appendix J). Each of the four items had a stem of, “I have made a detailed plan of…” followed by (a) “when to do my physical exercise” (b) “where to exercise”, (c) “how to do my physical exercise”, and (d) “how often to do my physical exercise”.

3.4.4.5 *Coping planning.*

Coping planning in this study was related to the strategies devised to address overcoming the barriers to maintaining exercise and was measured using a four item scale previously used by Scholz et al. (2008) (see Appendix K). An example of coping planning for exercise would be planning to use an exercycle indoors on the days that it was raining if it was too wet to go for a walk. The scale commenced with the stem, “I have made a detailed plan regarding…” followed by items such as, “…what to do when something interferes with my plans to exercise”.

3.4.4.6 *Task self-efficacy.*

Task self-efficacy in this study measured the confidence one had in the ability to undertake physical activity using a three item scale (see Appendix L). Each item commenced with the stem, "I am confident that I can…" and was followed by an ending such as, "…continue a physically active lifestyle".

3.4.4.7 *Maintenance self-efficacy.*

Maintenance self-efficacy or the belief the individual had in their ability to overcome the barriers to exercise was measured with a four item scale (see Appendix M). Each item on this scale commenced with the stem, "I am confident I can engage in physical activity regularly on a long term basis even if …", which was followed by an ending such as, "…I have to exercise alone".

3.4.4.8 *Recovery self-efficacy.*

Recovery self-efficacy, or the belief that one had in their ability to resume their exercises after taking a break from exercise was measured with a three item scale (see Appendix N). The stem for each item on this scale was, "I am confident that I am able to return to a physically active lifestyle even if…" followed by three items concerning the ability to resume physical activity after taking a break from the activity, for example, "…I have stopped exercising for several weeks".

3.4.5 Pain and function.

Current pain and function of the replaced knee joint was assessed using the WOMAC Likert version 3.1, which is a self-administered 24 item questionnaire specifically designed for OA, with subscales for pain (five items), stiffness (two items) and function (seventeen items) (Bellamy et al., 1988). The Likert response scale was from 0 (none) to 4 (extreme). The maximum possible scores for the pain and function subscales were 20 and 68, respectively. High scores indicated worse pain and limited function. Function refers to the degree of difficulty a person has undertaking certain activities, for example descending stairs. The WOMAC Likert version pain, stiffness and function subscales have been shown to be valid and reliable in patients with OA and in joint arthroplasty patients (Bellamy et al., 1988; Roos, Klässbo, & Lohmander, 1999). For the purpose of this study, only the pain and function subscales are reported and analysed. Reproduction of the WOMAC Likert version 3.1 in the appendices is prohibited due to copyright laws.

3.4.6 Physical activity.

The PASE was used to measure physical activity (Washburn, Smith, Jette, & Janney, 1993). The scale combines information on leisure, occupational and household activity that have been undertaken in the past seven days (Washburn et al., 1993). The scores were calculated by multiplying the activity weight by the frequency for 12 activities and then summing these, with possible scores ranging from 0 to 400. The scale has good test retest reliability of .75 (95% CI 0.69 – 0.80) and validity in older adults (mean age = 65 years), when compared to portable accelerometer (r = .49, p < 0.05) (Washburn & Ficker, 1999; Washburn et al., 1993). The PASE was able to distinguish higher levels of activity in men compared to women and in people aged 55 to 64 years of age compared to those over 65 years (Washburn, McAuley, Katula, Mihalko, & Boileau, 1999). Reproduction of the PASE in the appendices is prohibited due to copyright laws.

3.5 Study Procedure

Ethical approval was obtained from the Ministry of Health Northern X Regional Ethics committee reference NTX/12/EXP/124 (see Appendix O). Ethical approval was also obtained from Auckland University of Technology Ethics Committee (see Appendix P). People were invited to take part in the study by the receptionists at the orthopaedic surgeons' clinics, who gave a brief verbal outline of the study. Those who were interested in taking part in the study were then referred to the principal investigator who provided further detail about the study, including verbal and written information. Participation in the study was voluntary and participants were given the opportunity to ask any questions about the study. The principal investigator screened potential participants on the inclusion/exclusion criteria. Participants completed all questionnaires in paper format. The questionnaires took less than an hour to complete and were completed either at the orthopaedic clinics or at the participant's home. All data in written format were kept in a locked cabinet in the principal investigator's office. Computer data were kept on a password controlled computer with a backup copy stored on an external hard drive which was also stored in the locked cabinet.

3.6 Data Processing

Data were entered into and analysed using Statistical Package for Social Sciences (SPSS) software version 20 (IBM Corporation, 2011). To ensure accuracy of data entry, all data were screened by analysing the range of scores as well as the

medians, interquartile ranges, means and standard deviations. Frequencies were calculated for nominal demographic data. The range, mean and standard deviation were calculated for continuous demographic variables.

3.7 Data Analysis

Screening was undertaken for outliers as well as testing for normal distribution. Box plots and histograms were plotted for visual analysis of the data distribution and Kolmogorov-Smirnov tests were undertaken to assess the normality of the data distribution (Tabachnick & Fidell, 2007). Outliers were identified on the following scales: WOMAC pain subscale, action planning, task self-efficacy, maintenance self-efficacy, WOMAC function subscale and the PASE. The questionnaires for these subscales were rechecked to ensure the outliers were not due to data entry error. Analyses were undertaken with and without the outliers; however, removal of the outliers did not change the outcome and so the outliers were kept in all analyses. Data were identified as non-normally distributed on the following scales: task self-efficacy, maintenance self-efficacy, action planning and both the pain and function subscales of the WOMAC. Non-parametric analyses were undertaken on all data. The range, median and interquartile range were calculated for the following ordinal scales: SACQ; social support; risk perception; outcome expectation for exercise; intention to exercise; action and coping planning; task, maintenance and recovery self-efficacy; PASE; and WOMAC pain and function. Statistical analyses were undertaken on the total raw scores for the ordinal scales. Means and standard deviations of the HAPA variables, social support, pain, function and physical activity were included to enable comparison to the results or findings of other published research. A descriptive analysis of the sample demographic was undertaken. Frequencies were calculated for gender, side of surgery and type of implant. Means and standard deviations were calculated for age, height, weight and BMI. The results are presented as means (standard deviations) and median (interquartile range).

The HAPA model was divided into three stages: motivation; post intentional planning; and planning, self-efficacy self-regulation and physical activity. Hypotheses were tested within and across the stages. An additional fourth stage was used to investigate relationships among physical activity, social support, co-morbidities, pain and function. Spearman's correlations (r_s) tested hypotheses one through to six. Hypothesis one tested the correlations among risk perception, task self-efficacy,

outcome expectation and intention to exercise. Hypothesis two tested the correlations among intention to exercise, task self-efficacy, maintenance self-efficacy and action and coping plans for exercise. Hypothesis three tested the correlations among social support for exercise, intention and action and coping planning. Hypothesis four tested the correlations among action and coping plans for exercise, maintenance self-efficacy, recovery self-efficacy and physical activity. Hypothesis five tested the correlations between task self-efficacy and maintenance self-efficacy and between maintenance self-efficacy and recovery self-efficacy. Hypothesis six tested the correlations among social support for exercise, co-morbidities, pain and function and physical activity. The interpretation of the strength of the correlations were based on those outlined by Munro (2005) but the descriptive words used are slightly different, namely weak instead of low, moderate instead of fine, and strong instead of high. The positive correlations were graded as very weak (.10 -.25), weak (.26-.49), moderate (.50- .69), strong (.70-.89) or very strong (.90-1.00). Alpha was set at 0.05.

Chapter 4. Results

4.1 Sample Characteristics

One hundred and seventy-five patients were approached; sixty-nine expressed an interest in participating. Fifteen of those were excluded for not meeting the inclusion/exclusion criteria (pain in the opposite leg being more than 4/10 on a VAS (2), BMI greater than 40 (1), bilateral lymphoedema (1), spinal surgery (1), patella fracture (1) and medical illness (1)). Eight were excluded because they lived out of the greater Auckland area. All of the participants who met the criteria consented to take part. Fifty-four patients were included in the final analysis.

The characteristics of the 54 participants recruited for this study are presented in Table 1. There were similar numbers of male and female participants and more participants had a TKA on the right than on the left. The majority of the implants were J&J 150 Sigma mobile bearing (70.4 %) or fixed bearing (5.6%) prosthesis, followed by the Triathalon (14.8%) and Genesis II (9.3 %) prostheses.

The range of scores on the SACQ for all participants was low given the total possible score range of 0-45. The three most common co-morbidities identified by the participants were OA (38), high blood pressure (25) and back pain (16). There was a wide range of scores for the social support scale, which covered the full range of possible scores. Fifty-six percent of participants had no pain (0) on the WOMAC pain subscale, 37% had mild pain (1-4), 5% had moderate pain (5-9) and 2% had severe pain (>10). Fifteen percent of participants had no problem with function, scoring zero out of a possible 68. Seventy-eight percent had mild difficulty with function (1 - 16) and 7% had moderate difficulty with function (17-34). No patients indicated severe difficulty with function (> 35). Five percent of participants had taken weak opioid analgesic medication and 20% had taken non-opioid analgesic medication or an adjuvant, such as an anti-inflammatory, in the previous 24 hours. The scores on the PASE were generally high with 48% of female participants and 59% of male participants over the age of 65 scoring higher than the normative values for their age and gender.

