

**DEVELOPMENT OF COMPUTER BASED PHYSIOTHERAPY
PATIENT EDUCATION GROUNDED IN HEALTH ACTION
PROCESS APPROACH AND MULTIMEDIA LEARNING
THEORY**

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Abstract

Adherence to home-based musculoskeletal physiotherapy is less than optimal, which may lead to poor treatment outcomes. Physiotherapy adjuncts that increase patients' self-efficacy and understanding of treatment facilitate rehabilitation adherence. The Health Action Process Approach (HAPA) that includes action and coping plans strengthens self-efficacy, while computer based patient education (CBPE) enhances patient understanding of treatment requirements when underpinned by the Cognitive Theory of Multimedia Learning. This thesis evaluated the effect of CBPE developed using the Cognitive Theory of Multimedia Learning and delivered in conjunction with action and coping plans on patient adherence to physiotherapy for shoulder injuries/disorders; and the value of extending the HAPA to include functional outcomes. The CBPE content was displayed using animations, videos, written text, and graphics, and included interviews with a physiotherapist and patient, exercise demonstrations, adherence hints, activities of daily living, information about the shoulder anatomy and pathologies, frequently asked questions and quizzes.

A four week one group prospective pilot study (n = 20) assessed the effect of CBPE combined with action and coping planning on adherence to physiotherapy, the procedures for the main study, and the feasibility of extending the HAPA to include functional outcomes. After their first physiotherapy appointment participants completed questionnaires measuring the HAPA motivational variables (risk perception, outcome expectancies, action self-efficacy and behavioural intentions), shoulder knowledge and functional outcomes, and made action and coping plans. Throughout the study clinic- and home-based adherence were measured, and at the end participants completed questionnaires evaluating the HAPA volitional variables (maintenance and recovery self-efficacy, and adherence), knowledge and shoulder function. The HAPA variable scores were high with moderate to strong correlations between the behavioural intentions and self-efficacies, behavioural intentions and adherence behaviours, and adherence behaviours and post-study shoulder function. Participants' shoulder function improved significantly during the study, and they valued the CBPE. The extended HAPA model incorporating functional outcomes was supported. The findings and feedback from the participants and physiotherapists led to changes to the CBPE programme, which included strategies to boost self-efficacy, less exercises, simpler

terminology, diary page changes and increasing the Likert scale to 7 points for HAPA variables.

The main study (n = 108) was an eight week two group randomised controlled trial, in which participants were allocated to either the combined CBPE planning group or the attention control group. This study tested the effect of the combination of CBPE and planning on rehabilitation adherence and shoulder function, evaluated the extended HAPA model, and validated the three-factor Rehabilitation Adherence Measure for Athletic Training (RAdMAT) as a measure of clinic-based adherence. The variables and their measurement timing were the same as the pilot study. The combined CBPE planning group had significantly higher levels of clinic-based adherence than the control and were highly satisfied with the programme. Moderately strong significant correlations occurred amongst all motivational stage HAPA variables, the three self-efficacies and behavioural intentions, the volitional self-efficacies and home-based adherence, clinic-based adherence and behavioural intentions, and clinic-based adherence and maintenance self-efficacy. Self-efficacy was the strongest predictor of behavioural intentions and home-based adherence. Significant moderately strong correlations existed between the RAdMAT and clinic- and home-based adherence measures. This thesis' key findings are combining the CBPE programme underpinned by the Cognitive Theory of Multimedia Learning with action and coping plans enhances adherence; self-efficacy is associated with home-based adherence; relationships exist between adherence and functional outcomes; the HAPA can be extended to include functional outcomes; and the RAdMAT is a valid measure of clinic-based adherence.

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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 another degree or diploma of a university or other institution of higher learning.

Signed:

A handwritten signature in black ink, appearing to be 'M. L. L.' or similar, written in a cursive style.

Date: 30 January 2015

Thesis Aims and Organisation

The primary aim of this thesis is to develop and test a computer-based patient education (CBPE) programme in conjunction with action and coping plans to enhance patient adherence to home-based physiotherapy. There are two secondary aims. One is to examine the influence of attitudes and beliefs identified in the Health Action Process Approach (HAPA) as a way of explaining rehabilitation adherence and its effect on functional outcomes. The second is to evaluate the utility of the Rehabilitation Adherence Measure for Athletic Training (RAdMAT) questionnaire to measure adherence in clinic-based physiotherapy.

The thesis consists of nine chapters. In Chapter 1 the costs associated with shoulder injuries/disorders are identified and the problem of poor adherence in physiotherapy is discussed together with the justification, rationale and significance of undertaking the research. Chapter 2 provides a definition of adherence and presents a critical narrative review of the problems of measuring adherence along with a discussion of the relationship between adherence and functional outcomes. Chapter 3 reviews the literature that have evaluated the association between self-efficacy and rehabilitation adherence. Selected Social Cognitive Models (SCM) are outlined with justification for using the Health Action Process Approach as the underpinning SCM for this thesis. Chapter 4 presents methods of patient education and the principles that foster patients' understanding of health information. The rationale for using CBPE is given along with the rationale for using the Cognitive Theory of Multimedia Learning to present the information. In Chapter 5 there is an overview of shoulder anatomy, the aetiology, the assessment of shoulder disorders/injuries, and the physiotherapy management for these injuries/disorders. Chapter 6 reports on the development of the CBPE programme which includes the design, development of content and navigation. At the end of this chapter, the modifications to the measures and CBPE are outlined. Chapter 7 describes the pilot study that tests the procedures and protocols of the CBPE programme in conjunction with action and coping planning. The randomised control trial that tests the intervention is reported in Chapter 8. Chapter 9 is the closing chapter that discusses the notable findings of the study, strengths and limitations, recommendations for future research, the clinical implications and conclusions. The literature search strategies for this thesis are presented in Appendix 1.

Chapter 1. Statement of the Problem

Introduction

Exercise rehabilitation is prescribed as part of treatment for many¹ musculoskeletal problems that includes diverse injuries/disorders such as painful shoulders, low back pain and osteoarthritis of the hip and knee. However successful functional outcomes for patients have been limited by less than optimal adherence to treatment programmes. This chapter will highlight the problem and show a need for research to investigate the use of computer-based patient education (CBPE) for patients with disorders that require home-based physiotherapy rehabilitation.

Direct Financial Costs Associated with Shoulder Injuries/Disorders

Shoulder pain is the third most common site of musculoskeletal pain after the knee and ankle and has been reported in Europe to have an annual incidence in primary care of 14.7 per 1000 patients per year (van der Windt, Koes, De Jong, & Bouter, 1995) and an annual lifetime prevalence of up to 70% (Luime et al., 2004). Recovery can be slow with 40 to 50% of patients reporting that shoulder pain persisted or reoccurred at 12 month follow-up (van der Windt et al., 1995). In New Zealand with a population of approximately four and a half million, the Accident Compensation Corporation (ACC) paid out \$239,600,416 for 118,321 new and 161,411 active claims for shoulder injuries in the year ending June 2014. This was the second largest claims total for a region of the body after back injuries.

Physiotherapy plays a central role in the conservative management of shoulder injuries/disorders and is responsible for a sizeable proportion of the rehabilitation costs paid by ACC. However the total annual cost for shoulder injuries/disorders is well in excess of the amount paid out by ACC for two reasons. Firstly, ACC payments are only made to accredited physiotherapy providers and typically this payment does not cover the full cost of treatment with the shortfall being paid by the patient. Secondly, shoulder pathologies such as frozen shoulder are not the result of injury and therefore are not included in ACC statistics, so consultations and treatment fees are covered by patients. These costs may not be able to be met by all patients, especially as shoulder

¹ In New Zealand the Accident Compensation Corporation (ACC) is crown entity that is responsible for administering and funding the costs associated rehabilitation resulting from accidental injury.

injuries/disorders can be slow to resolve (van der Windt et al., 1995) and may require physiotherapy over prolonged periods of time.

Based on the assumption that adherent patients may have better outcomes than non-adherent patients (Vermeire, Hearnshaw, & Van Royen, 2001; World Health Organisation, 2003) and on studies that have found adherence to physiotherapy is frequently less than optimal (Brewer, 1999; Sluijs, Kerssens, van der Zee, & Myers, 1998; Vermeire et al., 2001), the cost of shoulder rehabilitation could be contained or reduced if adherence to treatment was enhanced. Moreover, because the total rehabilitation programme consists of both clinic- and home-based components, increasing the home-based programme may lead to less clinic appointments which could result in greater reduction in costs to ACC and patients.

The Problem of Poor Adherence in Physiotherapy

A number of studies have identified a positive adherence-functional outcome relationship in exercise rehabilitation (for example Bassett & Prapavessis, 2011; Brewer et al., 2004; Friedrich, Gittler, Halberstadt, Cermak, & Heiller, 1998), although other studies have failed to do so (for example Basler, Bertalanffy, Quint, Wilke, & Wolf, 2007; Rejeski, Brawley, Ettinger, Morgan, & Thompson, 1997). The inconsistency in the results leaves the relationship between adherence and functional outcomes inconclusive. One explanation for these different findings may be the raft of adherence measures that are used which makes comparison between studies difficult.

Attendance at clinic-based appointments is one index that is often used to measure adherence but there are different ways that have been used to record it. The most common way in exercise rehabilitation is to calculate the average attendance at appointments with reports ranging from 51% (Friedrich et al., 1998) to 97% (Bassett & Prapavessis, 2007). A different method of recording attendance at clinic appointments was used by Grindley, Zizzi, and Nasypany (2008). They divided participants into three adherence behaviour groups. These were (i) no shows and non-no-shows (ii) cancellations and no cancellations and (iii) dropouts and non-dropouts. This study found 46.7% of participants attended all appointments, 55.9% completed therapy and 32.8% dropped out. Another study reported that 9% of participants did not attend any of their appointments, 40% were low adherers because they attended at least one appointment but less than 80% of appointments, and 51% were considered highly

adherent because they attended at least 80% of appointments (Alexandre, Nordin, Hiebert, & Campello, 2002). The number of participants who did not attend their first appointment compares favourably with Vasey (1990) who found that 7.9% of patients' did not attend their first appointment at hospital physiotherapy clinics, but they also reported that 14.3% of patients who started physiotherapy did not complete it. Al-Eisa (2010) classified participants attending physiotherapy sessions as 'adherers' if they attended all scheduled appointments or 'non-adherers' if they failed to attend two consecutive scheduled appointments. The study found only 40% of participants attended all treatments.

A second index of adherence that is increasingly being used to assess clinic-based adherence is the Sport Injury Rehabilitation Adherence Scale (SIRAS) questionnaire. This validated questionnaire comprising of three questions is completed by clinicians on a five-point Likert scale that has a maximum possible total score of 15 and a minimum possible total score of 3. The scores reported from many studies were generally high, ranging between 11.6 and 14.1 (Grindley et al., 2008; Kolt & McEvoy, 2003; Lyngcoln, Taylor, Pizzari, & Baskus, 2005; Mannion, Helbling, Pulkovski, & Sprott, 2009; Pizzari, Taylor, McBurney, & Feller, 2005). Hammer, Degerfeldt, and Denison (2007) used a different measure to assess clinic-based adherence. In this study clinicians rated the participants' movement performance and posture correction on a 0 to 2 scale, where 0 = '*cannot perform/correct the posture at all*' to 2 = '*correct performance*'. They found approximately 90% adherence to movement performance at all time points and between 53% and 82% for posture correction. Other clinic-based adherence scales have been used which were based on attendance and effort put into rehabilitation. For example Byerly, Worrell, Gahimer, and Domholdt (1994) scored adherence out of a possible total of two points per session which was then averaged across sessions to produce a single adherence score out of 2. Participants were classed as adherent if they scored 1.75 points or more and non-adherent if their score was less than 1.75. The study reported that 61.4% of participants were adherent. In another study by Evans and Hardy (2002) clinicians evaluated participants' adherence using four measures based on clinical symptoms, rehabilitation progress, behavioural observations and knowledge of the participant. These subjective adherence ratings were expressed as a single percentage value which ranged from 69% to 80% in the intervention and control groups.

A third index that is commonly used as an indicator of adherence is assessment of adherence to the home-based exercise component of rehabilitation. It is based largely on self-reports which record each time exercises are performed and the number of repetitions completed. The percentage of adherence to the prescribed home programme can then be calculated from the participants' recordings. Studies that measured home-based adherence in this way have found between 65% to 75% of participants were adherent (Bassett & Petrie, 1999; Chen, Neufeld, Feely, & Skinner, 1999; Kolt & McEvoy, 2003; Lyngcoln et al., 2005; Pizzari et al., 2005; Yardley & Donovan-Hall, 2007). Other studies that have reported on the percentage of exercises completed, found only 35% of participants were highly adherent to the home-based exercise regimen (Alexandre et al., 2002). This compares with Sluijs, Kok, and van der Zee (1993) who reported that 35% of participants were fully adherent, but that 41% were partially adherent and 24% of participants were non-adherent. Mannion et al. (2009) found that 50% of participants were fully or partially adherent and that over 30% of participants did less than half the prescribed exercise programme.

The different methods of measuring and recording the required behaviours associated with adherence to clinic- and home-based rehabilitation make it difficult to compare across studies, but it is clear that poor adherence does exist in physiotherapy. Additional factors that make this area of research complex have been the identification of over 250 antecedents or precursors of adherence (Meichenbaum & Turk, 1987) which are often grouped into personal and situational factors. Personal factors include self-efficacy (Levy, Polman, & Clough, 2008; Mannion et al., 2009), self-motivation (Basler et al., 2007; Friedrich, Gittler, Arendasy, & Friedrich, 2005; Jones, Jolly, Raftery, Lip, & Greenfield, 2007), social support (Byerly et al., 1994; Pizzari, McBurney, Taylor, & Feller, 2002) and knowledge (Jenny & Fai, 2001; Yeh, Chen, & Liu, 2005). Situational factors that are considered to influence adherence include work commitments (Pizzari et al., 2002) and the distance between the patients' home and the clinic (Jones et al., 2007). Both personal and situational factors have the ability to influence the commencement of physiotherapy and regular attendance at scheduled clinic appointments. This may result in poorer treatment outcomes amongst the less adherent patients.

An overriding problem affecting adherence in healthcare is the uptake of research findings which has been haphazard and unpredictable despite an increasing

volume of adherence research over the last decade. Studies in healthcare in the United States and the Netherlands suggest that between 30% and 40% of the patients do not receive care according to current scientific evidence (Eccles, Grimshaw, Walker, Johnston, & Pitts, 2005). Furthermore, other estimates indicate that two-thirds of the healthcare organizations endeavouring to implement change have been unsuccessful (Damschroder et al., 2009). The poor uptake of effective interventions is reflected in general physiotherapy practice where effective adherence interventions have typically failed to be translated into improved adherence. The reason that interventions have not been implemented may have arisen from multiple levels of healthcare delivery which could include the patient level, provider team, or the market/policy level (Damschroder et al., 2009). In physiotherapy it may be due to inadequate dissemination of information, or a need for clinicians to acquire additional skills before interventions can be implemented. Irrespective of the reason, studies have estimated that the time from theory to integration into routine clinical intervention can take up to 15 years (Bartlett, 1982) or longer (Eccles et al., 2005).

Justification of the Proposed Research

Prior to the last ten to fifteen years much of the adherence related research in physiotherapy and sport rehabilitation was atheoretical and used retrospective or cross-sectional study designs (Brewer, 1999). Since then greater conceptual clarity and advancement of knowledge has been achieved through studies that have used theoretical models to guide research as suggested by Brewer (1998b). The most consistent determinant of adherence behaviour that has been reported in this research has been self-efficacy (for example see Grindley et al., 2008; Luszczynska, Gregajtyś, & Abraham, 2006; Plotnikoff, Rhodes, & Trinh, 2009; Scholz, Sniehotta, & Schwarzer, 2005). In light of this evidence the social cognitive models that have self-efficacy central to their theoretical framework have formed the fundamental basis of adherence research. The major social cognitive models such as Social Cognitive Theory (SCT: Bandura, 1986); Theory of Planned Behaviour (TPB: Ajzen, 1991); Protection Motivation Theory (PMT: Maddux & Rogers, 1983); and the Health Action Process Approach (HAPA: Schwarzer, 1992, 2008a) have been at the forefront of research on adherence and exercise behaviour. All these models have been driven by the participants' formation of goals or intentions with respect to adherence which have in turn been dependent on self-efficacy beliefs. With the exception of the HAPA, a criticism of the social cognitive models is the apparent gap that exists between the

intended behaviour and the actual behaviour (Gaston & Prapavessis, 2012; S. Milne, Orbell, & Sheeran, 2002; Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008). This gap has been addressed by the HAPA (Schwarzer, 2008b) (see Figure 4, p42) which puts in place action plans that consider where, when and how the behaviour will occur, and coping plans that address any barriers that may prevent the behaviour from being carried out. The implementation of these plans can impact on adherence to rehabilitation programmes, and in the context of physiotherapy may especially impact on the unsupervised home-based component of the treatment. The other HAPA constructs are also relevant to the behaviours that are associated with adherence to physiotherapy treatment. That is the patients' perception of (i) their risk if they do not adhere to the prescribed treatment programme, (ii) the effectiveness of treatment and (iii) their self-efficacy or the ability of an individual to initiate and maintain the treatment programme and to recover from a lapse should this occur.

The HAPA has been used successfully to predict adherence to physical activity (Dohnke, Nowossadeck, & Muller-Fahrnow, 2010; Sniehotta, Scholz, & Schwarzer, 2006b; Sniehotta, Scholz, & Schwarzer, 2005). It has also been shown to enhance adherence to physical activity for coronary artery disease (Scholz, Sniehotta, Burkett, & Schwarzer, 2007) and a variety of orthopaedic disorder/injuries (Lippke, Ziegelmann, & Schwarzer, 2004a; Ziegelmann & Lippke, 2007). A limitation of these studies was that they were non-experimental and therefore were not able to determine cause and effect relationships although experimental studies have generally found support for the HAPA model. For instance, Lippke, Schwarzer, Ziegelmann, Scholz, and Schüz (2010) tested the effects of interventions that matched particular stages of the model. They found stage-matched interventions were more effective in moving participants forward towards the behaviour change. Other studies have found that action and coping plans were effective at engaging participants in exercise (Sniehotta, Scholz, & Schwarzer, 2006a; Sniehotta, Scholz, Schwarzer, et al., 2005), especially when planning was interviewer-assisted (Ziegelmann, Lippke, & Schwarzer, 2006). These studies have shown the predictive value of the HAPA and the ability of the model to involve participants in exercise behaviours for coronary artery disease and various orthopaedic conditions.

Different behavioural demands are associated with a diverse array of rehabilitation programmes. This led Brewer (1999) to recommend, for methodological

reasons, that study participants should have similar types of injuries that are located in specified body regions. A more homogeneous sample would be ensured under these conditions and it would be more likely that the rehabilitation undertaken would require similar behavioural demands. In studies that have used the HAPA model, participants with coronary artery disease have been homogeneous (Dohnke et al., 2010; Sneihotta et al., 2006a), but in the area of orthopaedics the population sample has often involved a variety of injuries/disorders (Lippke, Ziegelmann, & Schwarzer, 2005; Ziegelmann, Luszczynska, Lippke, & Schwarzer, 2007). Therefore the next logical step would be to investigate musculoskeletal injuries/disorders affecting a specific body region where the rehabilitation programmes are similar.

Rehabilitation of musculoskeletal injuries/disorders is the primary focus of physiotherapy practice. Hence it is appropriate that this healthcare sector investigate the value of the HAPA in enhancing rehabilitation adherence, especially to the home-based component which is unsupervised. Moreover, since the reason for increasing adherence is to optimise functional outcomes, it would seem prudent to extend the HAPA model to test the adherence-functional outcome relationship. Thus, the first part of the research component of this thesis was to develop a patient education programme designed to enhance rehabilitation adherence to the home-based component of treatment. This was achieved by embedding behaviour change strategies to enhance self-efficacy in line with the HAPA model into the patient education programme. The second part was to test the procedures and protocols of the programme using the extended HAPA in a pilot study and the third part was to test the effectiveness of the programme at enhancing adherence and optimising functional outcomes in participants undertaking home-based rehabilitation.

A computer-based platform was used as the interface for the dissemination of patient education for this thesis. The reasons for choosing this type of delivery was based on (i) the explosion of internet accessibility over the last two decades with New Zealand statistics in 2012 showing that four out of five homes have access to the World Wide Web (New Zealand Government, 2013); (ii) the ability of computer programmes to be interactive and accommodate a variety of media such as animation and video; (iii) reducing the barriers to treatment which may include travelling costs or time away from work; (iv) the opportunity to have less frequent face-to-face physiotherapy in favour of one with greater self-regulation; and (v) computer-based patient education (CBPE)

being identified as a valuable tool for disseminating patient information (Keulers & Spauwen, 2003; Keulers, Welters, Spauwen, & Houpt, 2007; Stromberg, Dahlstrom, & Fridlund, 2006). Computers are suitable for the age group of participants for this research which includes the elderly who have been found to appreciate the interactive and flexible features of computer programmes and are satisfied with this method of delivery (Jenny & Fai, 2001; Stromberg et al., 2006; Yeh et al., 2005).

Up until the last few years CD-ROMs were a common method of accessing computer programmes (D. Lewis, 2003), but new broadband technology has seen them surpassed by an acceleration of web-based initiatives (Brand, Ackerman, Bohensky, & Bennell, 2013). A meta-analysis of web-based self-care interventions for chronic illness such as eating disorders, asthma and weight control has found that these interventions had a better outcome for participants in knowledge and behaviour change compared to non-web-based interventions (Wantland, 2004). A more recent study that investigated heart failure patients found that one exposure to an interactive CBPE that contained animations, photos and voice-overs increased knowledge but had no effect on adherence with self-care and treatment (Stromberg et al., 2006). Other studies have shown that repeated instruction is more effective in making changes to behaviour (Huss, Salerno, & Huss, 1991; Wetstone, Sheehan, Votow, Peterson, & Rothfield, 1985). One of few studies that has investigated adherence enhancing strategies for musculoskeletal conditions using CBPE was undertaken by Wetstone et al. (1985). They found CBPE for participants with rheumatoid arthritis increased the use of joint protection and knowledge of their disorders. While these studies have identified the potential benefits of CBPE in a variety of healthcare sectors there are no known investigations that have used CBPE programmes for the purpose of enhancing adherence to physiotherapy rehabilitation.

To ensure the effectiveness of transferring information to a computer-based format the Cognitive Theory of Multimedia Learning (Mayer, 2001) was used to guide the development of the programme and the presentation of different multimedia elements such as animation and video. This theory is underpinned by research findings that focus on design of multimedia instructional messages for promoting knowledge acquisition and learning. It is based on the visual and auditory sensory modalities which structurally integrate pictures and words, a combination of which has been found to be better than presenting information in verbal form alone (Mayer, 2001; Mayer &

Anderson, 1992; Mayer & Moreno, 2003). Processing instructional messages in this way takes advantage of the full capacity of working memory or short term memory which is a system that underlies human cognition (Baddeley, 1996, 2003; Mayer & Moreno, 2003; Sweller, van Merriënboer, & Paas, 1998). Although multimedia has been defined by Mayer (2001) as simply '*the presentation of material using both words and pictures*' (p.2), computer technology has enabled sophisticated visual and auditory presentations to be developed using video and animation as well as static graphics with written and spoken text.

To my knowledge there is only one known CBPE study that has been developed in the healthcare sector using the Cognitive Theory of Multimedia Learning (Keulers et al., 2007). This investigation found that participants undergoing surgery for carpal tunnel syndrome could achieve higher knowledge scores through CBPE compared to face-to-face education. Interestingly, participants were equally satisfied with the CBPE as with doctor-based patient education. For consistency and methodological rigor future studies developing multimedia material for patient education could use the Cognitive Theory of Multimedia Learning (Mayer, 2001). Application of this theory would provide a framework for delivering multimedia material that could be used for the implementation of behaviour change strategies and knowledge acquisition in patient education. In a meta-analysis, knowledge was identified as one of the many factors associated with adherence behaviour (van Dulmen et al., 2008). As many patients feel insufficiently informed about their injury/disorder (Coulter, Entwistle, & Gilbert, 1999) the Cognitive Theory of Multimedia Learning could be used to develop material that would promote learner understanding.

The ability to embed multimedia in CBPE programmes provides a suitable platform for delivering behaviour change strategies through social cognitive models including the HAPA. For example videos can be used to enhance vicarious behaviour, a technique used to increase self-efficacy which has a key influence on behaviour change. Bandura (1986) defined vicarious behaviour as a behaviour that is learnt through the observation of others. CBPE can provide these opportunities through video clips where models demonstrate the correct execution of exercises or other behaviours such as applying ice or strapping that may be part of a home-based rehabilitation programme. Observation of the videos can reinforce participants' confidence that they are performing exercises or undertaking other behaviours correctly. Models may also

demonstrate via video alternative ways of undertaking everyday activities that would otherwise be difficult because of the musculoskeletal injury/disorder. Mimicking these activities through vicarious behaviours could enhance self-efficacy.

The use of cues is another technique that may assist patient adherence to home-based exercises. Cues are objects or events that can act as reminders for individuals to undertake a particular activity and they can become part of their daily routine (Sluijs et al., 1998; Sluijs & Knibbe, 1991; van Dulmen et al., 2008). During the acute stage of an injury/disorder the symptoms are usually sufficient to act as reminders to adhere to treatment, but as symptoms lessen new prompts may be required. Cues need to be meaningful, so patients should participate in determining the reminders that would be the most useful. Examples that are frequently used involve leaving exercise equipment in obvious places, or associating exercises with daily activities such as showering (Sluijs & Knibbe, 1991). A range of commonly used cues can be incorporated into CBPE programmes using photographs and accompanying text that may help patients integrate activities into their daily routine. They are popular adherence strategies but even so there is little evidence to back up the value of using them. Nevertheless Bassett and Prapavessis (2007) attributed the relatively high adherence scores to home-based activities, which ranged between 3.5 to 4.1 out of a possible 5, in part to cueing subjects to do the exercise programme.

Rationale for the Injury of Focus

The area of focus for this thesis was soft tissue injuries of the shoulder and was selected for four reasons. First, it provided a homogeneous sample as recommended by Brewer (1999). Second, shoulder rehabilitation typically involves exercise therapy that is based on scapulohumeral biomechanics (Brukner & Khan, 2002). These two conditions ensure that the behavioural demands for the rehabilitation programme are similar. Third, shoulder injuries/disorders are often prolonged (van der Windt et al., 1995) and have a large home-based exercise component with clinic-based physiotherapy being used for assessment and progression of treatment to ensure correct rehabilitation techniques are being used (Brukner & Khan, 2002). Fourth, rehabilitation for shoulder injuries/disorders has been shown to be efficacious (Brox, Staff, Ljunggren, & Brevik, 1993; Ginn, Herbert, Khouw, Lee, & Wilk, 1997).

Significance of the Research

Effective CBPE used as an adjunct to physiotherapy treatment could reduce some of the barriers associated with clinic-based treatment which may disadvantage a sector of the population. This could include patients being unable to attend clinic appointments on a regular basis because of travelling costs, time away from work or caregivers, and restricted access to clinics for patients living in rural areas. In such cases CBPE may provide an alternative treatment pathway that requires less frequent face-to-face physiotherapy in favour of one with greater self-regulation. Bassett and Prapavessis (2007) showed that patients can undertake the bulk of their physiotherapy at home without being disadvantaged psychologically or physically, provided they are given adherence enhancing strategies and loaned necessary treatment equipment. Thus CBPE could compliment clinic-based treatments and provide strategies to enhance adherence which ultimately may return better functional outcomes.

Should health behaviour informed CBPE successfully increase adherence to the home-based component of treatment and lead to better functional outcomes, it has the potential to reduce the increasing financial burden of physiotherapy services on government agencies and patients. Moreover, the time that clinicians spend on face-to-face patient education could be reduced with the extra treatment time being allocated to other treatment procedures if required. Effective CBPE could also see patients opting for fewer clinic appointments in favour of a greater component of home-based physiotherapy. This in turn may change the focus of clinic-based physiotherapy from a 'hands on' approach to one that has greater emphasis on patient education (see Bassett & Prapavessis, 2007).

Summary

Adherence to physiotherapy is frequently less than optimal which may result in poorer treatment outcomes. Investigations of adherence rates have been inconsistent which may be due to atheoretical studies and the nature of the array of adherence measures used. To obtain more consistent results: (i) a theoretical framework needs to be used to guide the research; (ii) all aspects of treatment behaviours need to be assessed which includes clinic- and home-based components and (iii) the measures used to assess adherence need to be reliable and valid. Research that applies these principles should result in a more accurate measure of adherence.

Patient education programmes that use a social cognitive model such as the HAPA to improve self-efficacy should be able to reduce in part some of the problems associated with rehabilitation adherence as well as reduce the cost to patients and health funders. With broadband internet facilities now being accessible to most people in the developed world, CBPE may be an effective way of delivering the information especially using the Cognitive Theory of Multimedia Learning to guide the presentation of the material. However the research has not specifically investigated the value of such programmes as part of physiotherapy treatment and it is now timely to do so. Successful outcomes will add to the existing small body of knowledge about CBPE for physiotherapy patients and may provide a template for the development of further computer-based physiotherapy rehabilitation programmes.

Chapter 2. Problems of Adherence and Measurement

Problems of Studying Adherence

Problems that beset adherence research in physiotherapy commonly relate to the lack of consistency in defining adherence (Bassett, 2006; Jordan, Holden, Mason, & Foster, 2010) and to the difficulties associated with its measurement (see Bassett, 2003, 2006; Jordan et al., 2010). There is no definition that identifies the meaning of ‘good’ or ‘poor’ adherence nor is there a gold standard that measures it. This chapter will provide a definition of adherence which will be used for the purpose of this thesis and will discuss its measurement and difficulties associated with it. The final section will focus on the inconsistent nature of adherence and functional outcomes.

Definition of Adherence

The World Health Organization (WHO) (World Health Organisation, 2003) defined adherence as “*the extent to which a person's behaviour ... corresponds with agreed recommendations from a health care provider*”(p. 3). They placed emphasis on using the term ‘adherence’ rather than ‘compliance’ since compliance implies that patients unquestioningly conform to prescribed treatments and do not require patient agreement (Meichenbaum & Turk, 1987). In contrast adherence suggests a dependence on the quality of negotiation and discussion between the clinician and patient which is recognised as one of the determinants of adherence (World Health Organisation, 2003). For this reason adherence will be used in preference to compliance throughout this thesis.

The WHO (2003) definition of adherence is useful conceptually but it is too broad to be applied to specific clinical and research settings where it needs to be used explicitly and in a manner that is appropriate to the health behaviour under study (Rand & Wise, 1994). In physiotherapy and sport injury rehabilitation, adherence is multifaceted and requires many different behaviours (Bassett, 2003, 2006; Brewer, 1999). For example, physiotherapy treatment procedures for patients attending clinic appointments may include manual therapy, electrotherapy, cryotherapy, and strengthening and stretching exercises. Patients may also be advised to avoid activities which could potentially slow their recovery and they may participate in educational discussions about their injuries/disorders and their treatment. Another aspect of physiotherapy is the unsupervised home-based treatment component that typically

includes a prescribed exercise programme. Hence, the range of behaviours required to adhere to both the clinic- and home-based rehabilitation protocol needs to be reflected in the definition of adherence. For the purposes of this research it will be defined as: *“the extent to which participants attend their physiotherapy clinic appointments, and follow the advice and clinic- and home-based physiotherapy programme recommended by their physiotherapist”* (p.14, Bassett, 2006).

Measurement of Adherence

It is important in physiotherapy rehabilitation to measure treatment adherence in order to avoid efficacious treatments being changed or discarded because of poor treatment outcomes that may have resulted from patient non-adherence (Gohner & Schlicht, 2006). If rehabilitation is not proceeding as expected, an awareness of the patient's adherence enables clinicians to determine whether the treatment protocol needs to be changed or whether adherence to the treatment regimen should be enhanced (Brewer, Van Raalte, Petitpas, et al., 2000). Measuring adherence does present challenges however, because of the range of behaviours that may be involved (Brewer, 1998a). Some studies have used clinic attendance as the only measure of adherence (Al-Eisa, 2010; Di Fablio, Mackey, & Holte, 1995; McNeely et al., 2011), but this fails to capture patients' behaviour during the treatment session. Other studies have used clinician evaluations of participant adherence during rehabilitation sessions and self-report diaries for home-based adherence but no attendance record (Evans & Hardy, 2002). Still other studies have measured adherence with retrospective self-report questionnaires alone (Gohner & Schlicht, 2006; Wesch et al., 2011). Physiotherapy rehabilitation programmes are multifaceted and therefore their measurement should reflect all the associated behaviours included in the clinic- and home-based components of the treatment programme (Brewer, 1998a). There are three categories that are commonly used to meet these requirements of adherence to physiotherapy rehabilitation programmes. They are: (i) attendance at clinic appointments (ii) participation in the treatment programme during the appointment and (iii) adherence to prescribed home-based activities (Brewer, 1999; Fisher, 1990). Each of these areas will be addressed in turn.

Patient Attendance at Rehabilitation Sessions

Patient attendance at rehabilitation sessions is a widely used measurement of adherence when there is for example a substantial clinic-based component to treatment

(Al-Eisa, 2010; Bassett & Prapavessis, 2011; Brewer et al., 2004; Kolt & McEvoy, 2003; Levy et al., 2008; Lyngcoln et al., 2005; Pizzari et al., 2005). The most common and reliable way of measuring the extent patients attend their physiotherapy sessions is by calculating the ratio of appointments attended to those scheduled (Brewer, 1999). The attendance ratio often indicates a general tendency of patients to attend most of their scheduled appointments (Brewer, 1998a). Mannion et al. (2009) suggested that reducing the number of scheduled appointments may influence the attendance ratio having found high attendance rates when appointments were limited to once per week. Nonetheless, the advantage of this adherence indicator is that it is objective and a quick and easy measurement to make.

Grindley et al. (2008) used a different method of recording patient attendance because they considered the patient attendance ratio did not account for patients who stopped their clinic-based physiotherapy before being discharged. Attendance was recorded by the number of visits, the number of no shows, and the number of cancellations. From these data no shows/non-no-shows; cancellations/no cancellations and dropouts/non dropouts were calculated with the belief that no shows and cancellations potentially interfere with the progression of the patient's treatment and that dropouts were at risk of a less than optimal recovery. However, the assumption that recovery may not be optimal in dropouts does not allow for the possibility that firstly, patients may have been doing their rehabilitation at home, and secondly that an incorrect diagnosis had been made and hence the rehabilitation regimen was inappropriate. Despite this, the measure does provide additional information about clinic attendance although it is only valuable in research that extends over the entire duration of the treatment programme for each participant. In investigations of injuries/disorders that require a long rehabilitation period, such as shoulder injuries, it is not always possible to conduct the research over the entire duration of the rehabilitation for every participant.

Adherence to Clinic-Based Physiotherapy

Activities undertaken during clinic appointments constitute an important part of the rehabilitation protocol and should comprise part of the adherence measure (Brewer, 1998a). Physiotherapists usually observe patients during their rehabilitation and make judgements about their performance. These subjective assessments by clinicians usually centre on frequency, duration, quality and intensity of the requested tasks and

may include how well the patient responds to communications. A simple measure of adherence to clinic-based treatment was developed by Byerly et al. (1994) where the therapist awarded points to patients who completed the prescribed exercises during the rehabilitation sessions but the measure's reliability and validity was not tested. Other psychometric measures of adherence to rehabilitation activities have been developed to reflect the behaviour of patients during rehabilitation that are based on the therapist's subjective assessment such as The Athletic Trainers' Perception of Athletes' Effort Scale (Fields, Murphy, Horodyski, & Stopka, 1995), the Rehabilitation Adherence Questionnaire (Fisher, Domm, & Wuest, 1988) and the Correctness of Exercise Performance Scale (Schoo, Morris, & Bui, 2005), but none of these have proven reliability and validity. Two questionnaires that have been tested for reliability and validity are the Sport Injury Rehabilitation Adherence Scale (SIRAS: Brewer et al., 2002; Brewer, Van Raalte, Petitpas, et al., 2000) and the Rehabilitation Adherence Measure for Athletic Training (RAdMAT: Granquist, Gill, & Appaneal, 2010). The SIRAS has been widely used and the RAdMAT is a more recently developed adherence questionnaire. Both of these measures will be outlined below.

The Sport Injury Rehabilitation Adherence Scale (SIRAS)

The SIRAS is a measure developed to assess adherence of athletes to their clinic-based rehabilitation following a sport injury (Brewer, Van Raalte, Petitpas, Sklar, & Ditmar, 1995). It consists of three items that are rated by clinicians to measure (i) the intensity that patients undertake their exercises (ii) how frequently they follow the clinician's instructions and advice, and (iii) how receptive they are to any changes in the rehabilitation programme. These behaviours are assessed by the physiotherapist at the end of each treatment session on a 1 to 5 Likert scale with anchors of 'minimum effort/maximum effort', 'never/always' and very unreceptive/very receptive provided for each item respectively. The scores of each item are summed to give a score between 3 and 15 (Brewer, Van Raalte, Petitpas, et al., 2000).

The reliability and validity of the SIRAS has been tested using experienced and novice clinicians including physiotherapists (Brewer, Van Raalte, Petitpas, et al., 2000; Kolt, Brewer, Pizzari, Schoo, & Garrett, 2007), and athletic trainers (Brewer et al., 2002; Brewer, Van Raalte, Petitpas, et al., 2000). Studies confirm the construct validity of the SIRAS as a unidimensional measure of adherence to clinic-based rehabilitation from musculoskeletal injury. Brewer, Van Raalte, Petitpas, et al. (2000) found high

internal consistency with a Cronbach's alpha of 0.82, a high test-retest intraclass correlation coefficient of 0.77 and a moderate interrater intraclass correlation coefficient of 0.57. Further, the three items loaded on a single factor accounting for 74% of variance which could be considered to represent adherence to clinic-based sport injury rehabilitation. Attendance at rehabilitation sessions was found to be significantly correlated with the SIRAS scores ($r = 0.21, p < 0.05$), but Brewer, Van Raalte, Petitpas, et al. (2000) noted that while this suggests common aspects of rehabilitation are being assessed, the relatively low magnitude of the correlation indicates that each measure is evaluating different aspects of treatment adherence.