Table 1. *Descriptive Statistics of Participants. Demographics and Personal Characteristics*

Participant characteristics		N	Range	Median (IQR)	Mean (SD)
Gender	Male	25			
	Female	29			
Age (Years)		54	47 - 85		68 (8)
Weight (kg)		54	52 - 120		83 (18)
Height (cm)		54	149 - 188		170 (10)
BMI (kg/m²)		54	19.5 - 40		28.5 (4.9)
TKA	Right	30			
	Left	24			
Co-morbidities		54	0 - 11	4 (2 - 6)	
Social Support		54	3 - 21	13 (8 - 17)	12.1 (5.3)
Pain		54	0 - 14	0 (0 - 2)	1.4 (2.6)
Function		54	0 - 27	5 (2 - 8)	6.5 (6.3)
Physical activity		54	55 - 379	158 (111 -202)	170 (79)

Note. N = number, IQR = interquartile range, SD = standard deviation.

4.2 HAPA Variables

The Cronbach alpha for the intention scale in this study was .64. For this reason, the reliability of the intention scale was re-analysed with item 3 removed, which increased the Cronbach alpha to .75. Thereafter, data analysis was undertaken without that item. The Cronbach alpha for all of the remaining HAPA variables ranged from .74 to .94 (see Table 2). The median, interquartile range, mean and standard deviation for all of the HAPA variables are presented in Table 3. The median scores for most of the HAPA variables were relatively high. The Spearman correlations among the HAPA variables, physical activity, pain, function, co-morbidities and social support are presented in Appendix Q.

Table 2. *Median, Mean and Range of the HAPA Variables*

HAPA variable	Possible range	Median (IQR)	Mean (SD)	α
Risk Perception	3-21	18 (16-20)	5.96 (0.85)	.74
Outcome Expectation	8-56	47.5 (44-53)	6.02 (0.71)	.86
Task SE	3-21	18 (17-19)	5.94 (0.90)	.79
Intention	2-14	13 (12-14)	6.33 (0.68)	.75
Action Planning	4-28	22.5 (4-28)	5.49 (1.18)	.94
Maintenance SE	4-28	23 (20-25)	5.60 (0.89)	.75
Recovery SE	3-21	18 (15-19)	5.82 (0.87)	.77
Coping Planning	4-28	19 (14-23)	4.58 (1.35)	.93

Note: α = Cronbach's alpha, IQR = interquartile range, SE = self-efficacy.

4.3 Hypothesis One: Variables in the Motivational Phase

Hypothesis one tested the correlations among risk perception, task self-efficacy, outcome expectation and intention to exercise in the motivational phase of the HAPA model, as shown in Figure 5. There was a significant weak correlation between task self-efficacy and intention and between risk perception and intention. There was a non-significant weak correlation between outcome expectation for exercise and intention.

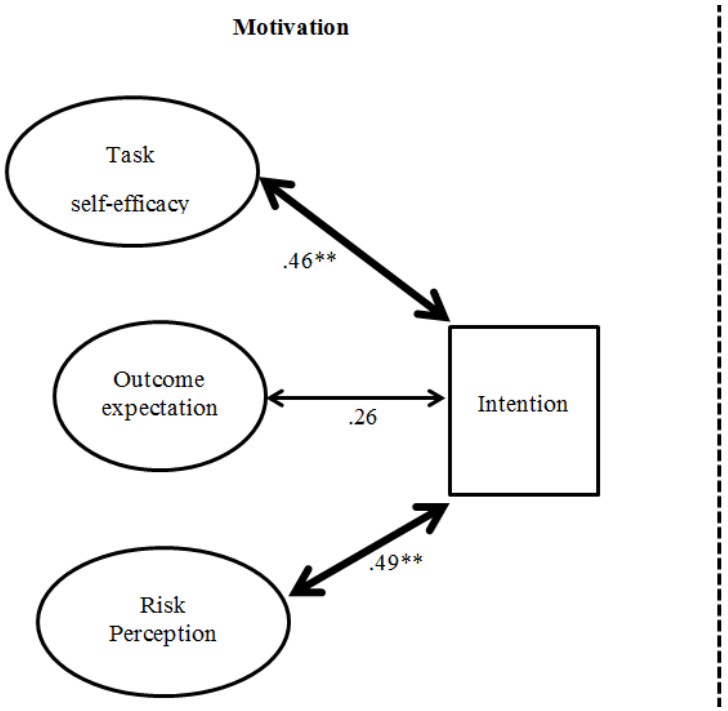

Figure 5. Correlations among task self-efficacy, outcome expectation, risk perception and intention.
Note. ** = $p < 0.01$. Significant correlations are indicated with a bolded line.

4.4 Hypothesis Two: Post-Intentional Planning

Hypothesis two tested the correlations amongst intention to exercise, task self-efficacy, maintenance self-efficacy and action and coping plans for exercise, as shown in Figure 6. In this post-intentional planning phase of the HAPA model, there were significant moderate correlations between task self-efficacy and action planning and between task self-efficacy and coping planning. There was also a significant moderate correlation between intention and action planning. There was a significant weak correlation between maintenance self-efficacy and action planning and between intention and coping planning. There was a non-significant very weak correlation between maintenance self-efficacy and coping planning.

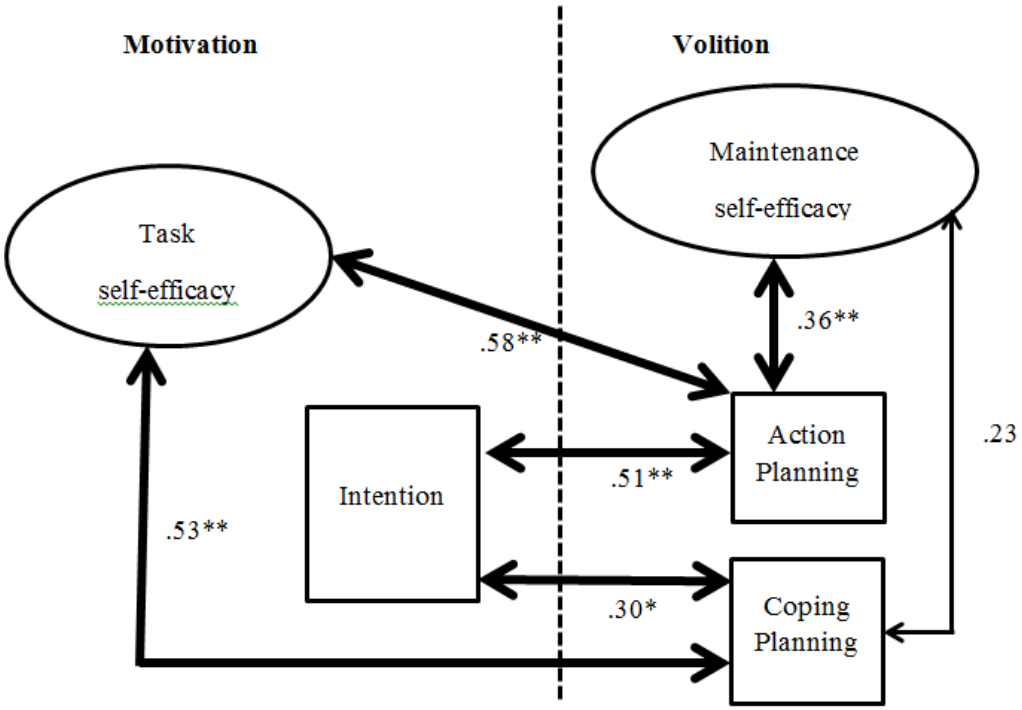

Figure 6. Correlations among intention, task self-efficacy, maintenance self-efficacy and exercise planning.
Note: *= $p < 0.05$, ** = $p < 0.01$. Significant correlations are indicated with a bolded line.

4.5 Hypothesis Three: Social Support, Intention and Planning

Hypothesis three tested the correlations amongst social support for exercise, intention and action and coping planning as shown in Figure 7. There was a non-significant very weak negative correlation between social support and intention. A non-significant very weak correlation was also found between social support and action planning. There was a significant positive but weak correlation between social support and coping planning.