The SIRAS has been found valid and reliable (Brewer et al., 2002; Brewer, Van Raalte, Petitpas, et al., 2000; Kolt et al., 2007), but there are limitations to this measure. Firstly, the multidimensional and complex nature of adherence has been reduced to only three items which captures a very limited amount of information (Granquist et al., 2010; T. Shaw, Williams, & Chipchase, 2005). This may limit the interpretations that can be drawn from the findings. Secondly, the clinic adherence measures may be prone to bias as the clinician is required to make subjective judgements (Brewer, Van Raalte, Petitpas, et al., 2000).

Rehabilitation Adherence Measure for Athletic Training (RAdMAT)

The RAdMAT² has been developed to measure rehabilitation adherence in athletic training (Granquist et al., 2010). It consists of a 16 item questionnaire with three subscales, enabling it to capture more behaviours that contribute to adherence than the SIRAS. The RAdMAT can also give an overall perspective of adherence behaviour since the questionnaire measures across all sessions by being administered once at the end of the rehabilitation period (Granquist et al., 2010). The 16 items may be used as a single total score or independently as subscales that measure (i) attitude/effort, (ii) attendance/participation and (iii) communication. The internal consistency for the subscales and the entire scale are acceptable with all their Cronbach's alphas being greater than 0.75. The ability to differentiate between the subscales may be useful for guiding practice and interventions aimed at enhancing rehabilitation adherence in specific areas. For example, a low score on the communication subscale could point to the need for clinicians to use skills that elicit better patient communication.

² The RAdMAT has been developed since the inception of this research

A limitation of the RAdMAT is that it has only been validated by athletic trainers treating college sports men and women. It is yet to be validated in other rehabilitation settings including physiotherapy where the pathology is not always injury based. Furthermore, it is known that clinicians may use subjective judgement so the questionnaire could be susceptible to bias (Brewer, Van Raalte, Petitpas, et al., 2000). Nevertheless, the RAdMAT has a high correlation with the SIRAS ($r = 0.90$, $p < .01$) and both questionnaires are able to differentiate between the most, least and average adherent athletes (Granquist et al., 2010).

Measurement of Adherence to Home-Based Physiotherapy

Home-based rehabilitation often includes exercises, avoidance of certain movements or activities and rest. It is normally done in an unsupervised environment so the adherence measurement is subjectively made by the participant using self-reports questionnaires or diaries, and less frequently it can be recorded objectively using electronic devices.

Self-Report

Self-report questionnaires measure the degree to which participants have been adherent to their prescribed rehabilitation programme and often includes duration, frequency and intensity. They are non-interactive, fast and inexpensive to administer (Rand & Wise, 1994), but the retrospective nature of reporting is open to response bias, inaccurate recall, and distortion (Meichenbaum & Turk, 1987). Although many of the questionnaires have not been tested for validity, there is evidence to indicate that self-report measures of physical exercise are valid (B. E. Ainsworth, Sternfeld, Richardson, & Jackson, 2000; Armitage & Conner, 2001). Kolt and McEvoy (2003) have also shown that the self-report Home Exercise Compliance Assessment had a significant correlation ($r = 0.64$) with the validated SIRAS adherence measure.

Studies that have used questionnaires to report adherence normally cover the time period since the previous treatment (Bassett & Prapavessis, 2011). A number of scales have assessed various treatment modalities such as exercises, restrictions from activities, cryotherapy and rest. A four-point scale has been used to measure exercise adherence of participants which ranged from (1) *not at all/definitely have not* to (4) *very regularly/definitely have* (Fields et al., 1995; Gohner & Schlicht, 2006; Luszczynska et al., 2006; Sluijs, Kok, et al., 1993). Scales from 1 (*never*) to 5 (*always*) have also rated

the degree of adherence (Bassett & Prapavessis, 2011; Levy et al., 2008; Pisters, Veenhof, de Bakker, Schellevis, & Dekker, 2010; Pisters, Veenhof, Schellevis, et al., 2010; Taylor & May, 1996). Brewer, Van Raalte, Cornelius, et al. (2000) used a larger scale that ranged from 1 (*none*) to 10 (*all*) to measure the extent of completion of a number of prescribed modalities. Another variation was used by Luszczynska, Schwarzer, Lippke, and Mazurkiewicz (2011) who evaluated frequency and intensity of physical activity on a seven point scale with 0 (*never*) to 7 (*as recommended, every day*). Some ratings of these scales have been rationalised into dichotomised groups (Dohnke et al., 2010; Pisters, Veenhof, de Bakker, et al., 2010; Pisters, Veenhof, Schellevis, et al., 2010) and reported as either ‘adherent’ when participants rated themselves as 4 (*often adherent*) or 5 (*always adherent*) or ‘non-adherent’ when participants rated themselves as 1 (*never adherent*), 2 (*seldom adherent*), or 3 (*sometimes adherent*) (Pisters, Veenhof, de Bakker, et al., 2010; Pisters, Veenhof, Schellevis, et al., 2010).

A variety of studies have assessed adherence using more than one scale or questionnaire. For example in addition to using a four-point scale for assessing accuracy of performance, Luszczynska et al. (2006) added another item to measure exercise frequency over a three week period that ranged from 0 (*never*) to 21 (*every day*), and Taylor and May (1996) used a second five-point scale from 1 (*none*) to 5 (*all*) to measure the time spent exercising at home. Other studies have included questionnaires that measure the intensity of activities by assigning a metabolic score (MET) which determined whether patients met the exercise recommendations (Pisters, Veenhof, de Bakker, et al., 2010; Pisters, Veenhof, Schellevis, et al., 2010), or questionnaires that evaluated the duration and quality of the rehabilitation exercises (Wesch et al., 2011).

The reliability and validity of early questionnaires were seldom evaluated. More recent studies have used validated self-report questionnaires to evaluate exercise adherence but they are often adapted for a particular study. For example Scholz et al. (2007) and Sniehotta, Scholz, Schwarzer, et al. (2005) used a subset of the International Physical Activity Questionnaire (Booth, 2000) that was adapted to the special characteristics of cardiac patients. Lippke et al. (2004a) adapted the Kaiser Physical Activity Survey (B. E. Ainsworth et al., 2000) to the special characteristics of orthopaedic patients. In each case the scores were calculated on the time spent

exercising and the intensity of the activity. In another study participants reported how often on average per week they trained at a strain level that corresponded with the intensity of the strain level at the rehabilitation centre (Sniehotta, Scholz, & Schwarzer, 2005). One study combined an objective measure (accelerometer) and a self-report measure to assess physical activity (Gaston & Prapavessis, 2012). They found similarities between the objective and subjective measures which provided support for the validity of the self-report measure.

In short, self-report questionnaires generally fall into one of two categories. One category measures adherence to exercise programmes designed to improve general fitness for individuals with conditions such as coronary artery disease (Sniehotta, Scholz, Schwarzer, et al., 2005) and diabetes (Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2008). The other category has questionnaires measuring adherence to specific exercises for injuries/disorders such as a painful shoulder (Brukner & Khan, 2002), or chronic low back pain (Mannion et al., 2009). These exercise programmes may need to be progressed throughout rehabilitation, although high intensity exercises may not be required immediately after an acute injury such as an ankle sprain (Bassett & Prapavessis, 2011). Whether the selection of the measurement scale falls into category one or two, it needs to reflect the behaviours required to undertake the rehabilitation.

Diaries

Diaries are self-report measures that have been used to assess adherence to exercise rehabilitation. It has been suggested that diaries or a daily log reporting on home exercises can be used to reduce memory-based limitations such as inaccurate recall (Brewer, 1999; Rand & Wise, 1994) especially if the diary is simple to use (Rand & Wise, 1994). With advancing technology electronic diaries have been developed to record adherence and these have been found to have higher adherence rate than paper diaries (Stone, Shiffman, Schwartz, Broderick, & Hufford, 2002). A limitation of diary reporting is that participants want to be viewed favourably which can result in social desirability or response bias with overestimation of exercise behaviour (Moseley, 2006; Sluijs et al., 1998). Even so, Moseley (2006) found that participants who diarised their adherence to a home-based training programme typically overestimated their adherence by approximately 10%, but this overestimation was seldom less than 3% or greater than 17%. Another feature of diary reporting is that the activity itself may act as a reminder to exercise and as such can be an adherence enhancing strategy that prompts

participants to engage in exercise programmes (Myers & Midence, 1998; Rand & Wise, 1994).

Studies that have used diaries have largely assessed adherence by reporting either a percentage or ratio of the (i) number of sessions completed to the number of sessions prescribed and (ii) number of exercises completed to the number of exercises requested (Alexandre et al., 2002; Bassett & Petrie, 1999; Evans & Hardy, 2002; Hammer et al., 2007; Lyngcoln et al., 2005; Mannion et al., 2009; Pickering, Fitton, Ballinger, Fazakarley, & Ashburn, 2013; Pizzari et al., 2005). Alexandre et al. (2002) converted the percentage score to 0, 1 or 2 points. High adherence was represented by 2 or at least 80% completion of exercises, 1 point was low adherence for doing some exercises but less than 80% and 0 was given when participants did no exercises. Other studies have combined diary reporting with objective measures such as videocassettes which recorded each time the videocassette was played (Brewer et al., 2004) or microprocessors (Vitalog) that recorded intensity and duration of exercise by monitoring heart rate and body movement (Brassington, Atienza, Perczek, DiLorenzo, & King, 2002).

Electronic Devices

Electronic devices such as pedometers, accelerometers and timing counters give an objective measure of evaluating exercise and are reasonably accurate for monitoring activity. They are often expensive which may account for their infrequent use, but also they may not be suitable for all types of prescribed home exercise as they primarily measure activities of daily living (Beinart, Goodchild, Weinam, Ayis, & Godfrey, 2013). An example is the use of accelerometers that can monitor adherence to walking programmes but they may be unable to evaluate strengthening exercises. Despite this, objective measures are less prone to response bias than self-reports and may provide the most accurate account of adherence to home-based rehabilitation (Brewer, 1999). As computer and internet facilities become more accessible to individuals, websites may be increasingly used for monitoring rehabilitation activities (T. Shaw et al., 2005).

Several studies have used electronic devices to monitor adherence. Brewer et al. (2004) used a hidden electronic counter to record the number of times a videocassette was played that had auditory and visual instructions on how to perform exercises following an anterior cruciate reconstruction. This objective measurement was found to

have a significant positive correlation with self-reported home exercise completion ($r = 0.58, p < 0.001$), which provided some validation for electronic monitoring and supported its use. Even so, there was a significantly higher number of self-reports which may have been due to participant overestimation compared to the number of times the videocassette was actually played. In another study a positive influence of electromyographic biofeedback was reported by Akkaya et al. (2012) who found that it increased patient participation in exercise therapy by providing auditory and visual stimulation following arthroscopic partial meniscectomy. No adherence measures were provided and no timing record was incorporated in the device to validate this finding.

Although objective measurements are associated with electronic devices, limitations to their use include their cost and the recordings which may not always be valid. An example of invalid recording is a pedometer that counts steps which could be worn by any individual and not necessarily the person for whom it was targeted, and similarly a videocassette could be run by any individual without verification that it had been watched or listened to by the intended recipient. Thus, the validity of such measurement needs to be viewed with some caution. Vitolins, Rand, Rapp, Ribisl, and Sevick (2000) also advised that electronic devices are liable to mechanical problems, so devices need to be well maintained to ensure accurate data is being recorded.

Relationship between Adherence and Functional Outcomes

Rehabilitation adherence is a behaviour that is often linked to functional outcomes (Brewer, 2010) with the assumption that the relationship between them is dependent on the quality, dose and intensity of the prescribed exercise regimen (Pisters, Veenhof, Schellevis, et al., 2010). The identification of a significant relationship between adherence and functional outcomes may be more successful using a multifaceted approach to the measurement of both adherence and functional/treatment outcomes (Bassett, 2006). The indices that can be used to evaluate rehabilitation adherence are self-report questionnaires or diaries for home-based activities, and attendance at physiotherapy and behaviour during clinic appointments for clinic-based behaviours (Bassett, 2003; Brewer et al., 2004). Functional outcomes indices are aligned to the injury/disorder which often includes pain and movement parameters in physiotherapy management. Rothstein (1989) suggested that the patients' perception of their disability is also valuable and recommended that it should be part of the functional

outcome assessment. Hence both objective and subjective measurements may be evaluated in the adherence-functional outcome assessment.

Studies that have found positive associations between exercise adherence and functional outcomes have included a variety of injuries/disorders such as osteoarthritis of the hip and/or knee (Pisters, Veenhof, Schellevis, et al., 2010); back pain (Alexandre et al., 2002; Kolt & McEvoy, 2003; Mailloux, Finno, & Rainville, 2006); hand therapy following distal radial fracture (Lyngcoln et al., 2005); and treatments following anterior cruciate repair (Brewer et al., 2002; Brewer et al., 2004; Pizzari et al., 2005); 'near falls' in patients with Parkinson's disease (Ashburn et al., 2007); stroke (Jurkiewicz, Marzolini, & Oh, 2011); heart failure (Duncan & Pozehl, 2002) and coronary artery disease (Sniehotta, Scholz, Schwarzer, et al., 2005). Although many studies have identified positive adherence-functional outcome associations, some investigations have resulted in unexpected and negative relationships.

Unexpected findings have been documented by Feller, Webster, Taylor, Payne, and Pizzari (2004) who found that participants who attended a limited number of physiotherapy appointments following anterior cruciate reconstruction did as well, if not better on functional outcomes than those who attended regularly. This may have been because these participants recovered quickly and did not feel the need to attend therapy so often. A negative relationship between clinic-based adherence and knee stability in an accelerated rehabilitation programme following anterior cruciate repair was also reported by Brewer et al. (2004). A third study with unexpected results found that reduced pain in knee osteoarthritis was associated with frequent exercise of moderate duration, rather than more intense exercise extending over longer periods. (Rejeski et al., 1997). In all these studies participants who were highly adherent to the exercise programme or exceeded it, did not do as well as those participants who exercised less.

Studies that have used multiple indices to assess exercise adherence-functional outcomes have sometimes observed mixed results within the one study. For example, although Brewer et al. (2004) reported a negative association had been found between adherence and knee stability they also found a positive relationship between adherence and self-report physical symptoms. In another study investigating chronic low back pain, Mannion et al. (2009) found adherence to home-based exercises was associated with improved functional outcomes which were measured by a reduction in pain and self-rated disability. However, the study found no significant relationships with clinic-

based adherence as measured by the SIRAS and the attendance ratio. Different studies measuring the same outcome have also been mixed. For example while the results of Mannion et al. (2009) identified home-based adherence associated with functional outcomes, they contradicted those of Gohner and Schlicht (2006) who reported that an intervention that successfully enhanced home-based exercise adherence did not lead to a decrease in pain compared to the control group. Conflicting results were also found in two similar randomised controlled studies investigating a motivational intervention to enhance adherence to an exercise programme for chronic low back pain. Friedrich et al. (2005) showed the intervention increased adherence which resulted in reduced disability and pain intensity, while Basler et al. (2007) found no significant associations between the same variables.

As has been shown in the examples above, the inconsistencies in findings from research investigating exercise adherence and functional outcomes suggests that the relationship is not straightforward. One factor that may have influenced the findings is a dose-response effect (Brewer et al., 2004; Feller et al., 2004; Gohner & Schlicht, 2006; Rejeski et al., 1997). For many injuries/disorders the most effective dose response remains unknown and it is possible that over exercising in terms of frequency or intensity may result in less than optimal outcomes. Brewer et al. (2004) have suggested that there may be costs and benefits of treatment programmes and have implied that greater knee stability may have been a cost for highly adherent participants. Mendonza, Patel, and Bassett (2007) also recommended that because of changes in connective tissues and the longer healing rates that occur with aging (Hildebrand, Gallant-Behm, Kydd, & Hart, 2005), that age and physical status of patients should be considered when prescribing rehabilitation programmes. Indeed Pizzari et al. (2005) found that participants under 30 years of age who adhered to an exercise programme had favourable outcomes compared to adherent adults who were older than 30 years of age who had negative outcomes. Slower recovery times may have been the reason for the variation. Different age groups may also have influenced the adherence-functional outcome relationship in two similar studies on low back pain (Basler et al., 2007; Friedrich et al., 2005). Friedrich et al. (2005) reported an improvement in functional outcomes in participants who had an average age of 44.12 years compared to Basler et al. (2007) who found no significant differences in participants with an average age of 70.3 years.

A second factor that may account for the lack of consistency in the adherence-functional outcomes relationships may be a reflection of the measurement tools used to assess both adherence and functional outcomes. Measurement needs to be appropriate to the requirements of the study which is usually needs to be multifaceted. For instance, Lyngcoln et al. (2005) appropriately used three adherence measures to assess hand therapy which consisted of home- and clinic-based treatment programmes, and evaluated functional outcomes using objective and subjective assessments. In comparison Ashburn et al. (2007) used a single adherence measure that was a diary sheet in a study centred around a home-based treatment programme. They found that participants in the exercise group had less 'near falls' than the control group and that they may have improved balance control and adaptive saving reactions. On the other hand, Al-Eisa (2010) used one adherence measure which was attendance at clinic-based treatment, to assess a variety of functional outcomes that included pain. The validity of the results in this study may be questioned because of the single tool used.

Multiple indices normally assess functional outcome but it is difficult to make comparisons when these are not consistent. For example, in four studies reporting on knee function following anterior cruciate repair, only two studies used the same subjective questionnaires (Feller et al., 2004; Pizzari et al., 2005) and there was only one common objective measure, the leg hop test, that was used in three of the four studies (Brewer et al., 2004; Brewer, Van Raalte, Cornelius, et al., 2000; Pizzari et al., 2005). Nevertheless, these studies did use multiple indices that included both subjective and objective measures. In comparison only subjective measures were used by Kolt and McEvoy (2003) in an investigation of adherence and low back pain. In this study the patients' and the physiotherapists' perception of the degree of rehabilitation that had been achieved was rated and there were no objective measures. The results of this study suggested that adherence was associated with improved functional outcome but since there were no objective measures it was not clear whether the association had been influenced by response bias.

Summary

The diversity of the measures used in adherence studies is reflected to some extent in the difficulty encountered making direct comparisons between studies. Despite this, adherence to physiotherapy rehabilitation can be measured when the definition of adherence is tailored to the treatment protocols and the measurement tools

reflect the behavioural requirements. Over the last decade the need for a multifaceted approach to adherence measurement has been acknowledged (Bassett, 2003, 2012; Brewer et al., 2002; Brewer et al., 2004) and the adherence measures in physiotherapy and sport rehabilitation research have become more consistent. The adherence indices that are increasingly being applied across a greater number of studies are (i) the attendance ratio and (ii) the SIRAS and/or RAdMAT for clinic-based components of treatment and (iii) patient self-reports for home-based treatment. The expense and inability of electronic devices to objectively measure an array of exercises currently excludes their use from many rehabilitation programmes.

The principal reason for promoting adherence to rehabilitation programmes is based on the assumption that better adherence leads to improved function, yet this complex relationship is still to be established conclusively in many areas of health and rehabilitation. Findings from the research have identified the multifaceted nature of adherence behaviours and functional outcomes, and the need to use objective and subjective measurement tools to evaluate each. Implementation of validated and reliable measurement tools should produce more consistency in the research and enable comparison across studies to be made.

Chapter 3. Self-Efficacy, Social Cognitive Models and their Association with Rehabilitation Adherence

Introduction

This chapter is a narrative review that will examine the research literature associated with self-efficacy and discuss the influence of self-efficacy on health behaviour that relates particularly to behaviour change in exercise rehabilitation. The most widely used social cognitive approaches designed to predict and change health behaviour will be assessed, with focus on three theoretical models that are arguably the most suited to a physiotherapy environment: (i) the Social Cognitive Theory (SCT; Bandura, 1977), (ii) Protection Motivation Theory (PMT; Rogers, 1975, 1983), and (iii) Health Action Process Approach (HAPA; Schwarzer, 1992, 2008a). Justification will be given for selecting the HAPA as the theoretical underpinning of this thesis and methodological issues associated with its application will be evaluated.

The Specificity of Self-Efficacy and its Influence on Behaviour

Self-efficacy has been identified as one of the major constructs that influences behaviour. It reflects the beliefs that people have about their ability to perform a specific behaviour in a particular situation and plays an important role in how people perceive a situation and how they might behave in response to it (Bandura, 1997). To bring about change in a health behaviour different demands and challenges need to be mastered which requires different self-efficacy beliefs (Bandura, 1977). Exercise-related literature has focused on three types of self-efficacy: action, maintenance and recovery self-efficacy (Luszczynska & Schwarzer, 2003). Action self-efficacy relates to an individual's belief in their ability to initiate a new behaviour such as undertaking a daily therapeutic exercise programme. People with high action self-efficacy imagine success and are less likely to harbour doubts about their ability to carry out the programme compared to those with low action self-efficacy. In contrast, maintenance self-efficacy, also known as coping self-efficacy, is a self-regulatory mechanism that refers to people's confidence in their ability to perform specified actions when faced with obstacles. People with high maintenance self-efficacy would plan better strategies, make more effort and be more persistent in carrying out the behaviour than people with low maintenance self-efficacy. For example, people who are undertaking a therapeutic exercise programme may need to reorganise their daily routine to find time to do the

prescribed exercises. Lastly, recovery self-efficacy refers to the perceived ability of people to recover from a lapse of the new behaviour, such as the confidence of people to resume the therapeutic exercise programme following a period of illness (Luszczynska & Schwarzer, 2003; Scholz et al., 2005). Recovery self-efficacy has been found to be associated with maintenance of the behaviour in correlational studies (Luszczynska et al., 2011).

A strong sense of self-efficacy facilitates cognitive processes and performance so that individuals may be more inclined to take action because they believe a problem can be solved. The decision to act is strengthened by the commitment people have to making the behaviour change and their persistence to continue the activity even when faced with obstacles (Bandura, 1997). The change in behaviour operates through a self-regulatory cycle involving action, maintenance and recovery self-efficacy, and that reflects the thought processes, emotions, motivation, behaviour and changing environmental conditions in the different phases of rehabilitation (Bandura, 1997). A confidence in one's ability or a 'can do' attitude relates to the individual's sense of competency and proficiency that gives them a feeling of control over their environment (Strauser, 1995). Nevertheless, because self-efficacy is so specific to the required behaviour only a narrow range of actions can be changed or predicted at any one time (Bandura, 1997).

Bandura (1997) identified four major sources from which self-efficacy is learned and through which techniques can be employed to enhance it. One is through mastery of an activity which occurs when an individual can perform the activity correctly and repeatedly, and is the most influential source of self-efficacy (Bandura, 1997). A second source of self-efficacy is through vicarious behaviour which occurs when a person or 'model' is observed successfully performing a difficult action. For example, a person may observe a model in a video performing a prescribed exercise. The impact of vicarious behaviour is greatest when the personal characteristics of the model are similar to the observer, such as age and gender (Bandura, 1977). The third factor affecting self-efficacy is verbal persuasion which is used by many health professionals to encourage or reassure patients about the action or new behaviour they have undertaken. The fourth factor arises from a physiological source where an individual's physiological state provides them with information that can impact on their efficacy expectations (Bandura, 1977). Hence, a person who is highly aroused such as when

they are anxious usually has impaired performance compared to a person who is more relaxed.

The remainder of this chapter will explore research relating to exercise rehabilitation and the role of self-efficacy in bringing about behaviour change. This area is most relevant to physiotherapy practice where clinic- and home-based exercise rehabilitation is commonly prescribed by physiotherapists. Atheoretical research relating to self-efficacy using non-experimental and experimental design will be evaluated first. This will be followed by theoretical investigations that have been guided by SCT, PMT and the HAPA. An overview of each social-cognitive theory will precede the findings from non-experimental and experimental research.

Atheoretical Studies of Rehabilitation Adherence

Up until the late 1990s much of the research on health behaviour was atheoretical even though many factors that were associated with it, such as demographic, social and cognitive factors had been identified (Brewer, 1999). Although more investigations are now guided by theoretical models, atheoretical research has continued with considerable numbers of studies investigating the relationship between self-efficacy and adherence to rehabilitation behaviours (Altmaier, Russell, Kao, Lehmann, & Weinstein, 1993; Blanchard, Rodgers, Courneya, Daub, & Knapik, 2002; M. Milne, Hall, & Forwell, 2005; Morgan, Tobar, & Synder, 2010; O'Brien, Bassett, & McNair, 2013; Orbell, Johnston, Rowley, Davey, & Espley, 2001; Thomee et al., 2007; Tung, Cooke, & Moyle, 2013; Wesch et al., 2011; Woby, Roach, Urmston, & Watson, 2008; Woodgate, Brawley, & Weston, 2005). Overall, the two most reliable findings have identified self-efficacy as a key component in rehabilitation adherence and high self-efficacy as being positively associated with greater rehabilitation adherence. Several atheoretical studies that used prospective designs to investigate self-efficacy throughout the rehabilitation period warrant additional comment.

Non-Experimental Studies in Rehabilitation Adherence

Self-efficacy is situation specific, therefore action-, maintenance- and recovery self-efficacy will have important but different influences that are required to accomplish the different behaviours. In two atheoretical studies, involving 270 and 90 respective injured athletes undergoing physiotherapy, action self-efficacy was found to be higher

than maintenance self-efficacy (M. Milne et al., 2005; Wesch et al., 2011), suggesting that individuals had more difficulty with the ongoing effort required to maintain the behaviour than initiate it. This may be especially relevant to individuals who have had previous experiences of injuries and are aware of the barriers that may be encountered over the course of their rehabilitation (Bassett & Prapavessis, 2011). Interestingly, Blanchard et al. (2002) found in cardiac rehabilitation that maintenance self-efficacy was gender dependent, with men having significantly higher maintenance self-efficacy to exercise and greater exercise adherence than women. Reasons attributed to the differences were that women had more fear than men of another cardiac event, of medication side-effects and angina-chest pain. Women also considered lack of time and financial concerns were barriers to them undertaking rehabilitation programmes.

Maintenance self-efficacy has been shown to vary over the rehabilitation period. In a study of 45 participants with chronic low back pain, self-efficacy increased over a three week course of rehabilitation and was maintained at a six month follow-up assessment (Altmaier et al., 1993). Although this was only a small intervention study, two more recent prospective observational studies supported the findings. One of these investigated anterior cruciate ligament injury (Thomee et al., 2007) and the other low back pain (Woby et al., 2008). The reported self-efficacy gains occurred in association with improved function and reduced pain which suggests that treatment induced self-efficacy may play a key role in maintaining gains in functional outcomes (Thomee et al., 2007). Moreover, relief brought about by a decrease in symptoms when injuries/disorders are chronic may have a positive effect on the patient's perceived ability to maintain the programme for a prolonged period.

In contrast to these studies, maintenance self-efficacy has also been shown to decline over a course of rehabilitation. In a longitudinal study involving 90 injured athletes, maintenance self-efficacy declined over the eight week study duration (Wesch et al., 2011). This decline was attributed to the difficulty of maintaining rehabilitation exercises over long periods when unsupervised (Sluijs & Knibbe, 1991) and when rehabilitation regimens becoming more complex and difficult to implement as acute symptoms subside (Bassett & Prapavessis, 2007). The reduction in acute symptoms together with improved function over time may lead to the priority for patients to maintain an exercise programme being replaced with other behaviours and activities as the symptoms no longer act as reminders (Sluijs & Knibbe, 1991). These findings

suggest that the maintenance self-efficacy-functional outcome relationship may be influenced by whether injuries/disorders are acute or chronic.

Experimental Studies in Rehabilitation Adherence

In two atheoretical intervention studies, one that recruited 29 sedentary adults (Morgan et al., 2010) and the other 27 participants with hip or knee osteoarthritis (O'Brien et al., 2013), maintenance self-efficacy was found to decline over the 12 week duration of both exercise programmes. The reason suggested for the decline in both studies was attributed to the participants having a limited understanding of the exercise requirements at the beginning of the study. As participants became more familiar with the exercise programme they may have realised they had underestimated their perceived ability to cope with any barriers arising over the study period, consequently maintenance self-efficacy declined. In addition, participants in both studies were unsupervised for most of the study period which may have influenced their ability to maintain the exercise programmes (Sluijs & Knibbe, 1991).

Shields and Brawley (2009) highlighted the relationship between self-efficacy, adherence and a proxy-agent, who Bandura (1997) defined as a person enlisted by a patient to help them achieve their goals, such as a physiotherapist. Using a quasi-experimental design they found that increased use of assistance from the proxy-agent can be associated with decreased action and maintenance self-efficacy when exercising independently. This has implications for physiotherapy practice since patients who prefer frequent assistance from their physiotherapist when exercising, may have more difficulty undertaking a home-based exercise programme where there is no or limited physiotherapist input. Lower levels of maintenance and action self-efficacy were found in these participants which may have affected their exercise adherence (Shields & Brawley, 2009). Indeed, Bassett and Petrie (1999) found participants were more adherent to their exercise rehabilitation when the treatment goals were set collaboratively with the physiotherapist rather than being mandated by the physiotherapist. This suggests that greater independence setting treatment goals may lead to better self-regulation resulting in enhanced rehabilitation adherence.

Theoretical Studies of Rehabilitation Adherence

Much research over the last two decades has been guided by social cognitive models that were developed to help understand and predict health behaviours. The main

models include the Theory of Planned Behaviour (TPB: Ajzen, 1991), the Transtheoretical Model of Change (TTC: Prochaska & DiClemente, 1983), Social Cognitive Theory (SCT: Bandura, 1982, 1997), Protection Motivation Theory (PMT: Rogers, 1975) and the Health Action Process Approach (HAPA; Schwarzer, 2008a; Schwarzer, Lippke, & Luszczynska, 2011). There is considerable overlap between the constructs within these models, with self-efficacy being a key construct in all the leading models of health behaviour (see Conner & Norman, 2005) (Figure 1). This is not surprising since self-efficacy appears to be one of the strongest determinants in predicting and adopting health behaviours (Allen, 2004; Bui, Mullan, & McCaffery, 2013; Luszczynska & Schwarzer, 2003; Schwarzer et al., 2007). Another construct common to these models is behavioural intentions which in addition has been found to be a major predictor of behaviour (Lippke et al., 2004a; S Milne, Sheeran, & Orbell, 2000). This construct mediates between the other social cognitive variables in the model guiding the research and the behaviour. It also signals the end of the motivational stage of a behaviour change and the beginning of the volitional stage where the actual behaviour is initiated (see Conner & Norman, 2005).

Investigations underpinned by these theories provide a basis for understanding the relationships between behavioural influences and predicting behavioural change. Importantly they identify targets that can be used in intervention studies and give confidence that the interventions are responsible for any observed behaviour change (Brewer, 1999). Intervention studies can test the cause-effect role of the variables and identify the effectiveness of the intervention on behaviour change. Hence, a theoretical basis gives greater conceptual clarity (Brewer, 1999) which provides a better understanding of behaviour and the interplay of the variables within the model (Dishman & Buckworth, 1996). TPB and the TTM have been applied to a broad range of health behaviours that include preventative behaviours such as smoking cessation but may be less applicable to injury rehabilitation. In contrast SCT, PMT and HAPA are the models that have been used most successfully for understanding exercise rehabilitation. They provide the most suitable adjuncts for individuals undertaking physiotherapy where risk perceptions, beliefs in treatment outcomes and self-efficacy may be the most important factors that can explain patient adherence to treatment programmes. Each of these theories will be evaluated in turn.

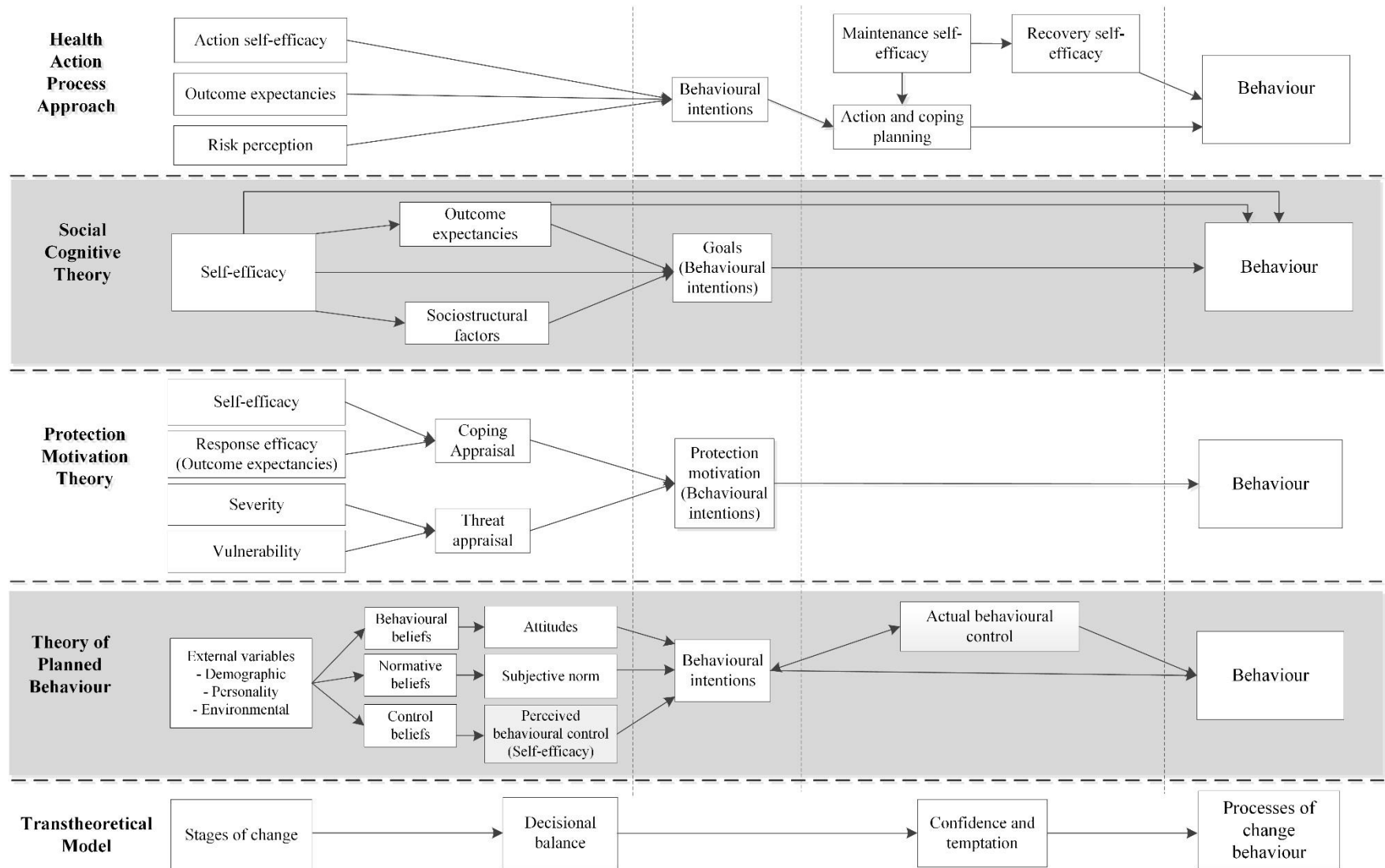


Figure 1. Overview of five major Social Cognitive Models.

Social Cognitive Theory

SCT (Bandura, 1977, 1992, 2000, 2004) is a widely used behaviour change model that has investigated the predictors of health behaviours (Fiala, Rhodes, Blanchard, & Anderson, 2013; Hammer et al., 2007; Plotnikoff et al., 2008; Rovniak, Anderson, Winett, & Stephens, 2002; Tavares, Plotnikoff, & Loucaides, 2009) and has provided the theoretical basis for interventions in a variety of contexts that includes physical exercise (Billek-Sawhney & Reicherter, 2004; Luszczynska et al., 2011; McAuley et al., 1999; Plotnikoff et al., 2008). It assumes intention to engage or adhere to a health behaviour such as rehabilitation exercises arises from a core set of determinants: self-efficacy, outcome expectancies, perceived facilitators and impediments, and goals (Bandura, 1977). Of these constructs, perceived self-efficacy and outcome expectancies are considered to have the most important influence on behaviour (Figure 2).

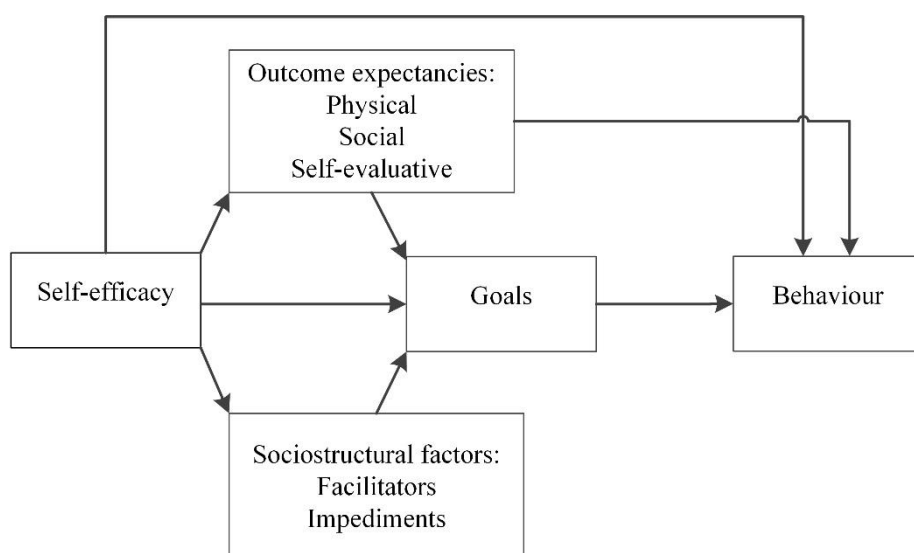


Figure 2. The Social Cognitive Theory (Bandura, 2000).