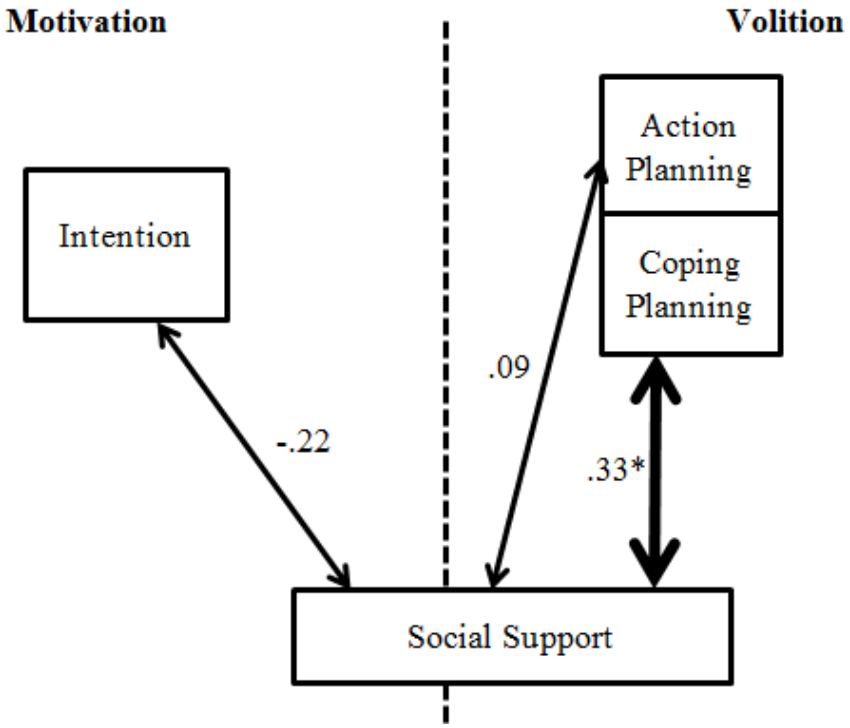

Figure 7. Correlations among social support, intention and planning.
Note: *= $p < 0.05$, ** = $p < 0.01$. Significant correlations are indicated with a bolded line.

4.6 Hypothesis Four: Planning; Maintenance and Recovery Self-Efficacy and Physical Activity

Hypothesis four tested the correlations amongst action and coping plans for exercise, maintenance self-efficacy, recovery self-efficacy and physical activity, as shown in Figure 8. There was a significant moderate correlation between action planning and coping planning. A significant weak correlation was found between coping planning and physical activity. There were very weak non-significant correlations between action planning and physical activity and between recovery self-efficacy and physical activity. There was no relationship between maintenance self-efficacy and physical activity.

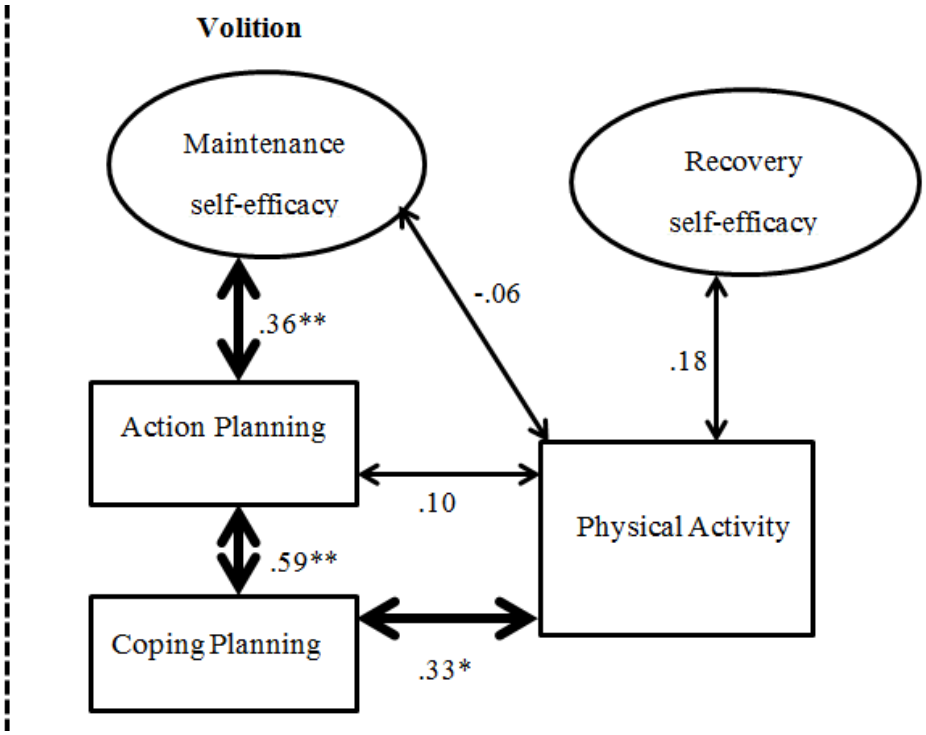

Figure 8. Correlations among planning, maintenance self-efficacy, recovery self-efficacy and physical activity.
Note: *= $p < 0.05$, ** = $p < 0.01$. Significant correlations are indicated with a bolded line.

4.7 Hypothesis Five: Task Self-Efficacy, Maintenance Self-Efficacy and Recovery Self-efficacy

Hypothesis five tested the correlations amongst the three types of self-efficacy, as shown in Figure 9. There was a significant weak correlation between task self-efficacy and maintenance self-efficacy. There was also a significant weak correlation between maintenance self-efficacy and recovery self-efficacy.

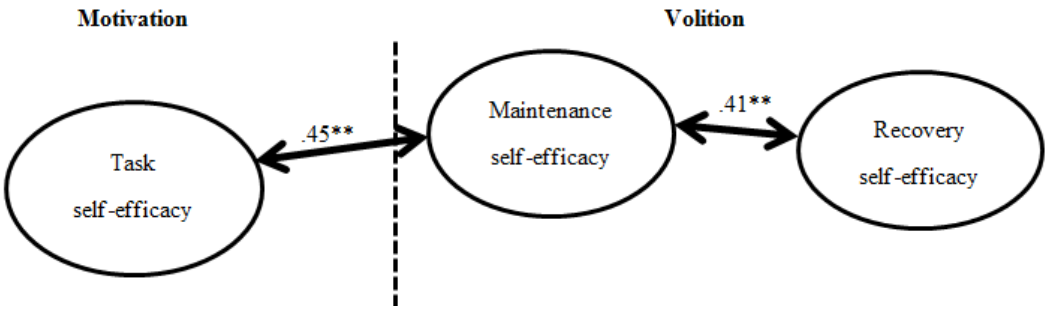

Figure 9. Correlations between task and maintenance self-efficacy and between maintenance and recovery self-efficacy.
Note: ** = $p < 0.01$. Significant correlations are indicated with a bolded line.

4.8 Hypothesis Six: Barriers and Resources, Co-morbidities, Pain, Function and Physical Activity

Hypothesis six tested the correlations among social support for exercise, co-morbidities, pain, function and physical activity, as shown in Figure 10. There was a non-significant positive but very weak correlation between social support and physical activity. There was a significant negative weak correlation between co-morbidities and physical activity. There was also a significant negative weak correlation between function and physical activity. There was a non-significant very weak negative correlation between pain and physical activity. The full HAPA model showing correlations among variables, including social support, co-morbidities, physical function and pain is shown in Figure 11.

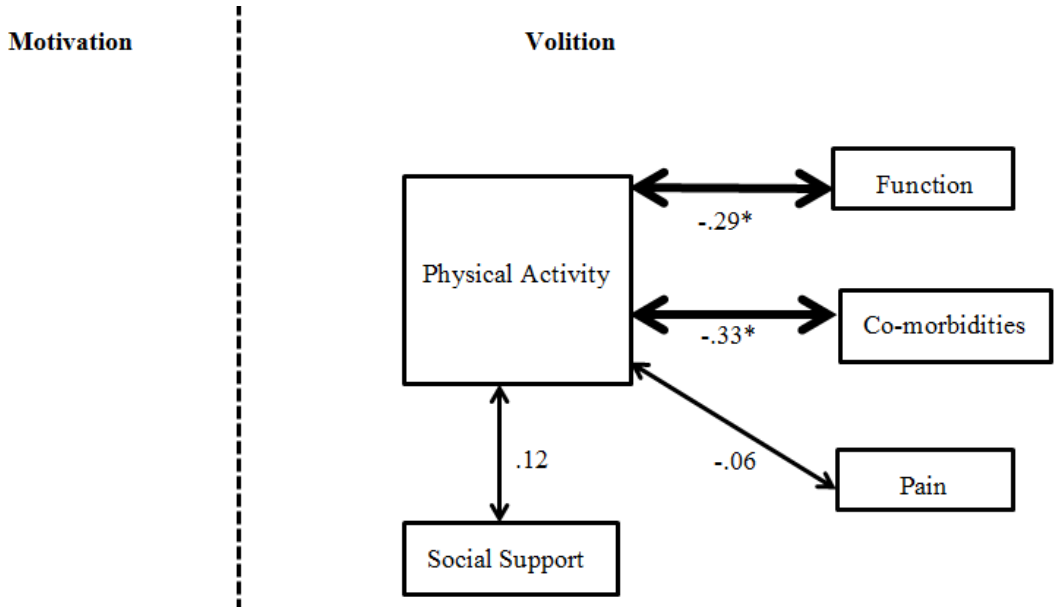

Figure 10. Correlations among social support for exercise, intention, coping planning, co-morbidities, pain, function and physical activity.
Note: *= $p < 0.05$, ** = $p < 0.01$. Significant correlations are indicated with a bolded line.