While self-efficacy reflects a person's confidence to undertake a behaviour, outcome expectancies relate to the perceived consequences of undertaking the behaviour. Both constructs are necessary in the formation of goals although outcome expectancies may play the greatest role in influencing the initial motivation and decision to change health behaviour because it focuses on the perception of possible consequences of taking action. However, once the behaviour has been initiated then self-efficacy may be more influential than outcome expectancies which may decrease in importance (Bandura, 1997). The physiotherapy literature associated with exercise

behaviours support this claim finding the utility of outcome expectancies is generally null (see Rhodes & Fiala, 2009). This may result from individuals having already initiated the behaviour change as evidenced by their seeking physiotherapy treatment and thus outcome expectancies has become less important.

Goals or behaviour intentions are the most proximal precursors of the health behaviour and provide the incentive to act (Bandura, 1997; Rovniak et al., 2002). Although the main influence of goal setting comes from self-efficacy and outcome expectancies, they may also be positively shaped by perceived facilitators (opportunities) such as social support, or negatively by impediments (barriers) such as financial costs. These sociostructural factors can in turn be affected by self-efficacy and an indirect pathway can operate between self-efficacy and goal formation. Similarly, although outcome expectancies are a core determinant of health behaviour, it often works in tandem with self-efficacy and this can form another indirect pathway between self-efficacy and goal formation.

According to SCT, because behaviour change is most influenced by self-efficacy and outcome expectancies these two determinants are commonly used as the main predictors of behaviour investigations (M. K. Campbell et al., 2002; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002; Rovniak et al., 2002; Tavares et al., 2009). Indeed they are the central constructs of SCT with much of the health behaviour research that has utilised this model assessing only these two constructs (Hammer et al., 2007) or even just the most influential construct, self-efficacy (McAuley et al., 1999). The following sections will review non-experimental and experimental studies that have employed SCT in exercise rehabilitation.

Non-Experimental Studies in Exercise Rehabilitation

Many non-experimental SCT studies within the clinical environment have shown positive and significant correlations between self-efficacy and outcome expectancies, and the actual behaviour (Leveille, Cohen-Mansfield, & Guralnik, 2003; Lox & Freehill, 1999). Fewer studies have examined the less influential dependent SCT variables that include sociostructural factors. In a prospective study investigating physical activity, Plotnikoff et al. (2008) found support for the sociostructural factors using a large sample of 2319 participants with type 1 and type 2 diabetes. They identified a strong association between self-efficacy and social support (a facilitator), and showed that decreasing barriers or impediments improved exercise behaviour. Self-

efficacy remained the strongest predictor of the behaviour in these studies which is in line with a review examining the utility of SCT for understanding exercise behaviour (see Allen, 2004), and it was also highly correlated with outcome expectancies.

Not all studies have reinforced the determinants of SCT as convincingly as the above investigations. Fiala et al. (2013) found that SCT did not explain exercise behaviour in a population awaiting total joint replacement. They suggest the reason may be that most individuals in the group were at end stage of osteoarthritic disease this group pain may have had a major impact on efficacy beliefs. This may explain why SCT was more effective in predicting walking which was a less painful activity than preoperative exercises. Further, action self-efficacy was associated with walking but not with the perceived confidence of overcoming the barriers to the activity (maintenance self-efficacy) such as time constraints, which suggests that separate measures should be used to assess specific self-efficacies.

Correlations between the SCT constructs were not significant in another study where 58 patients with low back pain undertook a home-based physiotherapy exercise programme (Hammer et al., 2007). However, there were high median scores for self-efficacy and outcome expectancies, and an overall adherence rate greater than 80%. The results may have been influenced by the self-report diary which was the only measure used to assess adherence and may not have captured all behaviours needed to undertake a home based physiotherapy exercise programme (Brewer, Van Raalte, Petitpas, et al., 2000). In addition, the study may have lacked power with only 58 participants being recruited. Nevertheless, there was a marked reduction in adherence scores at the two month follow-up which would suggest a decline in maintenance self-efficacy which is consistent with other studies (R. Campbell et al., 2001; Long, Donelson, & Fung, 2004; M. Milne et al., 2005; O'Brien et al., 2013).

Experimental Studies in Exercise Rehabilitation

SCT intervention studies have demonstrated that heightened outcome expectancies and self-efficacy can substantially increase exercise behaviour in a population of healthy adults where physical activity was the focus (for review see Keller, Fleury, Gregor-Holt, & Thompson, 1999). This was also demonstrated in a single case design, where SCT was used successfully to bring about behaviour change

in physiotherapy rehabilitation by strengthening self-efficacy (Billek-Sawhney & Reicherter, 2004). In this study the factors that strengthened self-efficacy included social support and peer modelling or vicarious behaviour which were included through group participation.

Protection Motivation Theory

The protection motivation theory (PMT) was developed by Rogers (1975) and was modified in 1983 to include self-efficacy as an antecedent of behavioural change (Rogers, 1983). The theory arose from cognitive responses resulting from fear appeals, such as on-going health issues if treatment was not sought. A threat appraisal arises through the perceived severity of the threat and the individual's perceived susceptibility to it. This is balanced against a coping appraisal which operates through the perceived effectiveness of the treatment (response efficacy) and the individual's confidence in their ability to undertake the behaviour (self-efficacy). Combining and evaluating the threat and coping appraisals leads to protection motivation (behavioural intentions) with higher threat and coping appraisals being more likely to result in the individual adopting the recommended protective behaviour Figure 3. PMT has been used in research to predict the effects that beliefs have on behavioural intentions and actual behaviours, and as a basis for interventions where variables can be manipulated in an effort to change beliefs and behaviours (S Milne et al., 2000). The theory takes into account personal beliefs about injuries/disorders and treatments and appears well suited to the acute conditions seen in physiotherapy practice (Bassett & Prapavessis, 2011).

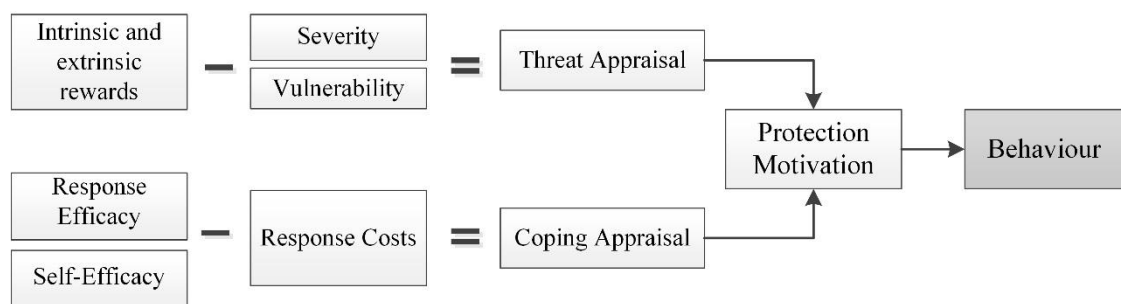


Figure 3. Schematic view of the Protection Motivation Theory (Maddux & Rogers, 1983).

The value of PMT in predicting and understanding a variety of health-related behaviours has been evaluated in two meta-analyses (Floyd, Prentice-Dunn, & Rodgers, 2000; S Milne et al., 2000). The findings identified that coping and threat appraisals

predicted behavioural intentions and behaviour, although coping appraisals were stronger than threat appraisals. The meta-analyses also showed that self-efficacy which is a component of coping appraisal, was most consistently related to behavioural intentions and behaviour, and that behavioural intentions were the most robust and best predictor of behaviour. Further endorsement of these findings were revealed in a more recent systematic review that investigated the effectiveness of PMT in predicting and promoting physical activity in healthy populations (Bui et al., 2013). Findings from this review were in line with the two meta-analyses and identified coping appraisal, in particular self-efficacy, as the strongest predictor of physical activity.

Non-Experimental Studies in Exercise Rehabilitation

The first study in physiotherapy rehabilitation to use PMT was undertaken by Taylor and May (1996) who investigated the beliefs and intentions of 62 participants to initiate and adhere to recommended treatment programmes for sports injuries. They found general support for coping and threat appraisals as determinants of adherence but in contrast to other studies (Maddux and Rogers, 1983, Wurtele and Maddux, 1987), they identified that the severity component of the threat appraisal was a stronger predictor of health behaviour than vulnerability. This may have occurred because participants who had already sustained an injury and were experiencing some disability had greater perception of the severity of the health threat than participants who had not yet been subjected to the injury or disease (Wurtele & Maddux, 1987). Thus preventative behaviours such as exercises for coronary artery disease may be perceived by participants as being less relevant or less important as a health threat since the person has not yet experienced symptoms associated with the condition (Wurtele & Maddux, 1987).

The methodological limitations of the Taylor and May (1996) study included participants who had a variety of injuries and were undertaking different treatment protocols. The study also focused only on home-based rehabilitation even though participants were involved in clinic-based rehabilitation. Brewer et al. (2003) addressed these methodological issues in a similar study using PMT variables. They recruited 85 participants who had undergone anterior cruciate ligament reconstruction and measured adherence to home and clinic-based rehabilitation using continuous indices. The results mainly supported those of Taylor and May (1996) and although severity was not correlated with adherence measures, higher vulnerability, response/treatment efficacy

and self-efficacy scores were associated with higher levels of adherence to clinic and home based behaviours. These two studies provided support for the PMT as a framework for understanding home-based rehabilitation adherence following sports' injuries.

A variety of healthcare professions have since used the PMT model as a framework to assess its ability to predict adherence to exercise rehabilitation. In a study involving 229 participants with various orthopaedic conditions, self-efficacy differentiated between participants who were adherent to their rehabilitation programme and those that were not (Grindley et al., 2008). Self-efficacy and response efficacy were also useful in explaining home-based exercise adherence of 76 cardiac participants in a short term longitudinal study (Blanchard et al., 2009). In this study a direct significant relationship was found between self-efficacy and exercise behaviour, and response efficacy predicted behavioural intentions. The predictive value of PMT was further substantiated by two large studies involving 1602 participants (Plotnikoff et al., 2009) and 787 participants (Tulloch et al., 2009) with coronary artery disease. Self-efficacy and behavioural intentions were significant predictors of exercise adherence (Plotnikoff et al., 2009), and coping appraisals and perceived severity predicted exercise intentions (Tulloch et al., 2009). Notably in the latter study the predictive value of the findings were evident only in the short term (six months) and not the long term (12 months).

Experimental Studies in Exercise Rehabilitation

In rehabilitation research, PMT has been used as a framework to establish a cause and effect relationship between the PMT variables. Interventions have targeted specific variables to enhance behavioural intentions that in turn may promote health-related behaviour. Several experimental studies have focused primarily on student populations which have delivered persuasive or motivational health messages associated with preventative activities such as exercise and smoking cessation to manipulate PMT variables (Courneya & Hellsten, 2001; Fruin, Pratt, & Owen, 1991; Maddux & Rogers, 1983; Wurtele & Maddux, 1987). Typically these studies used a factorial design with two levels of information. To ensure the information was substantially different, the information was often fabricated to exaggerate the effect. Generally, the results from these studies showed that the four main PMT constructs, perceived severity, vulnerability, response self-efficacy and self-efficacy could be strengthened, but self-

efficacy was the most consistently associated with increased behavioural intentions and subsequent behaviour.

While the results of these experimental studies highlight the successful manipulation of the PMT variables, the delivery of fabricated information which in part is responsible for the outcomes, raises ethical issues for the healthcare sector. For example, a study examining whether the threat of colon cancer could motivate 427 healthy undergraduate students to participate in a preventative exercise programme, provided two sets of persuasive information. With respect to perceived vulnerability (PV), one group received information that presented the risk of colon cancer as one in 200 (low PV) and the other as one in nine (high PV) (Courneya & Hellsten, 2001). Ethically, patients who have sought treatment and are willing to take part in experimental studies are entitled to truthful and factual information that they would normally receive from a health professional. Hence, more recent clinical studies that have been undertaken have provided balanced and factual health information to test cognitive and behavioural change that can be targeted through PMT. One such randomised controlled trial that involved 208 participants examined the effectiveness of persuasive messaging on exercise behaviour to prevent pregnant women developing gestational diabetes mellitus (Gaston & Prapavessis, 2009). In this study factual written information was an effective source of exercise motivation and in the short term changed behaviour. Response efficacy was significantly related to goal intention but self-efficacy was the only variable to significantly predict follow-up exercise behaviour. Bassett and Prapavessis (2011) also used factual information in the form of persuasive messaging and found that in physiotherapy rehabilitation, patient beliefs about severity, vulnerability and response efficacy could be influenced but there were no changes in self-efficacy and adherence behaviour. This study only recruited 73 participants so it may have been underpowered with more participants being required for adherence behaviour to reach significance. The authors also noted that the findings could have resulted because the majority of participants had been satisfied with earlier physiotherapy experiences. This could have alerted them to possible treatment requirements such as the undertaking of home-based exercise programmes leading to the inability to manipulate self-efficacy in the PMT intervention group.

Experimental studies across a variety of healthcare sectors (see Bui et al., 2013) point to the ability of the PMT constructs to predict and promote behavioural intentions, but their findings show a reduced ability of behavioural intentions to predict actual

behaviour. This has led to two studies trialling an action planning intervention as a means of closing the gap between behavioural intention and behaviour (Gaston & Prapavessis, 2009; S. Milne et al., 2002). Action planning involves formulating plans as to how, when and where the behaviour will be done and has been found to further the attainment of goals (Gollwitzer, 1999). The two PMT investigations endorsed the findings of Gollwitzer (1999) and showed that action planning strengthened the behavioural outcome considerably although a behavioural intention-behaviour gap still persisted.

The Health Action Process Approach

One of the criticisms of the SCT and the PMT is the apparent gap that exists between behavioural intentions and the implementation of actual behaviour. This gap has been addressed in the HAPA model (Figure 4) by employing action and coping plans (Schwarzer et al., 2011). The inclusion of this step has led to the division of the model into two distinct stages, a motivational stage that ends with a behavioural intention, and a volitional stage that ends with successful performance of the behaviour (Luszczynska & Schwarzer, 2003; Schwarzer, 2008a; Sniehotta, Scholz, & Schwarzer, 2005).

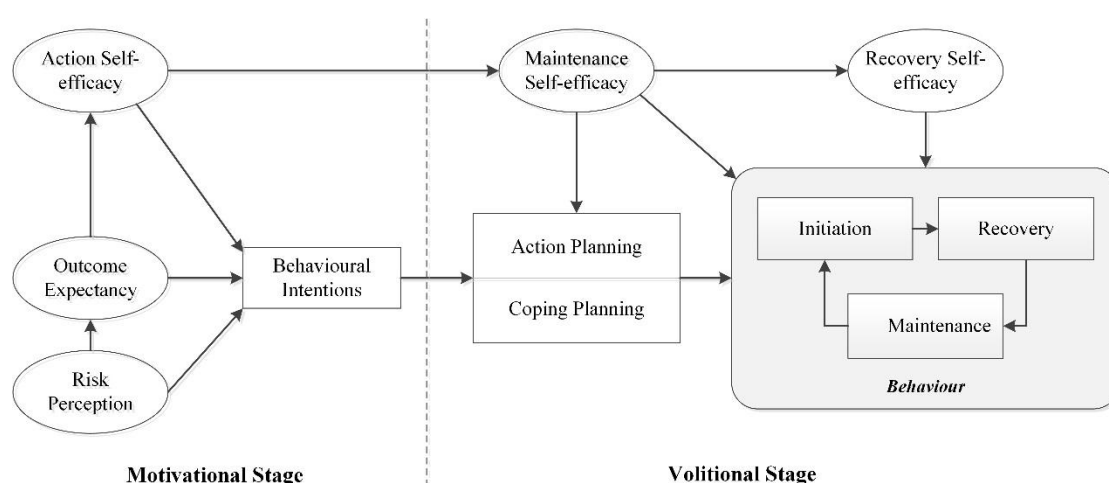


Figure 4. Generic diagram of the Health Action Process Approach.

Source: 'Modeling Health Behavior Change: How to Predict and Modify the Adoption and maintenance' by R. Schwarzer, (2008), *Applied Psychology*, 57, p6.

The motivational stage follows Bandura's SCT (Bandura, 1986) that has three antecedents leading to a behavioural intention. These are risk perception, outcome expectancies and self-efficacy which are thought to present in a causal order with risk perception the most distal and action self-efficacy the most proximal predictor of

behavioural intentions (see Conner & Norman, 2005). Change to this pattern may be influenced by personal experiences, with the impact of risk perception being dependent on the individual's awareness of the health threat which is usually greatest initially (Luszczynska & Schwarzer, 2003) and with outcome expectancies losing its predictive power after a decision to act is made (Schwarzer et al., 2011). Self-efficacy has consistently been found to be the most influential component of behaviour change, even though it has been shown to be situation specific with mastery of different actions requiring different self-efficacy beliefs at different stages of rehabilitation (Barg et al., 2012; Lippke et al., 2005; Scholz et al., 2005; Schwarzer et al., 2007). In the motivational stage individuals require confidence in their perceived ability to initiate the behaviour, hence action self-efficacy is crucial in the formation of behavioural intentions (Barg et al., 2012; Scholz et al., 2005; Schwarzer, 2008a; Schwarzer et al., 2007).

The volitional stage that follows the formation of behavioural intentions begins with planning which is divided into action and coping components. Action planning relates to where, when and how to carry out the behaviour (Schwarzer et al., 2011). In contrast, coping planning identifies possible barriers that may be encountered when undertaking the behaviour such as financial costs, situational constraints or lack of willpower, and plans are made to overcome them (Schwarzer & Fuchs, 1995). Once action and coping plans have been formulated they act as mediators between intentions and the behaviour (Sniehotta, Scholz, Schwarzer, et al., 2005). Action planning is thought to trigger automatic processes involved in initiating a behaviour while maintenance of the behaviour and its recovery require greater intentional processes should any lapse occur and is seen as essential in translating intentions into action (Gollwitzer, 1999).

Self-efficacy plays a key role in the volitional stage of the HAPA but during the course of the behaviour change, different behaviours to those required in the motivational stage need to be undertaken and require specific self-efficacy beliefs for successful mastery (Scholz et al., 2005). So while action self-efficacy is important in forming a behavioural intention in the motivational stage, maintenance self-efficacy is critical to the individual's belief that they are capable of acting and maintaining a behaviour despite obstacles encountered in the volitional stage. If lapses occur in the behaviour, recovery self-efficacy is required to focus one's attention and resume the

behaviour (Scholz et al., 2005). Cues that foster the desired behaviour, such as email reminders, can target these self-regulatory skills and have been shown to result in increased behavioural adherence (Latimer, Martin Ginis, & Arbour, 2006; Lippke, Ziegelmann, & Schwarzer, 2004b; Luszczynska & Sutton, 2006; Sniehotta, Scholz, & Schwarzer, 2005; Sniehotta, Scholz, Schwarzer, et al., 2005).

Non-Experimental Studies in Exercise Rehabilitation

Many studies point to action self-efficacy and outcome expectancies being significant predictors of behavioural intentions (Barg et al., 2012; Lippke et al., 2004a; Luszczynska & Schwarzer, 2003; Sniehotta, Scholz, & Schwarzer, 2005). In two longitudinal studies involving 484 and 307 participants undertaking cardiac rehabilitation programmes, both found action self-efficacy and outcome expectancies were significant predictors of intentions although action self-efficacy was stronger than outcome expectancies in both studies (Scholz et al., 2005; Sniehotta, Scholz, & Schwarzer, 2005). Further, a longitudinal study comprised of 368 individuals undertaking orthopaedic rehabilitation found that only action self-efficacy predicted behavioural intentions and that it was not predicted by either outcome expectancies or risk perception (Ziegelmann & Lippke, 2007).