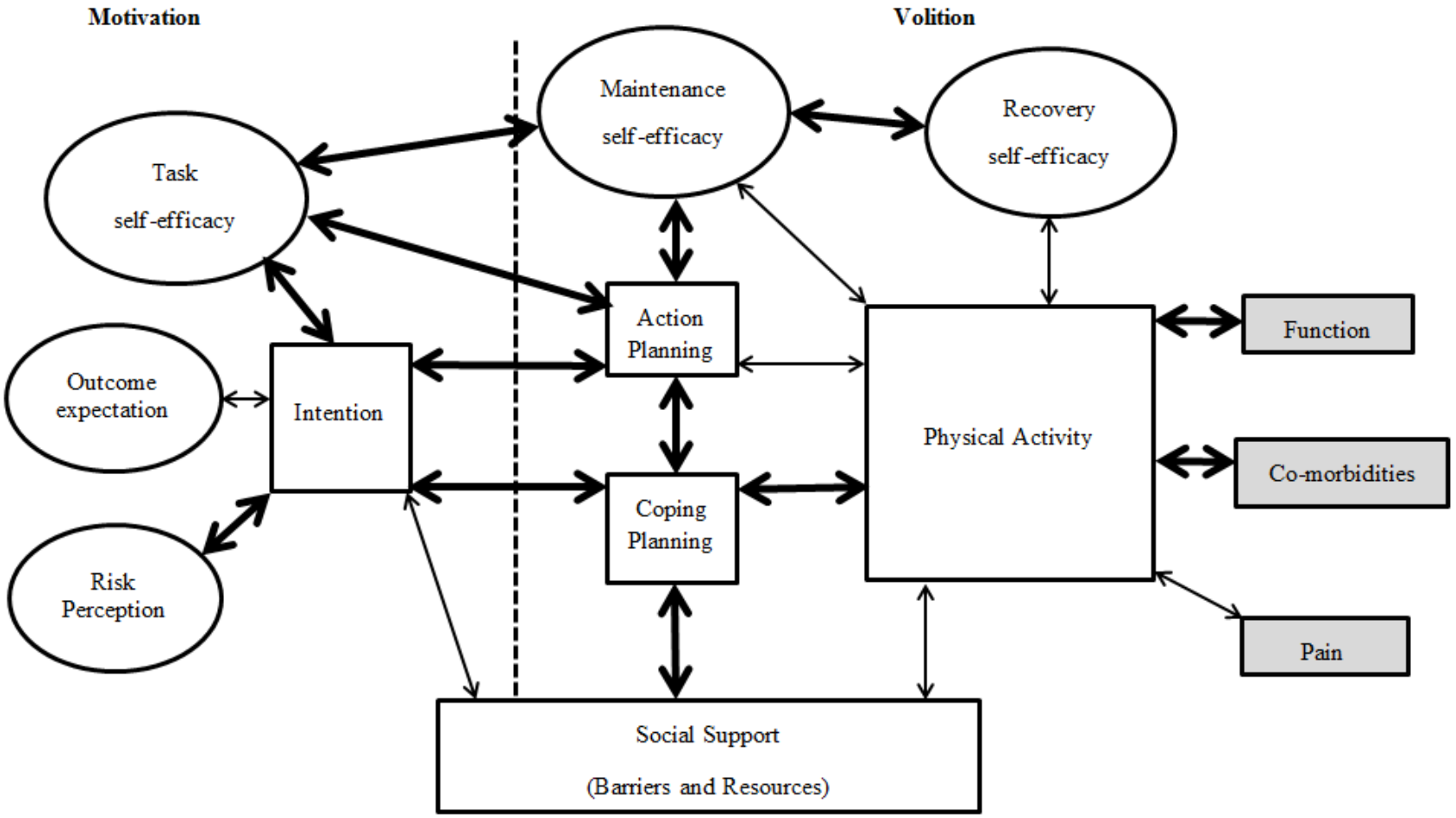

Figure 11. The full HAPA model showing correlations among variables, including social support, co-morbidities, physical function and pain.
Note: Significant correlations are indicated with a bolded line.

Chapter 5. Discussion

5.1 Introduction

There was some support for the HAPA model in the motivational and early volitional stages in this sample of people with TKA. Hypotheses one, two, three, four and six were partially supported and hypothesis five was supported. The following chapter will discuss the sample characteristics and each hypothesis in relation to the results of the current study. Possible explanations for the findings of the current research will be explored as well as comparisons made to previous research in this area. The chapter will conclude with suggestions for future research.

5.2 Sample Characteristics

The gender and age of the participants in the current study was similar to the mean age and gender of the majority of patients who undergo TKA in NZ (New Zealand National Joint Registry, 2011). The mean BMI (28.5 kg/m²) of participants in the current study was slightly less than the average patient undergoing a TKA (31 kg/m²) in NZ between 2010 and 2011 (New Zealand National Joint Registry, 2011). Participants were excluded, in the current study, if they had a BMI that was greater than 40. This could explain why the participants in the current study were at the upper end of the overweight category rather than the obese category.

The TKA procedures that the participants underwent were all performed in a private hospital and were representative of the type of TKA surgery that is undertaken in NZ (New Zealand National Joint Registry, 2011). In 2011, primary knee replacements in NZ were performed in 53 hospitals, 27 of which were public and 26 were private. The type of TKA prostheses used in the surgery on the participants in the current study were among the five most common types of prostheses used in NZ in 2011, although the majority of these were mobile bearing, which is less commonly used in NZ compared to the fixed prosthesis (New Zealand National Joint Registry, 2011).

The participants in the current study were healthier, more active and had better function and less pain than in comparable studies (Lingard & Riddle, 2007; Riddle, Wade, & Jiranek, 2010). A reason for this could have been the exclusion criteria limiting those with a BMI of greater than 40. The number of co-morbidities was lower than the number of co-morbidities found in other studies that have used the SACQ

(Riddle, Wade, & Jiranek, 2010; Riddle, Wade, Jiranek, & Kong, 2010). Seven percent of participants had moderate to severe pain, which is less than in previous studies which have used the WOMAC with a one to four year follow up (Beswick et al., 2012; Czurda, Fennema, Baumgartner, & Ritschl, 2010; Lingard et al., 2004; Lingard & Riddle, 2007; Núñez et al., 2007; Wylde et al., 2011). The participants' level of knee function was better in this study compared to previous and recent studies that have assessed function with the WOMAC at one to two years post-operatively (Lingard & Riddle, 2007; Maxwell et al., 2014). The level of physical activity was also higher than age and gender matched normative data for the PASE for 59% of male and 48% of female participants over the age of 65 (Washburn et al., 1999). Thirty percent of the participants were under the age of 65, which is younger than the participant age that the questionnaire was designed for and so normative values were not provided for this younger age group.

5.3 HAPA Model

5.4 Hypothesis One: Variables in the Motivational Phase

Risk perception and task self-efficacy were weakly related to intention to exercise and outcome expectation for exercise was weakly related to intention to exercise, indicating that hypothesis one is partially supported. The relationship between task self-efficacy and intention to exercise may reflect that people who were more confident in their ability to exercise have greater intentions than those who do not feel confident about exercising. This is consistent with other research involving physical activity in orthopaedic patients, cardiac patients, university students, middle aged women, retired people and people from South Korea and Thailand (Barg et al., 2012; Caudroit et al., 2011; Dohnke et al., 2010; Lippke et al., 2004a, 2005; Poomsrikaew, 2011; Renner et al., 2007; Scholz et al., 2009; Scholz et al., 2005; Schwarzer et al., 2008; Sniehotta, Scholz, & Schwarzer, 2005; Ziegelmann & Lippke, 2007). Self-efficacy has previously been found to be a better predictor of intention formation than other social cognitive variables, such as outcome expectations or risk perception (Lippke et al., 2005; Scholz et al., 2005). The levels of task self-efficacy were reasonably high in the current study, with a median of 18 out of a possible score of 21 (see Table 2). Higher levels of self-efficacy have been linked to people who are more likely to be active (Lippke et al., 2005).

Outcome expectation in the current study was weakly (non-significantly) related to intention to exercise. A possible explanation for this is the length of time between surgery and the administration of the questionnaires. If the participants were already active and undertaking regular exercise, the expected benefits of exercise may seem less relevant than task self-efficacy. Variables in the motivational phase of the HAPA may become less relevant once an intention has been formed or an action has been initiated (Jackson et al., 2011). Other studies have also found outcome expectation to have a weak relationship with intention to exercise (Caudroit et al., 2011; Lippke et al., 2005; Ziegelmann & Lippke, 2007). In the current study, the PASE showed that many of the participants were already active and so variables related to intention formation may have seemed less relevant, given the length of time from surgery.

Risk perception was weakly related to intention to exercise in the current study. Another way of explaining this is that people who felt that their knee might become stiff if they did not exercise, had more intention to exercise. The assessment of risk perception was contextually specific to the replaced knee joint, such as the knee becoming stiff, which may explain why there was a relationship with exercise intention. In contrast, some orthopaedic studies have found that risk perception was not related to intention (Lippke et al., 2004a; Schwarzer et al., 2008; Ziegelmann & Lippke, 2007). In these orthopaedic studies, risk perception asked about the perception of risk of suffering from chronic pain, or getting a severe disease. Risk perception may also seem less relevant to people if they are already in the habit of exercising. Previous studies have also found risk perception to be weakly related to intention to exercise in retired people and cardiac patients (Caudroit et al., 2011; Scholz et al., 2005; Sniehotta, Scholz, & Schwarzer, 2005). This could be due to a heightened awareness of age-related health issues associated with not exercising in these populations.

5.5 Hypothesis Two: Post-Intentional Planning

Hypothesis two was partially supported as task self-efficacy, maintenance self-efficacy and intention to exercise were related to planning. In other words, people who planned their exercise intended to be more active and they had a greater belief in their ability to exercise and to maintain their exercise. Task self-efficacy was moderately related to both action and coping planning in this study, which indicates that people who felt confident in their ability to be physically active were more likely to plan their exercise. This is consistent with previous studies where task self-efficacy was related to

planning in orthopaedic patients, in middle aged women and in obese adults (Barg et al., 2012; Lippke et al., 2004a; Parschau et al., 2014; Schwarzer et al., 2008; Ziegelmann & Lippke, 2007; Ziegelmann et al., 2006). Physically active people have been found to have higher levels of self-efficacy and planning compared to people who are not active but intend to exercise (Lippke, Fleig, et al., 2010; Parschau et al., 2012). Therefore, self-efficacy may have a moderating effect on the planning behaviour relationship in physical activity (Lippke, Wiedemann, et al., 2009; Luszczynska et al., 2011). In the current study, many of the participants were active and had high levels of task-self-efficacy, which was moderately related to planning.

Intention to exercise was moderately related to action planning and weakly related to coping planning. This implies that people who had strong intentions to exercise were more likely to plan their exercise and how to cope with barriers to exercise. Again, this is consistent with previous research that has been undertaken on orthopaedic patients and in middle aged women (Barg et al., 2012; Lippke, Fleig, et al., 2010; Lippke et al., 2004a; Ziegelmann & Lippke, 2007; Ziegelmann et al., 2006). In the current study, a stronger relationship was found between intention and action planning than between intention and coping planning. This may be because people who have strong intentions to exercise may plan their exercise but may not have planned strategies to overcome barriers to exercise. An example of this would be if someone plans to exercise by walking five times a week for 45 minutes at nine o'clock in the morning, but rain prevents them from walking. Rain would be perceived as a barrier to exercise. A coping strategy would be to use an exercycle indoors when it is raining. Similarly, a recent study that tested the applicability of the HAPA model with physical activity in obese adults found a stronger association between intention and action planning than between intention and coping planning (Parschau et al., 2014).

Maintenance self-efficacy was weakly related to action planning and very weakly related to coping planning in the current study. In other words, people who planned their exercise may have felt a little more confident in their ability to maintain their exercise but they may not have made coping plans for exercise. The relationships may be weak because planning may not seem as relevant once exercise has become habitual (Fleig, Pomp, Parschau, et al., 2013; Orbell & Verplanken, 2010). Parschau et al. (2014) also found maintenance self-efficacy was weakly related to both action planning and coping planning in obese adults. Coping self-efficacy, which is also

known as maintenance self-efficacy, has previously been found to decline over time (Wesch et al., 2012) and in the current study the levels of maintenance self-efficacy were lower than the levels of task self-efficacy.

5.6 Hypothesis Three: Social Support, Intention and Planning

There was limited support for hypothesis three as social support was weakly related to coping planning and very weakly related to action planning. Social support was also very weakly (negatively) related to intention to exercise. The weak relationship between social support and coping planning could reflect that people who had more social support were marginally more likely to be better at planning strategies to overcome barriers to exercise. In the current study, social support for exercise measured both emotional and instrumental support, which is similar to other studies that have measured social support (Jackson et al., 2011; Lopez-Olivo et al., 2011; Ranby, 2009). A study in adult women that used the HAPA model investigated spousal support for exercise and found that both were negatively related to barriers to exercise and positively related to intention to exercise (Ranby, 2009). The negative very weak relationship between intention and social support in the current study may have been because the participants had high levels of intention and may not have felt social support was so relevant one year after surgery.

5.7 Hypothesis Four: Planning; Maintenance and Recovery Self-Efficacy and Physical Activity

There was little support for hypothesis four with a very weak relationship between action planning and physical activity and a weak relationship between coping planning and physical activity. In other words, people who exercise regularly may not have action plans to exercise but may be a little more likely to have planned strategies to cope with barriers to exercise. There was also a very weak relationship between recovery self-efficacy and physical activity. There was no relationship between maintenance self-efficacy and physical activity in the current study. The weak to very weak relationships between maintenance and recovery self-efficacy and physical activity suggest that participant's confidence in their ability to continue physical activity, even after a break, is not associated with their actual activity levels. This is in contrast to previous studies which have found maintenance or barrier self-efficacy to be related to exercise in people in pulmonary or cardiac rehabilitation, pregnant women and middle aged women (Barg et al., 2012; Cramp & Bray, 2009; Guillot, Kilpatrick,

Hebert, & Hollander, 2004; Luszczynska & Sutton, 2006; Scholz et al., 2005). A further reason for the lack of relationship between maintenance self-efficacy and physical activity could be that maintenance self-efficacy measured confidence in the ability to overcome barriers to exercise rather than confidence in the ability to exercise (Maddison & Prapavessis, 2004).

A similar reason to that above may account for the very weak relationship between recovery self-efficacy and physical activity. The participants' confidence in their ability to return to exercise was not related to the level of activity they were undertaking. A low level of activity is typical prior to and following TKA (I. B. de Groot, H. J. Bussmann, H. J. Stam, & J. A. Verhaar, 2008a; de Groot et al., 2008b) but the range of physical activity scores in the current study was quite wide (55 to 379). Alternatively the participants may not have encountered any breaks from activity or recovery self-efficacy may not seem important if it was some time since they had taken a break. Again, this may explain why these results differ to other studies that have found recovery self-efficacy to be related to physical activity (Luszczynska & Sutton, 2006; Scholz et al., 2005).

In the current study there was a very weak relationship between action planning and physical activity and a weak relationship between coping planning and physical activity. The length of time from the surgery may explain the very weak relationship between action planning and physical activity, as most of the participants were already physically active following their TKA. Thus, action plans may be less relevant if people are already in the habit of exercising as there is some degree of automaticity when a behaviour becomes habitual, which involves less conscious thought (Orbell & Verplanken, 2010; Verplanken & Melkevik, 2008). This is supported by a study involving cardiac patients which found that action planning was more important in the early rehabilitation phase, whereas coping planning was more instrumental after completion of a cardiac rehabilitation programme (Sniehotta, Schwarzer, et al., 2005). Coping planning has previously been identified as an important self-regulatory strategy for the long term maintenance of physical activity, which is consistent with the findings of the current study where participants were 12 to 24 months following surgery (Scholz et al., 2008; Ziegelmann et al., 2006). The weak relationship between coping planning and physical activity could also be explained by exercise habit strength in that people

who are in the habit of exercising may not make conscious plans to overcome barriers to exercise (de Bruijn & Rhodes, 2011).

Previous studies have also found a lack of a relationship between planning and physical activity in older adults and in middle aged women (Barg et al., 2012; Caudroit et al., 2011). The lack of a relationship between planning and physical activity was explained in one of these studies as possibly being due to physical activity measuring leisure time activity as the participants were not in a structured rehabilitation programme. Similarly, this could explain why planning was not related to physical activity in the current study as the participants were not undertaking a structured rehabilitation programme. Another reason could be the validity of the physical activity measure used in the current study, as recent research has questioned the construct validity of the PASE for use in TKA patients (Bolszak, Casartelli, Impellizzeri, & Maffiuletti, 2014).

A moderate relationship existed between action planning and coping planning in the current study. In other words, people who plan when, where and how they are going to exercise are more likely to plan how to cope with barriers to exercise. This is similar to previous studies in cardiac or orthopaedic rehabilitation patients that have found a relationship between action planning and coping planning (Scholz et al., 2007; Sniehotta, Schwarzer, et al., 2005; Ziegelmann & Lippke, 2007; Ziegelmann et al., 2006). Implementation intentions or planning have been shown to be effective for goal attainment in relation to physical activity (Bélanger-Gravel, Godin, & Amireault, 2013; Carraro & Gaudreau, 2013; Gollwitzer & Sheeran, 2006; Ziegelmann et al., 2007).