The ability of risk perception to predict behaviour is inconsistent. Several studies have shown that this construct does not predict behavioural intentions (Barg et al., 2012; Lippke et al., 2004a, 2005; Luszczynska & Schwarzer, 2003; Schwarzer et al., 2007; Tavares & Plotnikoff, 2008). In a study of 423 orthopaedic patients Lippke et al. (2005) found that risk perception was not important for participants who had already formed an intention. These participants had moved beyond the initial health threat and therefore their injury/disorder may no longer have been impacting on their behavioural intentions (Schwarzer, 2011). Schwarzer et al. (2007) also found in a study involving over 1300 participants that risk perception was not significantly correlated to behavioural intentions across three different preventative behaviours which were seat belt use, dietary behaviour and physical activity. In contrast, risk perception was a significant predictor in the two cardiac rehabilitation studies (Scholz et al., 2005; Sniehotta, Scholz, & Schwarzer, 2005). Schwarzer and Renner (2000) argued that the importance of the antecedents are dependent on which construct is more central in the formation of the behavioural intention. Thus, for cardiac patients the perceived risk of not partaking in exercise rehabilitation may have a greater influence on their intention to

exercise compared to participants involved in preventative behaviours who have no experience of the disorder they are endeavouring to prevent. Hence, while the influence of risk perception may be dependent on the type of injury/disorder, overall the findings suggest that it is the weakest of the three determinants of behavioural intentions.

Many correlational studies have found the inclusion of planning which takes place after the formation of behavioural intentions has a considerable impact on behaviour change (Lippke et al., 2004a, 2004b; Luszczynska & Schwarzer, 2003; Schwarzer et al., 2008; Schwarzer et al., 2007; Sniehotta et al., 2006a; Sniehotta, Scholz, & Schwarzer, 2005). A longitudinal study involving 307 cardiac patients undertaking an exercise programme showed planning mediated between intentions and physical activity (Sniehotta, Scholz, & Schwarzer, 2005). Moreover, Lippke et al. (2004a) found evidence that planning was a proximal predictor of behaviour in a group of 509 orthopaedic patients undertaking a rehabilitation programme. While there is general agreement that planning does influence behaviour another study involving 175 generally healthy inactive women found no support for planning in predicting physical activity (Barg et al., 2012). Reasons suggested for this were attributed to the physical activity being a non-prescribed and leisure time measurement compared to studies that typically used a clinical population attending scheduled rehabilitation sessions.

Action planning is important in initiating physical exercise. Scholz et al. (2005) found that action planning that involves when, where and how to exercise predicted physical activity in cardiac patients four months after discharge from hospital although its influence was not significant at 12 months. Coping planning on the other hand, was a better predictor of long-term maintenance of the behaviour (S. Milne et al., 2002; Scholz et al., 2005). Sniehotta et al. (2006a) suggest that once a pattern has been established and the behaviour becomes routine, coping plans may be required to maintain the action. Moreover, coping planning may not be a strong predictor of behaviour in the early stages of rehabilitation but once the behaviour has been undertaken and experience gained, a more realistic view of obstacles or difficulties may emerge (Sniehotta et al., 2006a). Hence, coping planning for patients who have previously undertaken exercise rehabilitation may be a more reliable predictor of behaviour, since these individuals have a better perception of the obstacles that may be encountered.

Maintenance self-efficacy was a strong predictor of physical activity in a group of 175 inactive women four weeks after recruitment (Barg et al., 2012) and for cardiac patients two months after discharge from hospital (Scholz et al., 2005). This may have occurred because the participants in both studies were aware of the obstacles that could be encountered after this duration and the extent to which they would be able to continue the behaviour. Scholz et al. (2005) also found that recovery self-efficacy influenced physical exercise in individuals whose exercise programme had been interrupted over the 12 month duration of the study, but had no impact on those individuals who had exercised continuously over the period. It could be expected that participants who experienced a relapse and had recovered from it would have greater recovery self-efficacy than those participants who had maintained their exercise programme and had not experienced a relapse.

Experimental Studies in Exercise Rehabilitation

Most HAPA intervention studies have targeted the constructs in the volitional stage of the model and have shown that action planning and especially coping planning can promote physical exercise in patients undertaking orthopaedic and cardiac rehabilitation (Lippke et al., 2004b; Luszczynska et al., 2011; Scholz et al., 2007; Scholz et al., 2005; Sniehotta, Scholz, Schwarzer, et al., 2005; Ziegelmann et al., 2006). The success of planning in promoting behaviour change may be dependent on the self-efficacy of the patient. Luszczynska et al. (2011) found that planning was effective in preventing lapse from regular running in a group of 187 active individuals with high self-efficacy over a two year duration, but was of no benefit to individuals with low self-efficacy. Furthermore, translating plans into action may be reliant on individuals being in the volitional stage. Lippke et al. (2004b) found in a study of 560 orthopaedic patients undertaking rehabilitation programmes, that individuals were unable to translate plans into actions if they were still in the motivational stage.

Methodological Issues Relating to the Health Action Process Approach

Overall the findings indicate that the HAPA model has been used successfully in both observational and experimental research to explain and enhance exercise rehabilitation across a range of injuries/disorders such as coronary artery disease (Dohnke et al., 2010; Scholz et al., 2007; Schwarzer et al., 2008; Sniehotta et al., 2006a; Sniehotta, Scholz, & Schwarzer, 2005; Sniehotta, Scholz, Schwarzer, et al., 2005) orthopaedic conditions (Lippke et al., 2004b, 2005; Ziegelmann et al., 2006;

Ziegelmann et al., 2007), and diabetes (Luszczynska et al., 2011). Many of these studies have had a large sample size, for example 560 participants (Lippke et al., 2005), although small studies with only 58 participants (Luszczynska et al., 2011) have also demonstrated the utility of the model. Differences in the findings have been mainly in the motivational stage when behavioural intentions are being formulated from the three antecedents; that is risk perception, outcome expectancies and self-efficacy. Methodological factors such as measurement tools, operationalization of the model and type of injury/disorder may account for some of these differences and are discussed below.

Questionnaires that have measured the HAPA variables have been relatively standard although some adaptations have been made to suit the behaviour change being investigated. For example, an item that measured behavioural intentions for cardiac participants on a four-point Likert scale (*strongly disagree* to *strongly agree*) was “*I intend to elevate my heart rate to the levels recommended in the rehab for at least 30 minutes three times a week*” (Sneihotta et al., 2006b). This compared to an item measuring behaviour intention for orthopaedic patients on a four-point Likert scale (*not at all true* to *exactly true*) that was “*I intend to perform special exercises for my back*” (Lippke et al., 2005). Questionnaires that have minimal wording changes as seen in these questions does enable comparisons across studies to be made. On the other hand a substantial change in wording that is used to measure the same variable may influence results. For example, risk perception has been assessed using comparative measures adapted from Fuchs (1996) such as “*Compared to other persons your age and sex how do you estimate your likelihood of...*” (Lippke et al., 2004a; Ziegelmann & Lippke, 2007) and by absolute measures adapted from Schwarzer and Renner (2000) such as “*If I keep my lifestyle the way it was prior to the acute treatment ...*” (Sneihotta et al., 2006a). The former comparative measure is recommended (Weinstein et al, 1998) as it is conditional on a specified behaviour which differs from an unconditional measure where respondents may take into account a possible future behavioural change that could be made when estimating their risk. Predicting future behaviour is not easy and responses are unreliable because participants may never have considered the issue before (Oyster, Hanten, & Llorens, 1987).

Studies that have used the HAPA have mainly drawn on questionnaires with good internal reliability for risk perception, outcome expectancies and phase specific self-efficacy with Cronbach’s alphas usually 0.70 or greater. However, the internal

reliability for behavioural intentions has been lower in some studies with Cronbach's alpha less than 0.70, such as 0.51 (Lippke et al., 2004a), 0.53 (Lippke et al., 2005) and 0.63 (Ziegelmann et al., 2007). Interestingly, these studies with lower Cronbach's alpha were associated with orthopaedic rehabilitation in contrast to cardiac rehabilitation (Scholz et al., 2005; Schwarzer et al., 2008; Sniehotta, Scholz, & Schwarzer, 2005). There are several reasons that may account for these differences. First, it may reflect the diverse behaviours required in orthopaedic rehabilitation where clinic- and home-based treatments are undertaken for specific body regions such as the shoulder or hip. In contrast, lifestyle changes involving general exercise programmes are commonly recommended to cardiac and diabetic patients. Second, the questionnaires assume participants have knowledge of the required behaviours. For instance the following item *"I intend to perform fitness and muscle strengthening activities."* assumes participants have knowledge of what fitness and muscle strengthening activities are. Third, some items measuring behavioural intentions may be very similar and lack clarity because of insufficient differentiation. An example is *"I intend to exercise for 20 minutes on at least 2 days per week on a regular basis"* and *"I intend to exercise for 20 minutes on at least 2 days per week sometimes (at least once a month)"*. The second statement may be seen as redundant which could confuse participants and lead to an inaccurate response. Fourth, Cronbach's alpha could be lowered by behavioural intentions in questionnaires when items ask for diverse behaviours. For example *"I intend to exercise occasionally for 20 minutes ..."* *"I intend to perform fitness and muscle strengthening activities"*, *"I intend to perform special exercises ..."* and *"I intend to be physically active ..."* (Lippke et al., 2005). These questions require different behaviours which were reflected in a lower Cronbach's alpha (< 0.6) of the questionnaire.

Correlations between the variables generally support the HAPA model although the strength of correlations between risk perception and behavioural intentions tends to be variable. This association may depend on the type of injury/disorder under investigation and its impact on the individual. For example non-life threatening conditions such as many orthopaedic conditions may result in a weaker association between risk perception and behavioural intentions (Lippke et al., 2004a; Schwarzer et al., 2008; Schwarzer et al., 2007; Ziegelmann et al., 2007) compared to life threatening conditions such as coronary artery disease (Scholz et al., 2005; Schwarzer et al., 2008). For individuals in non-life threatening situations the perception of risk may be less

important than their treatment expectancies and the confidence in their ability to undertake it. Hence the association between risk perception and behavioural intentions may be weaker than that between outcome expectancies and behavioural intention, or self-efficacy and behavioural intentions. Traditionally the fear appeal approach uses risk communication such as *“If I continue my lifestyle, I have a high likelihood of developing severe health problems.”* (Schwarzer et al., 2007) which has been found less successful than resource communication that challenges what an individual could gain from the behavioural change. A response to, *“If I exercise regularly I am more likely to reduce my risk of developing health problems”* demonstrates the difference using resource communication (for review see Ruiter, Abraham, & Kok, 2001).

While these methodological issues may have influenced outcomes in the motivational stage, there are other methodological factors that warrant attention in the volitional stage. Firstly, operationalizing action and coping plans need to be consistent as different approaches could affect the quality of the planning intervention. In most studies participants received planning sheets which contained instructions for formulating their action and coping plans with interviewers being available to answer any concerns in a nondirective manner (Gaston & Prapavessis, 2012; Lippke et al., 2004b; Scholz et al., 2007; Sniehotta, Scholz, Schwarzer, et al., 2005). In these studies the entire planning intervention was reported as taking between five and ten minutes. Other studies have had assistants who aided the formulation of plans through empathetic listening, eliciting self-motivating statements and responding to resistance (Ziegelmann et al., 2006). They found under these circumstances that more complete action plans were made which resulted in longer periods of adherent exercise participation in orthopaedic patients. Luszczynska et al. (2011) also found more complete plans were made over a duration of 15 and 25 minutes when assistants gave feedback and complimented participants on their successful formation of action plans. Thus, assisted planning may lead to more comprehensive planning than that which is self-administered.

The type of injury/disorder may be one factor that needs to be taken into account when determining the length of a study. For example, the rehabilitation period for acute sports injuries or postsurgical musculoskeletal conditions is likely to extend over a shorter period of time such as four to 12 weeks (for example see Bassett & Prapavessis, 2011; Grindley et al., 2008) compared to recommended exercise programmes that are prescribed for people with coronary artery disease and diabetes which could extend over

a year (Scholz et al., 2005) or more (Luszczynska et al., 2011). The duration of the rehabilitation is also likely to vary when a diverse range of conditions are being investigated. Participants in the study of Lippke et al. (2005) involving orthopaedic injuries/disorders included spinal diseases; surgery of bones, joints, muscles or ligaments; constraints in movement; chronic pain; arthrosis and arthritis; and stroke which have differing rehabilitation periods. Therefore, while noting that stroke is a neurological condition rather than an orthopaedic one, the appropriate time for these injuries/disorders would vary making the external reliability of any findings difficult.

Summary

Research into the influence of self-efficacy on adherence has been mainly cross-sectional or correlational in design and while these studies have identified the core determinants of behaviour such as self-efficacy they have not been able to determine cause and effect relationships (Weinstein, 2007). A smaller group of experimental studies have used social-cognitive models suitable for physiotherapy practice to research the causal pathways. These models include SCT, PMT and the HAPA.

Research in health behaviour has shown that perceived self-efficacy is one of the most influential determinants in the formation of behavioural intentions and in bringing about behavioural change. This is evident in it being a prime construct in all major social cognitive theories (see Conner & Norman, 2005). In SCT, self-efficacy is the main predictor and antecedent of behaviour (Bandura, 1997). Its strength in intervention studies relates to the application of specific theory-based techniques such as mastery, vicarious behaviour or verbal persuasion that can be used to enhance self-efficacy. However, SCT fails to differentiate between the specific attitudes and beliefs that are required in the formation of a behavioural intention and those that are required to initiate and maintain the actual behaviour. Moreover, there is no provision for attempting to close the gap that exists between behavioural intentions and actual behaviour.

PMT research has identified self-efficacy as the most reliable and robust factor influencing exercise related behaviour and suggests that coping appraisals are more influential than threat appraisals, (Bui et al., 2013; Floyd et al., 2000; S Milne et al., 2000; Plotnikoff & Trinh, 2010). Experimental manipulations that target the PMT constructs especially coping appraisals can generally enhance behavioural intentions and behaviour. Nevertheless, the PMT associations are commonly weaker in clinical

experimentation where factual rather than fabricated information has been delivered (S Milne et al., 2000). Ethical considerations limit the use of PMT as issues arise when fabricated information is delivered to participants who have sought treatment. Coupled with this limitation, the gap between behaviour intentions and actual behaviour persists as it does in SCT.

The findings from non-experimental and experimental studies indicate that the HAPA model can successfully bring about changes over different sectors of healthcare and endorse the division of the HAPA into motivational and volitional stages. As in other social-cognitive models, self-efficacy has emerged as a prime construct but in the HAPA it has been differentiated into action-, maintenance- and recovery self-efficacy. Research points to the importance of targeting these phase-specific self-efficacies for successful manipulation of the HAPA constructs and may help address the intention-behaviour gap (Luszczynska & Sutton, 2006; Sniehotta, Scholz, & Schwarzer, 2005). In addition action and coping planning have been specifically introduced to mediate between behaviour intentions and actual behaviour. Thus the HAPA has addressed both the specific nature of self-efficacy and the intention-behaviour gap. Therefore the HAPA model which extends and develops the constructs of SCT and has not thus far been tested in physiotherapy rehabilitation will be the social cognitive model of choice to be used on homogeneous musculoskeletal injuries/disorders for the purpose of the research for this thesis.

Chapter 4. Patient Education and Information Delivery

Introduction

Patient education is generally regarded as an integral component in physiotherapy (Chase, Elkins, Readinger, & Shepard, 1993; May, 1983; J. Miller, Litva, & Gabbay, 2009; Nijs, Roussel, van Wilgen, Koke, & Smeets, 2013; Rindflesch, 2009; Sluijs, Kok, et al., 1993; Sotosky, 1984; Wulf, 2007) which is reflected in the daily practice of physiotherapists with 90% or more delivering some form of education to their patients (Chase et al., 1993; May, 1983; Sotosky, 1984). Within New Zealand its importance is recognised by the Physiotherapy Board where one of the competencies states ‘Apply educational principles to physiotherapy practice’ and by the code of ethical principles developed conjointly by the Physiotherapy Board and Physiotherapy New Zealand (2011) which specifies that patients are entitled to be clearly informed about their treatment. Moreover, across the health sector in general the demands on the health budget are increasing (Heffler et al., 2004), leading to more focus being placed on patient self-management, which in turn demands greater emphasis on patient education (Bodenheimer, Lorig, Holman, & Grumbach, 2002).

Bartlett (1982) described patient education in broader terms than the imparting of information by defining it as ‘a planned learning experience using a combination of methods such as teaching, counselling and modification techniques which influence patients’ knowledge and health behaviour’ (p323). This definition indicates that patient education should not only be informative but that behaviour changing strategies should be integrated into patient education programmes. In physiotherapy rehabilitation, such approaches are important as unsupervised home-exercise programmes are usually prescribed. Thus patients are required to understand the information they have been given so instructions on how to perform exercises at home need to be clear and strategies need to be devised that enable patients to accommodate them into their daily routine. To facilitate this process techniques that incorporate multimedia, defined as the use of words and pictures (Mayer, 2001), may be an appropriate format to employ. Furthermore, with computers now being a common household device in the 21st century (U.S. Department of Health & Human Services, 2014) a computer interface may provide a suitable platform for delivering patient education. This chapter will discuss the issues involved in providing patient education by focusing on the techniques used to communicate medical information effectively, methods of delivery that can be

employed to convey the information and the design of multimedia programmes based on the Cognitive Theory of Multimedia Learning (Mayer, 2001).

Techniques for Communicating Medical Information

Patients often fail to understand the meanings of words that healthcare professionals use and they are reluctant to ask for more information (Ley, 1988). Consequently patients often forget a lot of what they are told or they may recall the information inaccurately. There are seven communication techniques that can be used by physiotherapists when educating patients. First is the simplification of language so that simple words are used in preference to medical terms or technical jargon. When the information is conveyed to patients in shorter sentences using simple terms, patient recall and understanding improves (Ley, 1988). It has also been shown to improve patient satisfaction (George, Waters, & Nicholas, 1983) and sometimes result in better adherence (Estey, Musseau, & Keehn, 1991; Ley, 1988). Second, repetition of information by the physiotherapist can be used to increase recall (Ley, 1988; Reid et al., 1995). Ley (1979) found that across six studies the average mean recall of information that was repeated by the presenter increased from 33% to 47%.

Third, explicit categorisation or alerting patients to categories of information in advance has been reported to help patients remember the material and in some cases improve adherence (Falvo, 2004; Ley, 1988; Reid et al., 1995). Explicit categorisation of information is thought to have been a possible factor that increased adherence in a study that tested the effects of treatment goals on adherence (Bassett, 1996). Fourth, messages that are delivered to patients first are better recalled, therefore the most important information should be given at the start of a treatment session (Ley, 1988). Testing this primacy effect, Ley (1988) found 86% of patients were able to recall instructions and advice when they received the information at the beginning of the treatment, compared to 50% of patients who received the instructions and advice following other information.

Fifth, targeting and tailoring information so that it pertains to a group or individual's situation is perceived by patients as being more important than communication that is expressed in general terms, and may encourage better adherence. Kreuter and Wray (2003) found that targeted material could be as effective as personally tailored information as long as the communication was a 'good fit' to the individual's needs. Communication that makes messages more personal includes the

use of the active voice so the patient becomes the doer of the action (Ley, 1988; Reid et al., 1995; Sluijs, van der Zee, & Kok, 1993). For example, 'patients find the best time to do their exercises is after dinner' uses active voice compared to 'exercises are best done by patients after dinner' which uses passive voice.

Sixth, spreading educational activities over the course of treatment should prevent patients being overloaded with information (Sluijs, 1991). Two studies found that patients receive nearly twice as much information relating to home exercise instructions, their disorder and advice in the first two treatments and at their final treatment compared to other times (Gahimer & Domholdt, 1996; Sluijs, 1991). This can overload patients with new information at the beginning of their course of physiotherapy which may predispose them, especially older patients, to forgetting the information and therefore being less adherent (Ley, 1988; Rastall et al., 1999). Moreover, patients forget a considerable amount of what they are told, particularly when they are anxious and in pain, which is more likely to occur in the initial stage of their physiotherapy (Ley, 1988). Interestingly, Sluijs (1991) found that in the final treatment session, instead of physiotherapists giving patients information about ways to cope with their injury/disorder or prevent recurrence of it as may have been expected, they continued to give patients more information and advice about their injury/disorder.

Seventh, planning treatments may be required if techniques that foster understanding are to be incorporated into patient education, especially as physiotherapists generally feel inadequately prepared to teach patients (May, 1983; Sotosky, 1984). This may be because physiotherapists (i) often educate their patients informally as part of the treatment session (Gahimer & Domholdt, 1996; Sluijs, 1991); (ii) need to adjust treatments to patient circumstances; and (iii) have difficulty translating medical terminology into lay language that is easily understood by patients (Sluijs, van der Zee, et al., 1993). Rindflesch (2009) has shown more recently that experienced physiotherapists were competent at unplanned and impromptu patient education and that they had difficulty separating the practice of physiotherapy from patient education. The probability of omitting information is likely to increase when patient education is unplanned and it may be necessary especially for those less experienced to devise plans to ensure information is disseminated simply and appropriately for patient understanding.

In summary, a planned and systematic approach that spreads information over the duration of the treatment period could bring about more efficient and effective patient education. This should include physiotherapists communicating in simple terms with patients, categorizing and repeating information, and prioritising the messages that are given. When information is communicated in this way and related to the patients' circumstances and daily routine, it leads to patients' having better recall, understanding and adherence. The optimal method used to impart information may depend on the type of message to be conveyed, the time frame required for patients to retain the information and the resources available (Wilson et al., 2010).

Delivery of Information

Information can be delivered to patients verbally in face-to-face encounters, using written material, watching videotapes and viewing or interacting with computer-based programmes. Chase et al. (1993) found that physiotherapists most often used verbal discussion, demonstration and tailored instruction sheets with sketches to deliver patient education, and that technical equipment or prepared material for teaching was rarely used. However, there have been rapid advances in information technology since the late 1980s and early 1990s when much of the research in patient education and adherence to home-based treatment programmes in physiotherapy practice was done (for example see Chase et al., 1993; Ley, 1988; Sluijs, 1991; Sluijs, Kok, et al., 1993; Sluijs, van der Zee, et al., 1993). This has resulted in the emergence of more sophisticated educational material being delivered via computers through compact disc (CD), digital video disc (DVD) and the internet. This section will review verbal communication, written material, videotapes and computer-based programmes employed in patient education.

Verbal Information

The greatest exchange of information between patient and clinician is done verbally in face-to-face interactions (Ni et al., 2005). Not only does this provide the opportunity to educate patients but it presents a chance to establish trusting patient-clinician relationships which have been identified as highly important to physiotherapists (Chase et al., 1993; Sluijs, van der Zee, et al., 1993) and to patients (Friedrich, Cermak, & Maderbacher, 1996; Pizzari et al., 2002). Friedrich et al. (1996) found that patients were more adherent and more motivated to carry out their exercises in the presence of the physiotherapist and importantly were more likely to perform their

exercises correctly because of the feedback from the physiotherapist. During treatment sessions physiotherapists have the opportunity to demonstrate exercises which show patients how to perform the movements correctly. Supervision may lead to more accurate recall of the exercises (Rastall et al., 1999) and produce better outcomes for patients compared to unsupervised conditions (Friedrich et al., 1996). Face-to-face communication also enables information to be tailored to suit individual patients which can foster patient-clinician relationships, and facilitate understanding and adherence compared with non-tailored educational material (Bental, Cawsey, & Jones, 1999; M. K. Campbell, Honess-Morreale, Farrell, Carbone, & Brasure, 1999; Ley, 1988; Mazieres et al., 2008).

A problem associated with the delivery of verbal information and instruction, especially for the elderly, is remembering the therapeutic exercises that are often prescribed by physiotherapists to optimise treatment outcomes. Failing to complete or adhere to the exercise regimen that is usually performed unsupervised at home may impact on treatment outcomes (Friedrich et al., 1996). Rastall (1999) found that when participants had to remember exercises for 30 minutes, healthy participants over 60 years of age had significantly poorer memory for exercises and remembered 6.27 out of 10 exercises compared to healthy younger participants between the ages of 18 to 35 who remembered 8.53 out of 10 exercises. There was however no significant difference in memory between the younger and older participants when a short list consisting of five exercises was tested. In other studies, participants over 65 years of age who were prescribed two exercises performed them better than participants who were prescribed eight exercises (Henry, Rosemond, & Eckert, 1998), although patients between 65 and 95 years of age did not remember three exercises well enough to perform them all effectively (Smith, Lewis, & Prichard, 2005). While there are slight variations in findings, these studies clearly identify that older patients have less ability to recall exercises than younger patients which needs to be considered when prescribing exercise programmes for older patients.

In general, most information between patient and clinician is done verbally which encourages the development of rapport between the two parties and enables information to be tailored to the patients' personal circumstances. Where therapeutic exercises are part of the treatment programme, face-to-face sessions enable clinicians to demonstrate exercises and give immediate feedback which patients find helpful. The problems that are encountered using verbal delivery are often associated with patients

not remembering what they have been told, overloading patients with information and clinicians using language that patients have difficulty understanding. Indeed Schneiders, Zusman, and Singer (1998) suggest verbal instructions should be supported with written or visual material as an educational strategy to help patients remember the exercises and hence improve adherence.

Written Information

Delivery of health information via brochures, pamphlets and booklets is not routine, although information and prescribed home exercises are sometimes given in this way to patients (Ley, 1988; Meade, McKinney, & Barnas, 1994; Morrow et al., 2005). Ley and Morris (1984) found that a patients' knowledge could be increased by as much as 97% using written information, and Schneiders et al. (1998) showed that adherence improved 77.4% when illustrations reinforced written information that was used in conjunction with verbal instruction. One advantage of written information is that it can be taken home by patients which enabled them to review the information in their own time. Wilson et al. (2010) found that when written material was taken home, patients had better recall of the health related messages. Schneiders et al. (1998) support this finding but suggested that written information that complements face-to-face treatment sessions may also assist understanding, stimulate memory and promote correct performance of exercises. Indeed Little et al. (2001) regarded written information as useful so long as it was the same information as that given verbally by clinicians.

Patients who have difficulty attending the recommended number of face-to-face treatment sessions may find written information a valuable resource. Circumstances that could give rise to this situation include patients living in rural areas with large distances to travel (Kingston, Gray, & Williams, 2010), those who have no transport, or patients that have financial or time constraints. These patients may be more dependent on written information to progress through a treatment programme than those attending regular clinic appointments where clinicians can directly monitor progress and offer support throughout the programme. Previously it has been found that if patients are given adequate written information and advice about their physiotherapy, they can undertake the majority of physiotherapy at home and only need a minimal number of clinic appointments (Bassett & Prapavessis, 2007). In this study the information was written in simple everyday language and illustrated with pictures and diagrams. In

comparison to the participants who had the usual number of physiotherapy clinic appointments those who undertook most of their treatment at home were not disadvantaged physically or psychologically.

The problems that can result from written information usually relates to the literacy level that the material is pitched at, the difficulty of the content and how the information is presented (Ley, 1988). To be effective any written material used for patient education should be written at a level that can be understood by the recipient. Low literacy generally and low health literacy in particular have been identified as a reason for poor understanding and adherence in various healthcare sectors (Estey et al., 1991; Morrow et al., 2005; Trifiletti, Shields, McDonald, Walker, & Gielen, 2006; Wolf, Davis, Tilson, Bass III, & Parker, 2006). Estey et al. (1991) have shown that comprehension of health information is improved when reading level is pitched at grade five (approximately 10 or 11 years of age), even for patients with high readability scores. This study found that health literacy levels may be lower than general reading ability because of the technical and specialised nature of health information.

The impact of written material may be affected by the way health messages are written. Messages that are framed to highlight the benefits of adhering to an exercise programme (a gain-frame) may be different from messages that are framed to highlight the consequences of not adhering to the exercise programme (a loss-frame). Gallagher and Updegraff (2012) clarified in a meta-analytic review and Tulloch et al. (2009) in a large study involving 787 participants with coronary heart disease, that gain-frames may be more effective in promoting behaviour change than loss-frames. Moreover, the use of negatively worded statements should be avoided as this can result in an incorrect message being remembered, particularly in older adults (Wilson & Park, 2008). For example, information for patients following a total hip joint replacement that includes the statement 'do not cross your legs when you sit down' may be recalled as 'cross your legs when you sit down' since older adults are at risk of remembering the opposite of the suggested information when written in a negative format (Wilson & Park, 2008). Thus, positive wording and framing of messages leads to instructional messages being received and interpreted more clearly by patients than their negative counterpart.

Pictures and diagrams are often given with written exercise instructions prescribed by physiotherapists (Lin, Lin, & Lin, 1997; Schneiders et al., 1998) which may assist understanding when presented alongside text (Mayer & Moreno, 2003). A

wide range of health studies, especially those relating to medication, have investigated how easily instructions are understood and have shown that illustrations and graphics can result in better comprehension and recall of information (Austin, Matlack, Dunn, & Brown, 1995; Choi, 2012; Dowse & Ehlers, 2005; Kripalani et al., 2007; Michielutte, Bahnson, Dignan, & Schroeder, 1992; Weeks et al., 2002). Michielutte et al. (1992) identified illustration and narrative text as being more effective with women who had lower reading scores than with women who had high reading scores, citing a possible reason as the illustrations and/or narrative text increasing concentration and interest amongst the poorer readers. Schneiders et al. (1998) also suggested that illustrations of exercises alongside written information make instructions more attractive as well as more understandable and this encourages patients to read and adhere to them.

The physical packaging of educational materials associated with healthcare impacts on understanding and recall of information (Ley, 1988; Mayberry, 2007; McGee, 2010). The principles of good design and layout require establishing a clear hierarchy of prominent headings and subheadings which can be emphasised by using, for example, enlarged font sizes or bold type face. Within the body of the text a font size no smaller than twelve point should be used and its readability can be improved by justifying the text to the left margin but not the right, and linking written text through appropriate line spacing. Bulleted and numbered lists may be used to identify important information (Mayberry, 2007; McGee, 2010). The application of these formatting techniques when developing educational material influences recall and understanding and may lead to better patient care (Ley, 1979, 1988).

Although the effectiveness of written information is optimised when it is simple, accompanied by illustration and has clear design and layout, it may still not be effective for all population groups, such as elderly patients and those with low literacy. Smith et al. (2005) found that patients between the ages of 65 and 95 years did not remember their exercises effectively even when an instruction sheet was provided to reinforce face-to-face instruction. Similarly, Wolf et al (2006) found that even though written information had been simplified some patients with low literacy continued to have difficulty interacting with it and still experienced comprehension problems. Additional supervision or different interventions may be more suitable for promoting the correct exercise and its performance for these population groups.

Video Information

Videotapes for patient education have been used in a wide range of healthcare sectors where they have been found to be an effective way of providing education and instruction (Meade, 1996; Meade et al., 1994; J. Miller et al., 2009; Sweeney, Taylor, & Calin, 2002). This medium can combine various resources such as movie clips, graphics, sounds, animations, illustrations and text. When both visual and auditory senses are utilised simultaneously, such as when watching an animation with voiceover, videotapes are considered to be a more powerful educational tool than written information, even when written information features both words and illustrations (Baddeley, 1996; Chandler & Sweller, 1996; Mayer, 2001).

Patient knowledge has been enhanced by videotapes across many healthcare areas including back surgery (Deyo et al., 2000), polio vaccinations (Leiner, Handal, & Williams, 2004), colon cancer (Meade et al., 1994), knee joint replacement (Lin et al., 1997), and physiotherapy for shoulder and back pain (J. Miller et al., 2009). Generally the findings suggest they are especially worthwhile for patients with low literacy (Leiner et al., 2004; Lin et al., 1997; Meade et al., 1994; J. Miller et al., 2009) and the elderly (Lin et al., 1997). These two groups of patients may benefit most from videotapes because they can take more time for learning which enables them to review material at their own pace, repeat information as necessary, and when viewed in a safe environment such as their home they can do so without pressure or embarrassment.

In physiotherapy, videotapes which often demonstrate prescribed home-based exercise programmes have largely been developed as an adjunct to clinic consultations and are used by patients for self-management between treatments (J. Miller et al., 2009; Roddey, Olson, Gartsman, Hanten, & Cook, 2002; Weeks et al., 2002). The effectiveness of this form of delivery has been contradictory. Some studies have found videotapes that teach exercises were superior to written instructions and resulted in patients performing exercises more accurately (Lin et al., 1997; J. Miller, Stanley, & Moore, 2004; Weeks et al., 2002; Wilson et al., 2010; Yildirim, Merde, Toprak, Yalcyn, & Irmak, 2007) and being more confident that they were doing them correctly (J. Miller et al., 2009; Weeks et al., 2002). Other studies have shown that customised videotapes used in a home-based exercise programme had no advantage over written exercise instructions (Lysack, Dama, Neufeld, & Andreassi, 2005). This finding aligns with Schoo et al. (2005) who found that when older patients with osteoarthritis were given a

videotape in addition to written and verbal exercise instructions they did not improve the correctness of their exercise performance. Sample numbers were small in these two studies which may have compromised results. Furthermore, in the study by Schoo et al. (2005), face-to-face meetings with the therapist plus the written instructions given to patients may have already enhanced comprehension and accounted for the videotape not leading to further improvement. In a different area of healthcare where procedural information was given about using an asthma inhaler, Wilson et al. (2010) found that the video intervention was better than printed material over a short term, but there was no difference between the two groups one week later.

The motivation for patients to adhere to an exercise programme has been found to increase with the use of videotapes. Bandura (1997) hypothesised that observational learning has a strong motivational impact and when applied clinically may encourage patients to practice their exercises having observed them being modelled on the videotape. Indeed Weeks et al. (2002) compared static (photographs) and dynamic modelling (videotape instruction), and found that the motivation to perform exercises at home increased in the static modelling group after they were exposed to the dynamic modelling videotape. Conversely, the motivation of the dynamic modelling group was reduced when they were exposed to the still-photograph illustrations. This research was consistent with that of Miller et al. (2009; 2004) who found videotapes were both popular and motivating for patients undertaking home exercises for shoulder and back pain.

The findings of Roddey, Olsen, Gartsman, Hanten, and Cook (2002) supported the use of videotapes in an unsupervised environment even though they found no significant difference in overall self-reported functional outcomes when compared to face-to-face instruction by a physiotherapist following rotator cuff surgery. This study showed that patients were not disadvantaged if they were offered only one of the two methods of instructions, that is either face-to-face or videotape instructions, for the home-based portion of their rehabilitation programme. Since home-based rehabilitation is common practice following orthopaedic surgery, such as for shoulder surgical repairs and joint replacements, videotapes may be an effective alternative to face-to-face patient education. Periodic monitoring of progress may be required if the rehabilitation extends over several months, as studies have shown that patients become less adherent to home-based programmes if they are prescribed for long periods of time (Pisters, Veenhof, Schellevis, et al., 2010; Sluijs & Knibbe, 1991; Sniehotta, Scholz, Schwarzer, et al.,

2005). Reducing face-to-face treatment session by either monitoring progress combined with videotape or by using videotapes alone would save time for both physiotherapist and patient and have financial implications for both parties.

In summary, videotapes that have been developed for physiotherapy practice are a useful option for delivering patient education and exercise instructions. The main benefits are that they give patients more confidence they are performing their home exercises correctly (Lin et al., 1997; Weeks et al., 2002) and they can motivate patients to adhere to their home-based exercises (J. Miller et al., 2004; Weeks et al., 2002). Videotapes can be as effective as face-to-face instruction (Lin et al., 1997) and appear to be suitable for elderly patients and those across a range of literacy levels (Meade et al., 1994).

Computer-Based Information

CBPE has evolved particularly over the last decade as advances in software have made the development of programmes easier and more cost effective (Wilson et al., 2012). A variety of media have been used to access the programmes which includes CDs, DVDs and websites (see Wantland, 2004). The advantage of CDs and DVDs over websites is that patients who have computers but no internet facilities such as those living in remote areas, can access CBPE programmes. The downside of this software is that changing or upgrading content is expensive and time consuming. On the other hand, web-based programmes can be accessed from any computer with internet facilities and information can be updated easily with programmes having the potential for patients to enter data which can be monitored in real time.

Computer-based programmes have similar features to videos and can accommodate an array of resources which include movie clips, animations, sounds, photographs, illustrations and text. Unlike videos, CBPE does not run in a linear fashion from start to finish but can have a variety of navigational pathways with the user being able to determine which pathway to use. This interactive capability differentiates CBPE from other traditional patient education material, creates interest and enables patients to take greater control over their learning (Stemler, 1997). Interactivity can range from selecting items that provide information such as instructions on how to perform activities (C. Lewis, Gunta, & Wong, 2002) through to patients inputting information that is targeted to group features (Kreuter & Wray, 2003) or tailored to personal characteristics (Jerant et al., 2007). These navigational and interactive features

facilitate understanding and recall of information by enabling patients to review material in a self-determined order (Keulers, Keulers, Scheltinga, & Spauwen, 2006), work at their own pace and repeat information as needed (Ley, 1988).