5.8 Hypothesis Five: Task Self-Efficacy, Maintenance Self-Efficacy and Recovery Self-Efficacy

There was some support for hypothesis five on the basis of there being weak relationships between task self-efficacy and maintenance self-efficacy and between maintenance self-efficacy and recovery self-efficacy. In other words, people with more confidence in their ability to be physically active are to some extent more likely to be confident at maintaining exercise, and if they are confident at maintaining their exercise they are a little more likely to get back to exercising after taking a break from it. This is consistent with research which used the HAPA model to explore variables related to physical activity in obese adults, middle aged women, in older adults and in people undergoing cardiac or orthopaedic rehabilitation (Barg et al., 2012; Caudroit et al.,

2011; Parschau et al., 2014; Parschau et al., 2012; Schwarzer et al., 2008). Self-efficacy has been identified as being important across both phases of the HAPA (Schwarzer et al., 2011), which is also evident from the current study. A person with low task self-efficacy may also have low maintenance and recovery self-efficacy, which could lead to lower levels of intention and planning.

Alternatively, the relationships amongst the three self-efficacies could be reflective of the concept of people possessing a general self-efficacy whereby individuals have optimistic beliefs about coping across a wide range of demanding situations (Luszczynska, Gutiérrez-Doña, & Schwarzer, 2005). Luszczynska and Schwarzer (2005) explain that general self-efficacy is not in opposition to Bandura's (1997) notion that self-efficacy is situation specific. Instead people who feel efficacious generally about coping with stressful situations, such as undertaking regular physical activity following TKA may also score high on situation specific self-efficacy scales, which in turn is apparent from the weak correlations amongst the three self-efficacies.

5.9 Hypothesis Six: Barriers and Resources, Co-morbidities, Pain, Function and Physical Activity

Hypothesis six was partially supported as co-morbidities and function had a weak inverse relationship with physical activity. Stated another way, people with more co-morbidities were less likely to undertake physical activity. High scores on the function subscale indicated less function; therefore, those with lower function were less likely to be physical active. Pain was not related to physical activity in the current study. Social support was very weakly related to physical activity, which could indicate that people who had good social support were no more likely to be physically active.

Other studies have found social support to be related to function and physical activity participation. Instrumental social support was found to be inversely related to function following TKA (Lopez-Olivo et al., 2011). Instrumental support was positively related to physical activity in an older population when both partners participated in physical activity together (Gellert et al., 2011). Higher levels of physical activity have been associated with levels of social support in people undergoing orthopaedic rehabilitation (Jackson et al., 2011; Lippke, Fleig, et al., 2010).

A reason for the very weak relationship between social support and physical activity in the current study could be that the participants were already physically active

at one to two years after the surgery and that some did not feel the need for social support for exercise. This is supported by a recent mixed methods study involving middle aged adults in Australia which found that social support was not important for physical activity participation (Freene, Waddington, Chesworth, Davey, & Cochrane, 2014). By comparison, Ranby (2009) found a relationship between social support and exercise behaviour in adult women but identified that the participants' level of intention may alter the perception of social support. People who have no intention to exercise may perceive social support as being negative. This may explain the variability in the results of research that has investigated social support and physical activity.

Previous qualitative research in people with anterior cruciate ligament reconstruction has shown that support from the therapist was important early in the rehabilitation but this importance may reduce over time as the rehabilitation changes (Pizzari, McBurney, Taylor, & Feller, 2002). This may be the case with TKA, in that early in the recovery process social support is more important when starting to exercise, but may become less important when maintaining exercise. This is consistent with a previous review that found a stronger association with social support for the initiation of physical activity compared to maintenance of physical activity (van Stralen et al., 2009).

Several studies have investigated physical activity levels one year after TKA, which have been shown to be lower than the general population (Brandes et al., 2011; Naal & Impellizzeri, 2010; Stevens et al., 2012). Co-morbidities have been related to pain and function or health related quality of life following TKA but no studies have investigated co-morbidities in relation to physical activity following TKA (Ayers, Li, Oatis, Rosal, & Franklin, 2013; Escobar et al., 2007; Lingard et al., 2004; Nilsdotter, Toksvig-Larsen, & Roos, 2009; Sullivan et al., 2009). Physical health has been identified as an important factor for the initiation and maintenance of physical activity in older adults (van Stralen et al., 2009).

The weak relationship between function and physical activity could be explained by a discrepancy between improvement in function following TKA, versus an increase in level of physical activity. More specifically, gains in function may not translate into increased physical activity. Previous research has shown a larger improvement in function compared to activity level following TKA (de Groot et al., 2008a; Vissers, Bussmann, De Groot, Verhaar, & Reijman, 2013). In the current study, there were no participants who had severe difficulty with function but there were some participants

who had a low level of physical activity. A similar relationship between function and physical activity has been identified, using the Knee Society Score, at a minimum of one year after TKA (Bauman, Williams, Petruccelli, Elliott, & Beer, 2007; Marker et al., 2009). Conversely, in long term studies of more than four years, people who are more physically active following TKA have greater function than those who are less active (Núñez et al., 2009; Waciakowski & Urban, 2011).

The lack of a relationship between pain and physical activity in the current study may in part be explained by the low percentage of participants with moderate to severe pain. A previous study found increased levels of physical activity were related to lower WOMAC pain levels following TKA, although the pain levels in that study were higher at the seven year follow up than the pain levels in the current study (Núñez et al., 2009). A study that investigated pain and physical activity levels prior to TKA found that women had higher levels of pain than men but undertook equivalent levels of physical activity, which would indicate that pain did not limit their physical activity (Tonelli, Rakel, Cooper, Angstom, & Sluka, 2011). This is similar to another study that also found that pain did not limit physical activity in patients waiting for a TKA (Thomas, Pagura, & Kennedy, 2003). Contrasted to this, Wylde, Blom, Dieppe, Hewlett, and Learmonth (2008) found the most common reason for not returning to sport one to three years after TKA was pain. Thus, the relationship between pain and physical activity is equivocal, but there is at least some evidence that physical activity following TKA is not limited by pain.

5.10 Strengths and Limitations

There were three strengths identified in this study. One, the study was theory based, using the HAPA model as its framework, which provides structure and boundaries to the analyses undertaken (Michie, Rothman, & Sheeran, 2007). Two, the demographics of the participants were similar to the majority of people who undergo TKA in NZ, thus enhancing the generalisability of the study outcomes and implications to people undergoing TKA in NZ. Three, the questionnaires used were valid and reliable and the study was sufficiently powered. The sample size was adequate to be able to analyse the relationships among the variables studied. The Cronbach alpha values of the questionnaires were all acceptable to excellent in this study, indicating their validity for use with these participants.

Two limitations were identified in this study. One was that the PASE questionnaire for physical activity was designed for people over the age of 65. The mean age of the participants in the current study was 68 years but because the participants' ages ranged from 47 to 85 years, the questionnaire may not have been appropriate for the younger participants. The validity of the PASE has also recently been identified as not suitable for use in TKA samples (Bolszak et al., 2014). The second was the exclusion criteria limiting people with a BMI of more than 40, which may limit generalisability of the results to the wider TKA population.

5.11 Future Research

There was not complete support for the HAPA in the volitional phase which may have been due to the construct validity of the PASE. Replication of this study could be undertaken using a more appropriate measure of physical activity and a prospective study design. This could involve the use of measures which incorporate both subjective and objective assessments of activity. If the findings of that study were in the expected direction then future research could test the effectiveness of using action and coping plans as a way of initiating and maintaining regular physical exercise amongst people who are about to undergo a TKA. This could be a prospective pre-test post-test randomised controlled trial which would commence prior to surgery with a twelve month follow up period. People would be randomised into one of three groups; a control group which consists of usual care; an action planning group or a combined action and coping plans group. The main HAPA variables would be assessed at baseline. Participants in the action planning group would be asked to determine actions plans. In the combined action and coping planning group, participants would also plan strategies to cope with barriers to exercise. In line with recent research, booster sessions to upgrade the exercise programme would be included in the action and coping planning interventions (Fleig, Pomp, Schwarzer, & Lippke, 2013). A limitation in the current study would be addressed by using a physical activity measure that was not restricted to an older age group. A functional measure that is suitable for the sample that assesses lower limb function should also be included in the outcome measures.

5.12 Clinical Implications

The results of this study identified factors related to physical activity one to two years after TKA. Physical activity levels prior to TKA are lower than the general population (Naal & Impellizzeri, 2010; Stevens et al., 2012) and so educating patients

about the risks associated with not exercising may lead to increased levels of risk perception, which in turn may lead to increased levels of intention to exercise. Pre-operatively identifying people who have low levels of physical activity or low task self-efficacy and guiding them in action and coping plans may lead to increased levels of physical activity. This would have health benefits for people undergoing TKA. The health benefits should also reduce health care costs, as increasing levels of physical activity should decrease morbidity and mortality (Haskell et al., 2007).

5.13 Conclusion

There was some support for using the HAPA to explain the social cognitive variables related to the participation in physical activity in this sample of people who have undergone a TKA. Task self-efficacy was shown to have the strongest relationships with intention and action and coping planning. Contrary to the expectation that maintenance self-efficacy and action planning would be related to physical activity, there were not strong relationships between these variables and physical activity. This may have been because the participants were already in the habit of undertaking physical activity, in which case the automaticity of being active may have meant that planning was less relevant. Additionally, the PASE may not have been appropriate for measuring physical activity in this group of people. Resources such as social support were not strongly associated with physical activity, which may have been because of the length of time from surgery. There was some evidence that co-morbidities and poorer function were related to lower levels of physical activity. As a theoretical framework, the HAPA could be used to promote physical activity in people undergoing TKA, however further research is required.

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Appendix A. Sample Size Calculation

Computation of achieved power based on Lippke et al. (2004) (N=509)

t tests - Correlation: Point biserial model

Analysis:	Post hoc: Compute achieved power		
Input:	Tail(s)	=	One
	Effect size |ρ|	=	0.5099020
	α err prob	=	0.05
	Total sample size	=	509
Output:	Noncentrality parameter δ	=	13.3730282
	Critical t	=	1.6478646
	Df	=	507
	Power (1-β err prob)	=	1.0000000

Computation of achieved power based on a smaller sample size of N = 50

t tests - Correlation: Point biserial model

Analysis:	Post hoc: Compute achieved power		
Input:	Tail(s)	=	One
	Effect size |ρ|	=	0.5099020
	α err prob	=	0.05
	Total sample size	=	50
Output:	Noncentrality parameter δ	=	4.1913688
	Critical t	=	1.6772242
	Df	=	48
	Power (1-β err prob)	=	0.9935487

Appendix B. Participant Information Sheet

Participant Information Sheet

Department of Physiotherapy,
School of Rehabilitation and Occupation Studies,
Faculty of Health and Environmental Sciences.

May 2012

Principal Investigator: Bronwyn Harman, Lecturer, AUT University, North Shore Campus, 90 Akoranga Drive, Northcote 0627, Auckland.Phone: (09)9219999 ext 7518. Email: bronwyn.harman@aut.ac.nz

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Title: Relationships between psychological variables and long term treatment outcomes in people who have undergone knee joint replacement.

Invitation to take part in the study

My name is Bronwyn Harman and I am a physiotherapy lecturer undertaking this research as part of a Masters of Health Science qualification. You are invited you to take part in this study, but before you accept this invitation please read the following outline of the study, the reasons for it, and your role in it. Your participation in this study is entirely voluntary (your choice). You do not have to take part in this study, and if you choose not to this will not affect any future health care or treatment. If you do agree to take part in this study, you are free to withdraw from the study at any time without having to give a reason, and this will in no way affect your future or continuing health care. You may have a friend or whānau support to help you understand the risks and/or benefits of this study and any other explanations you may require.

What is the purpose of this study?

The purpose of this study is to assess the relationships between psychological variables related to exercise and long term treatment outcomes in people who have undergone knee joint replacement.

How many participants are involved in the study, how are they selected and who selects them?

Fifty people with osteoarthritis of the knee who have undergone a knee joint replacement are required for this study, and your name was given to me by your surgeon. People are invited to take part if they have had a total knee replacement 1 to 2 years ago for knee osteoarthritis and understand English enough to complete the questionnaires. The exclusion criteria are: if you have had surgery to both knees

at the same time, have a painful knee on the knee that was not operated on, if you have any neurological or cardiac condition or are of a weight that affects your leg function or ability to exercise.

What happens in this study?

This study will take about 30 minutes of your time at only one time point, and you will be required to answer a series of questionnaires. The first questionnaire asks about your gender, age, height, weight and pain medications. The second set of questionnaires ask about physical activities that you do, your expectations regarding exercise, your intentions to exercise, your confidence in your ability to exercise and in your ability to maintain exercise. The last series of questionnaires is about friends and family who help you to exercise, your pain and function and your current level of physical activity.

You can complete the questionnaires while attending your orthopaedic appointment. If you cannot complete the questionnaires during your time at the clinic, you will be given a postage paid addressed envelope to return the completed questionnaires to Bronwyn Harman. You do not have to answer all the questions if you do not wish to.

It is expected to take about eight months to recruit all the participants for this study. Once all the information has been collected, the questionnaire responses will be analysed to establish the relationships between psychological variables related to exercise and long term treatment outcomes in people who have undergone knee joint replacement. The study and the results will be presented in a report to the Physiotherapy New Zealand Scholarship Trust, which has provided funding for this research, and AUT University. A paper will be written for an academic journal and presented at physiotherapy conferences.

Can I get a copy of the results?

Participants are entitled to a short version of the report, or alternatively it can be discussed individually with the researcher. However there will be a delay between taking part in the study and receiving the report.

What are the benefits of the study?

By answering the questionnaires you will be able to express your opinion and feelings about your ability to exercise and your pain and function. Participants may gain insight into their recovery through the use of validated measures. This study will give clinicians added insight into the psychological variables that may affect successful recovery.

What are the discomforts, risks and inconveniences of the study?

There are no physical or psychological discomforts or risks associated with this study. The only possible inconvenience is the time it will take you to complete the questionnaires.

How is my privacy protected?

No material which could personally identify you will be used in any reports in this study. For the analysis of the questionnaires, each participant will be given a confidential coding. After the analysis the questionnaires will be kept locked in a filing cabinet in the Department of Physiotherapy, AUT University for ten years. Then they will be shredded in the Physiotherapy Department, AUT University.

Are there any costs for participating?

There are no monetary costs involved in taking part in this study. The only cost to you is the time it will take to answer the questionnaires.

Do you have any questions regarding your rights as a participant?

If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact an independent health and disability advocate:

Free phone: 0800 555 050

Free fax: 0800 2 SUPPORT (0800 2787 7678)

Email: advocacy@hdc.org.nz

Who can give me more information about the study?

If you need more information about the study you may contact Bronwyn Harman, who is the principal investigator, by phone at 09-9219999 ext 7518. Alternatively your surgeon can give you more information about the study.

Thank you for taking the time to read this information sheet and for the interest you have shown in the study. Should you wish to take part please inform Bronwyn Harman, the clinic staff or your surgeon.

This study has received approval from the Northern X Regional Ethics Committee on 11th June 2012. Northern X Regional Ethics Reference number NTX/12/EXP/124

Appendix C. Consent Form

Consent Form

Department of Physiotherapy,
School of Rehabilitation and Occupation Studies,
Faculty of Health and Environmental Sciences.

***Project Title*:** Relationships between psychological variables for exercise and long term treatment outcomes in people who have undergone knee joint replacement
Project Supervisor: Sandra Bassett, Senior Lecturer AUT University
***Researcher*:** Bronwyn Harman, Lecturer AUT University

○ I have read and understood the information provided about this research project in the Information Sheet dated May 2012.

○ I have had an opportunity to ask questions and to have them answered.

○ I understand that I will fill out a series of questionnaires.

○ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.

○ If I withdraw, I understand that all relevant information including questionnaires, or parts thereof, will be destroyed.

○ I agree to take part in this research.

○ I wish to receive a copy of the report from the research (please tick one):

Yes○ No○

- Participant's signature:

.....

- Participant's name:

.....

- Participant's Contact Details (if appropriate):

If you have indicated that you would like a copy of the final report please provide a postal or email address

- ……..
- ……..
- ……..
- ……..
- Date:
- ***Approved by the Northern X Regional Ethics Committee on 11th June 2012 Northern X Regional Ethics Reference number NTX/12/EXP/124***

Appendix D. Demographic Information

Participant Number:

Date:

Demographic Characteristics

Medications

Please answer the following questions, where an option is given circle the response that is correct for you.

1.	Age (in years)	
2.	Gender	Male / Female
3.	Height (cm)	
4.	Weight (kg)	
5.	Medications taken in the past 24 hours:	
	Medication Name	Amount
	e.g. Voltaren	75mg

Appendix E. Co-morbidities

Participant Number:

Date:

Other Health Problems

The following is a list of common problems. Please indicate if you have the problem in the first column. If you do not have the problem, skip to the next problem. If you do have the problem, please indicate in the second column if you receive medications or some other type of treatment for the problem. In the third column indicate if the problem limits any of your activities. Finally, indicate all medical conditions that are not listed under "other medical problems" at the end of the page.

	Do you have the problem?		Do you receive treatment for it?		Does it limit your activities?	
Problem	No (0)	Yes (1) →	No (0)	Yes (1) →	No (0)	Yes (1)
Heart Disease	N	Y	N	Y	N	Y
High Blood Pressure	N	Y	N	Y	N	Y
Lung Disease	N	Y	N	Y	N	Y
Diabetes	N	Y	N	Y	N	Y
Ulcer or stomach disease	N	Y	N	Y	N	Y
Kidney Disease	N	Y	N	Y	N	Y
Liver Disease	N	Y	N	Y	N	Y
Anaemia or other blood disease	N	Y	N	Y	N	Y
Cancer	N	Y	N	Y	N	Y
Depression	N	Y	N	Y	N	Y
Osteoarthritis, degenerative arthritis	N	Y	N	Y	N	Y
Back pain	N	Y	N	Y	N	Y
Rheumatoid arthritis	N	Y	N	Y	N	Y
Other Medical problems (please write in)	N	Y	N	Y	N	Y
	N	Y	N	Y	N	Y

Appendix F. Social Support

Participant Number:

Date:

Social Support

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

In the last three months friends, acquaintances and neighbours

1.	exercised with me	
2.	gave me encouragement to stick with my exercise programme	
3.	helped me organise my exercise	

Appendix G. Risk Perception

Participant Number:

Date:

Perceived Risk

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

1.	If I don't exercise regularly it may make my new knee joint become stiff	
2.	If I don't exercise regularly it could affect the range of movement in my new knee joint	
3.	If I don't exercise regularly it may cause me to lose the strength in the muscles of my operated leg	

Appendix H. Outcome Expectation

Participant Number:

Date:

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Outcome Expectations for Exercise

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

1.	If I exercise on a regular basis it will make me feel better physically	
2.	If I exercise on a regular basis it will make my mood better	
3.	If I exercise on a regular basis it will make me feel like I have more energy	
4.	If I exercise on a regular basis it will make my muscles stronger	
5.	If I exercise on a regular basis it will help to strengthen my bones	
6.	If I exercise on a regular basis it will give me a sense of personal accomplishment	
7.	If I exercise on a regular basis it will make me more alert mentally	
8.	If I exercise on a regular basis it will improve my endurance in performing my daily activities	

Appendix I. Intention

Participant Number:

Date:

Behavioural Intention

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

1.	I intend to be physically active for a minimum of 20 minutes at least 3 times a week	
2.	I intend to exercise regularly e.g. by using an exercycle, swimming, walking or playing golf	
3.	I intend to perform fitness and muscle strengthening activities	

Appendix J. Action Planning

Participant Number:

Date:

Action Planning

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

I have made a detailed plan of

1.	when to do my physical exercise	
2.	where to exercise	
3.	how to do my physical exercise	
4.	how often to do my physical exercise	

Appendix K. Coping Planning

Participant Number:

Date:

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Coping Planning

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

I have made a detailed plan regarding

1.	what to do when something interferes with my plans to exercise	
2.	how to stick to my intentions to exercise, even in difficult situations	
3.	how to cope with setbacks that affect my ability to exercise	
4.	when to be especially careful in order to avoid setbacks with being able to exercise	

Appendix L. Task Self-Efficacy

Participant Number:

Date:

Task Self Efficacy

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

I am confident that I can

1.	continue a physically active lifestyle	
2.	follow the advice of the physiotherapist about exercise and being physically active.	
3.	be physically active three times a week for 30 minutes	

Appendix M. Maintenance Self-Efficacy

Participant Number:

Date:

Maintenance Self-Efficacy for Exercise

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

I am confident I can engage in physical activity regularly on a long-term basis even if

1.	I have to exercise alone	
2.	I cannot see any positive changes immediately	
3.	I have to force myself to exercise	
4.	I am with friends and relatives who are not physically active	

Appendix N. Recovery Self-Efficacy

Participant Number:

Date:

Recovery Self Efficacy

Please use the scale below to indicate the extent to which you agree to each of the following statements.

Very strongly disagree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Very strongly agree
1	2	3	4	5	6	7

I am confident that I am able to return to a physically active lifestyle even if

1.	I have stopped exercising for several weeks	
2.	I feel weak after a period of illness	
3.	I stopped my routine of exercise	

Appendix O: Ethical Approval Ministry of Health Northern X Regional Ethics committee

Health and Disability Ethics Committees

Northern X Regional Ethics Committee
Private Bag 92522
Wellesley Street
Auckland 1141
Phone: (09) 580 9105
Fax (09) 580 9001
Email: northernx_ethicscommittee@moh.govt.nz

11 June 2012

Ms Bronwyn Harman
Auckland University of Technology
PB 92006
Auckland 1142

Dear Bronwyn

Re: Ethics ref: **NTX/12/EXP/124** (please quote in all correspondence)
Study title: Relationships between psychological variables and long term treatment outcomes in people who have undergone knee joint replacement
Investigators: Ms Bronwyn Harman (Principal), Dr Sandra Bassett (Supervisor), Dr Gwyn Lewis (Supervisor)

Thank you for your application received 6 June 2012.

The above study has been given ethical approval by the Chairperson of the **Northern X Regional** Ethics Committee under delegated authority.

Approved Documents

- Protocol [undated, received 06/06/012]
- Information Sheet/Consent Form – please make the following changes
  - Insert footer with version number and date (given in Consent form para 1 as May 2012)
  - Insert page numbers
  - Amend last paragraph of Information Sheet from Auckland Regional Ethics Committee to Northern X Regional Ethics Committee
- Data collection sheet (Appendix 3)
- Questionnaires (Appendices 4 to 16)

Ethical approval is valid until 30 June 2014, provided that Annual Progress Reports are submitted (see below).

Amendments and Protocol Deviations

All significant amendments to this proposal must receive prior approval from the Committee. Significant amendments include (but are not limited to) changes to:

- the researcher responsible for the conduct of the study at a study site
- the addition of an extra study site
- the design or duration of the study
- the method of recruitment

Significant deviations from the approved protocol must be reported to the Committee as soon as possible.

Annual Progress Reports and Final Reports

The first Annual Progress Report for this study is due to the Committee by **11 June 2013**. Please note that progress reports are the responsibility of the researcher and forms can be found on the website, www.ethicscommitttees.health.govt.nz. (Website will change after July 2012 to www.ethics.health.govt.nz). Please provide report before due date to ensure ethical approval is continued.

A Final Report is also required at the conclusion of the study. The Final Report Form is also available at www.ethicscommittees.health.govt.nz.

Statement of compliance

The committee is constituted in accordance with its Terms of Reference. It complies with the *Operational Standard for Ethics Committees* and the principles of international good clinical practice.

The committee is approved by the Health Research Council's Ethics Committee for the purposes of section 25(1)(c) of the Health Research Council Act 1990.

We wish you all the best with your study.

Yours sincerely

Cheh Chua(Ms)
Administrator
Northern X Regional Ethics Committee

Appendix P: Ethical Approval AUT Ethics Committee

AUT UNIVERSITY
TE WĀNANGA ARONUI O TAMAKI MAKAU RAU

MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To: Sandra Bassett
From: Rosemary Godbold, Executive Secretary, AUTEC
Date: 29 June 2012
Subject: Ethics Application Number **12/158 Relationships between psychological variables and long term treatment outcomes in people who have undergone knee joint replacement.**

Dear Sandra

I am pleased to advise that on 28 June 2012, the Chair of the Auckland University of Technology Ethics Committee (AUTEC) and I have approved your ethics application. This delegated approval is made in accordance with section 5.3.3.2 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on.

Your ethics application is approved for a period of three years until 28 June 2015.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through http://www.aut.ac.nz/research/research-ethics/ethics. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 28 June 2015;
- A brief report on the status of the project using form EA3, which is available online through http://www.aut.ac.nz/research/research-ethics/ethics. This report is to be submitted either when the approval expires on 28 June 2015 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

To enable us to provide you with efficient service, we ask that you use the application number and study title in all written and verbal correspondence with us. Should you have any further enquiries regarding this matter, you are welcome to contact me by email at ethics@aut.ac.nz or by telephone on 921 9999 at extension 6902. Alternatively you may contact your AUTEC Faculty Representative (a list with contact details may be found in the Ethics Knowledge Base at http://www.aut.ac.nz/research/research-ethics/ethics).

On behalf of AUTEC and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Dr Rosemary Godbold
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Bronwyn Harman bronwyn.harman@aut.ac.nz, Gwyn Lewis

From the desk of ...
Dr Rosemary Godbold
Executive Secretary
AUTEC

Private Bag 92006, Auckland 1142
New Zealand
E-mail: ethics@aut.ac.nz

Tel: 64 9 921 9999
ext 8860
Fax: 64 9 921 9902

Appendix Q: Spearman Correlations Among HAPA Variables, Physical Activity, Pain, Function, Co-morbidities and Social Support

Spearman Correlations Among HAPA variables, Physical Activity, Pain, Stiffness, Function, Co-morbidities and Social Support

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Risk Perception	1												
2. Outcome Expect	.47**	1											
3. Intention	.49**	.26	1										
4. Task SE	.34*	.44**	.46**	1									
5. Maintenance SE	.59**	.49**	.52**	.45**	1								
6. Recovery SE	.28*	.41**	.27*	.59**	.41**	1							
7. Action Plan	.45**	.24	.51**	.58**	.36**	.29*	1						
8. Coping Plan	.25	.26	.30*	.53**	.23	.27*	.59**	1					
9. PASE	.04	.13	-.03	.27*	-.06	.18	.10	.33*	1				
10. Pain	.12	-.01	-.11	-.23	-.17	.06	-.09	-.24	-.06	1			
11. Function	.18	-.11	-.12	-.24	-.01	.02	-.07	-.28*	-.29*	.71**	1		
12.Co-morbidities	.12	-.06	-.21	-.36**	-.08	-.26	-.22	-.22	-.33*	.27*	.29*	1	
13. Social Support	.06	.24	-.22	.08	-.02	.24	.09	.33*	.12	.08	.01	-.03	1

Note. * $p < 0.05$, ** $p < 0.001$, SE= self-efficacy, Expect = expectation, PASE = Physical Activity Scale for the Elderly