Much of the research that has explored the use of CBPE programmes has been associated with providing information to (i) assist decision making in health-related contexts (see Sheehan & Sherman, 2012); (ii) educating patients about their disease or disorder, for example rheumatoid arthritis (Wetstone et al., 1985), hypertension (Consoli et al., 1995) and heart failure (Stromberg, Ahlen, Fridlund, & Dahlstrom, 2002; Stromberg et al., 2006), or (iii) informing and preparing patients about forthcoming procedures such as surgical repair for carpal tunnel syndrome (Keulers et al., 2007), hip and knee arthroplasty (C. Lewis et al., 2002; Lysack et al., 2005), colonoscopies (M. Shaw, Beebe, Tomshine, Adlis, & Cass, 2001), or coronary catheters and endoscopies (Enzenhofer et al., 2004). Of these studies, the six that measured knowledge all found significant improvements (Enzenhofer et al., 2004; Jenny & Fai, 2001; C. Lewis et al., 2002; Stromberg et al., 2002; Stromberg et al., 2006; Wetstone et al., 1985), and of the five studies that measured patient satisfaction, four found that patients were either satisfied or more satisfied with CBPE than traditional patient education (Enzenhofer et al., 2004; C. Lewis et al., 2002; Stromberg et al., 2002; Wetstone et al., 1985). Other outcome measures found that the computer programme increased participant self-efficacy (Jenny & Fai, 2001; Yeh et al., 2005) and one study found an increase in the use of self-management behaviours for rheumatoid arthritis that involved joint protection and rest (Wetstone et al., 1985).

CBPE programmes can target or tailor information to suit the characteristics of a group such as gender, age, ethnicity and behaviour (for example see Ministry of Health, 2011) or individual patients (van Stralen, de Vries, Mudde, Bolman, & Lechner, 2011). Customising information in this way encourages patient involvement (Murphy, 1998) and it may be better remembered generally as programmes are perceived to be more relevant to individuals compared with educational material that is not targeted or tailored (Kreuter & Wray, 2003). This has resulted in greater behavioural change than standard, non-customised materials (M. K. Campbell et al., 1999; Noar, Benac, & Harris, 2007; van Stralen et al., 2011) and has been shown to enhance understanding and adherence (Bental et al., 1999). Sizable effects on adherence behaviour using tailored computer-based education have been found in health related areas such as physical activity of older adults (van Stralen et al., 2011), nutrition (Brug, Steenhuis,

van Assema, & de Vries, 1996), colorectal cancer screening (Jerant et al., 2007), and smoking cessation (Etter & Perneger, 2001). Campbell et al. (1999) also found that a tailored multimedia nutrition programme given to low income women was a more effective health promotion strategy in comparison to print-based media for individuals with limited literacy skills and disadvantaged populations.

Elderly patients may benefit more from CBPE delivery than other forms of patient education. Hill et al. (2009) found patients aged 60 years or older who were recruited from a hospital setting had better uptake of information, modification of beliefs and perceptions, and were more motivated to participate in protective health strategies following a DVD-based programme on falls prevention compared to a written workbook. Yeh, Chen and Liu (2005) also found older participants who had undergone total hip joint replacements achieved higher self-efficacy, needed less assistance to perform functional activities and had a shorter hospital stay after CBPE than the control group who received routine care. The findings of Yeh et al. (2005) should nevertheless be interpreted with caution since this was a quasi-experimental design with no specific self-efficacy enhancing strategies. Other studies in cardiac rehabilitation and heart failure have shown that elderly patients who were less well educated were not disadvantaged by using CBPE programmes. This group had better knowledge than patients who had tutorial-based education and individualised face-to-face education (Jenny & Fai, 2001; Stromberg et al., 2002). Stromberg et al. (2002) also found that although patients were elderly, with a mean age of 74 years, they preferred using the computer to watching a videotape or reading a booklet about heart failure.

Knowledge acquisition has been the most consistently reported significant finding of CBPE studies (for review see Fox, 2009; D. Lewis, 1999). Less evidence has emerged to suggest that CBPE programmes are superior to traditional methods in bringing about a change in health behaviour (for example see Homer et al., 2000; C. Lewis et al., 2002; Stromberg et al., 2006), although other investigations have reported that they are more effective than written material (Hill et al., 2009) and routine instructions (Wetstone et al., 1985). The lack of consistency in findings may in part be due to the range of study designs, outcome measures and strategies used to bring about such behaviour change. It may also in part be due to studies which have no theoretical underpinning to guide the research.

Two CBPE programmes that have used a theoretical approach successfully (the TTM: Prochaska & De Clemente, 1983) to bring about behaviour change were for eating disorders (Irvine, Ary, Grove, & Gilfillan-Morton, 2004) and smoking cessation (Etter & Perneger, 2001). These results suggest a CBPE programme that incorporates theoretically guided behaviour change strategies may be a valuable treatment adjunct in physiotherapy where poor exercise adherence is a well-recognised problem in the home-based component of physiotherapy (Sluijs, Kok, et al., 1993). Given the previous evidence (see Chapter 3), a social cognitive model such as the HAPA would appear to be a suitable theoretical underpinning for patients who have already sustained an injury/disorder and are undertaking physiotherapy.

Rationale for Using Computer Based Patient Education

Learning and applying health related information and concepts are complex with patients needing to process, retain and accurately act on information (see Wilson et al., 2012). A broad set of cognitive skills is necessary to accomplish these tasks (Wilson et al., 2012) and the choice of interface to deliver the information may depend on the type of information to be conveyed (Wilson et al., 2010). Computer-based multimedia programmes that can incorporate videos, animations, sound and text appear to be a promising tool for delivering both procedural- and declarative-based patient education. Procedural knowledge entails knowing ‘how to do’ activities (Anderson, 1987) such as how to perform exercises correctly or ice a body part correctly and may be most effectively taught by demonstration. A combination of video clips and sound can substitute for face-to-face explanation and may utilise videotapes with sound to teach the activities. Delivery of information using this format may be especially helpful for elderly patients (Hill et al., 2009) and those with low-literacy (Choi, 2012; Wilson et al., 2010). Declarative knowledge on the other hand is knowing ‘what to do’ (Anderson, 1987) such as itemising activities in an exercise programme and may be delivered successfully through printed format. A combination of procedural and declarative knowledge is often given by physiotherapists to their patients who have been prescribed home-exercise programmes. Information which is both procedural and declarative could be accommodated in computer-based format which may be advantageous to patients because of the interest it can generate, and because it can be reviewed and repeated as needed.

The Cognitive Theory of Multimedia Learning

Medical literature has not fully identified and evaluated the principles of programme design that influence the effectiveness of delivery (Keulers et al., 2006). This requires a systematic approach based on learning theory to optimise the interactive components and deliver the most effective CBPE. The Cognitive Theory of Multimedia Learning (Mayer, 2001) provides a suitable framework for developing CBPE which is based on the organisation and presentation of different types of multimedia that facilitate understanding. This theory highlights the need to consider working memory and the cognitive demands placed on individuals and the effect of the modality employed during programme development.

The Cognitive Theory of Multimedia Learning (Clark & Mayer, 2008; Mayer, 2001) uses a learner-centred approach that is based on how the human mind functions to enhance meaningful learning. Focus is placed on design features and human processing systems in knowledge construction that use both words and pictures to present instructional messages. It assumes that incoming information is processed in two separate channels, one by the eyes that receives visual information such as printed words and graphics, and the other by the ears that receives auditory information such as spoken words and background noises (Baddeley, 1992). Because of the limited processing capacity of each channel, only a portion of this information is selected into working memory where it is temporarily held and consciously manipulated as images or sounds (Baddeley, 1992; Chandler & Sweller, 1991). Mental connections are made between the selected sounds and images with the building of these connections being important for conceptual understanding (Mayer, 2001). Within working memory the sounds and images are organised into verbal and pictorial mental models that are integrated with information that is brought from long-term memory where prior knowledge is stored as can be seen in Figure 5 (Mayer, 2001).

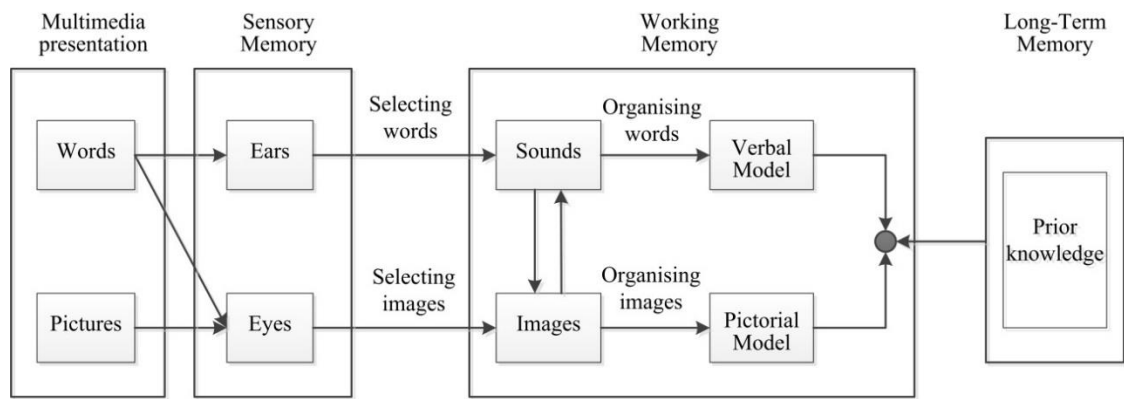


Figure 5. The Cognitive Theory of Multimedia Learning (Mayer, 2001, p44).

Processing of pictures (Figure 6a) and spoken words (Figure 6b) take a direct route through the eyes/visual image base and ears/word sound base respectively before being integrated with long-term memory. Printed words (Figure 6c) take a more complex route and are initially processed through the eyes with some of the words being selected into working memory to form the visual image base. Visual images are mentally converted into a word sound base which is subsequently processed in the auditory/verbal channel (Figure 6c). The processing route is thus different for written words which compete for attention when presented with any pictorial material. The most favourable conditions for increasing meaningful learning are therefore when words are presented in the auditory channel and pictures in the visual channel. This minimises the load in working memory and makes more cognitive resources available to form connections between words and pictures (Mayer, 2001).

Cognitive tasks activate working memory but because working memory has limited capacity, information is prioritized with some elements being ignored to prevent information overload (Baddeley, 1992, 1996). Effective design of programmes minimise the processing of information and frees cognitive resources that allow the user to focus on the most important information. According to Sweller (1994) and Sweller et al., (1998) there are two sources of cognitive load, intrinsic and extraneous. Intrinsic load refers to the inherent difficulty of the material, while extraneous load relates to design features and can be modified through organisation and presentation of information, such as format, font size, or use of colour. Well-designed multimedia minimises extraneous cognitive load so learners have a greater capacity to engage in intrinsic cognitive activities.

Mayer (2001) describes a number of principles that reduce extraneous cognitive load when implemented. The multimedia principle states that “*learning is better from words and pictures than words alone*” (Mayer, 2001, p63). This is based on the rationale that when words and pictures are presented together mental connections are constructed between the verbal and pictorial mental models which leads to more meaningful learning and conceptual understanding. The formation of these connections occurs because the information received from the two channels is not equivalent. Words for example, present information in a linear sequence that requires some mental effort to interpret or translate whereas pictures are nonlinear, and may be more intuitive and visually realistic. When words alone are presented, the learner may create a verbal mental model, but they are less likely to build a pictorial mental model and make connections between the two (Mayer & Anderson, 1992).

The modality principle forms a core element of the Cognitive Theory of Multimedia Learning and is based on the utilization of both the visual/pictorial and auditory/verbal channels which are available using computer-based technology (Moreno & Mayer, 1999). When information is presented via narration and pictures both channels are processing information which increases the effective cognitive capacity and reduces the potential to overload one channel whilst leaving the other relatively underused (Mousavi, Low, & Sweller, 1995). Thus pictures, including animations that accompany narration rather than written words, may make the best use of cognitive resources. Moreno and Mayer (1999) have found that if only one channel is utilised, such as in a document where written words are used with pictures, the most effective learning occurs when the text is placed close to the picture. This is known as the spatial contiguity principle (Mayer, 2001). Mayer (2001) suggests that there may be some circumstances when this may be as effective, if not more effective, than narration (voiceover) and pictures. For example, if animations are controlled by a scroll bar then the user controls the speed of the animation which enables information to be processed in one channel at a rate suitable to the user.

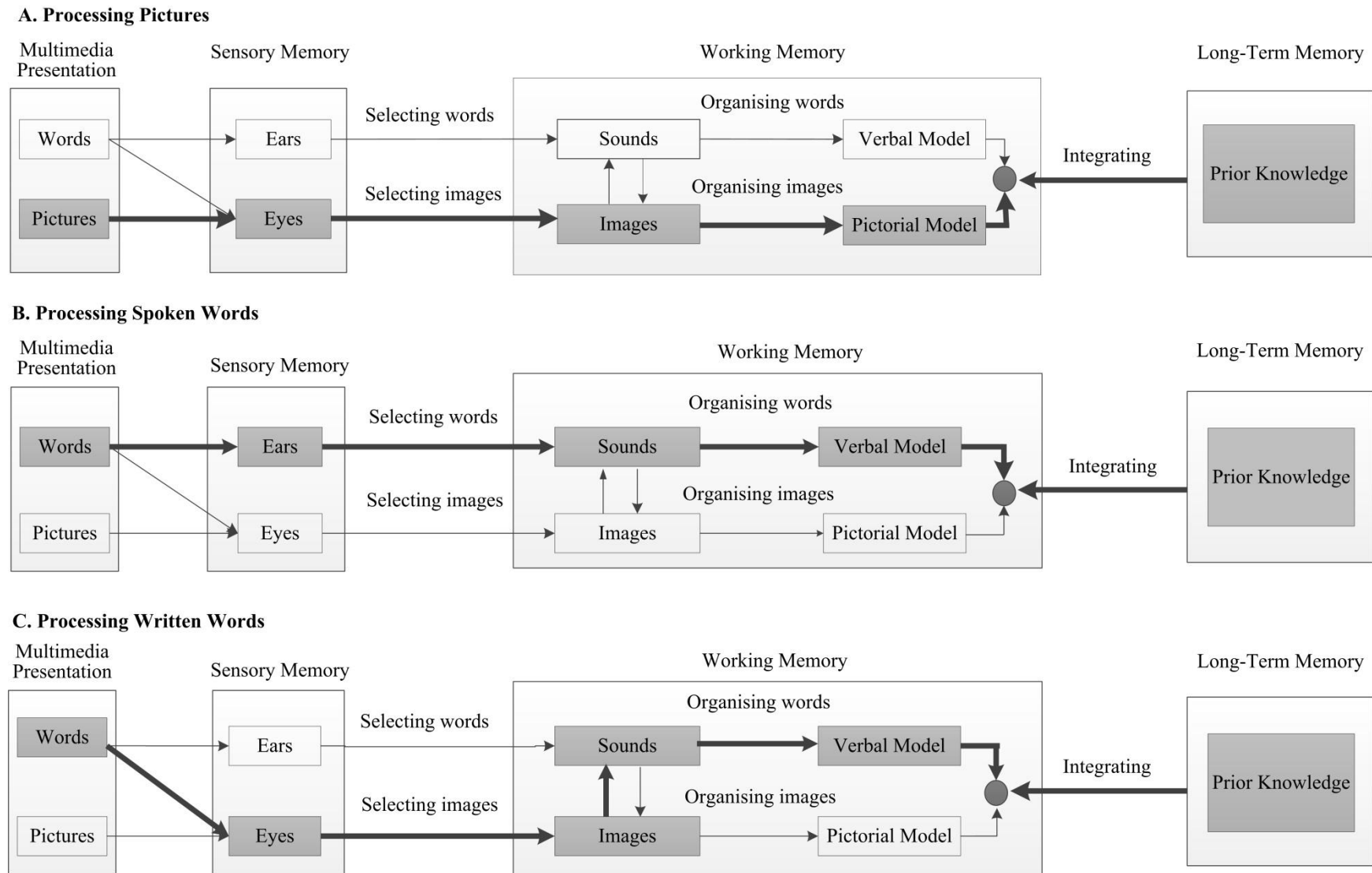


Figure 6. Processing (a) pictures, (b) spoken words, and (c) printed words in the Cognitive Theory of Multimedia Learning (Mayer, 2001, p59).

Other design features used to reduce extraneous cognitive load are (i) the presentation of words and pictures simultaneously (temporal contiguity principle) (Mayer & Anderson, 1992; Moreno & Mayer, 1999); (ii) the use of only pictures and words that are relevant to the topic (the coherence principle) (Moreno & Mayer, 2000); and (iii) the use of animation with narration rather than animation, narration and text (the redundancy principle) (Mayer, Heiser, & Lonn, 2001). While these principles affect a broad range of learners, there may be individuals who are more affected by the multimedia design than others. Mayer and Gallini (1990) found that reducing extraneous cognitive load benefitted low-knowledge learners more than high-knowledge learners which has led to the individual differences principle. Low-knowledge learners are less likely to be able to construct verbal models from printed text than high-knowledge learners and are therefore less likely to be able to form connections between verbal and pictorial channels which are required for deeper understanding. When multimedia messages are well designed low-knowledge learners should be able to construct both pictorial and verbal representations in working memory simultaneously which will facilitate making better connections between the two channels. In the same way that reducing cognitive load assists low-knowledge learners, it may also assist patients with low literacy gain a better appreciation of health messages although this has not been tested.

In the healthcare literature few studies have used educational software and design principles to develop patient education programmes and even fewer have used these multimedia principles in the development of CBPE programmes. Nevertheless, a limited number of studies have published guidelines for developing optimal CBPE programmes (Keulers et al., 2006; Wilson & Wolf, 2009). A recent study developed written and illustrated instructions in breast health-care for immigrant women with low literacy based on the Cognitive Theory of Multimedia Learning (Choi, 2012). They found that simple line drawings with clearly stated captions were useful and easy to understand. This was a pilot study with a sample size of six women so a larger study is needed to compare the results with written text-based instructions. Simple, clear instructions to explain the drawings or voiceover that does not require reading skills is also necessary as immigrants with limited literacy have been thought to bypass the text and interpret instructions by guessing the meaning of the pictographs or pictorial representations (Choi, 2012). Keulers et al. (2007) who have advised on development and design of CBPE using Mayer's (2001) Cognitive Theory of Multimedia Learning

found that a patients' knowledge could be improved more using a CBPE programme than face-to-face instruction from the doctor and that patients were equally satisfied with both educational methods.

Summary

Patient education is regarded as an integral part of physiotherapy especially as unsupervised home exercise programmes are typically prescribed as part of treatment. Patients need to understand and retain the information they have been given as well as devise strategies to accommodate the home-based activities into their daily routine. To facilitate this process, communication techniques such as the use of simple everyday language should be applied to written and verbal information. Incorporating pictures alongside text in any of these deliveries has been found to increase the effectiveness of patient education and instruction especially for the elderly and those with low literacy levels. The most common means of delivery are during face-to-face clinic appointments, or via written material, videotapes and computer-based programmes. Much of the research investigating dissemination of patient education was done in the 1980s and 1990s however it still provides the underpinning for effective patient education today.

In the last decade a greater number of CBPE programmes have been developed. These programmes can create interest by providing a variety of navigational pathways and interactive functions which differentiates them from other types of patient educational material. The greater functionality of CBPE programmes can accommodate an array of behaviour changing strategies such as vicarious learning and tailoring to suit individual needs. One suitable framework from which to develop and design such programmes is the Cognitive Theory of Multimedia Learning. This theory is based on the use of words and pictures to deliver educational messages which has been shown in patient education to enhance its effectiveness. There are no known studies in physiotherapy that have developed CBPE using the Cognitive Theory of Multimedia Learning to improve its effectiveness or that has incorporated the HAPA to enhance adherence to the unsupervised treatment component. It is now timely to do so.

Chapter 5. Shoulder Disorders and Injuries

Introduction

Shoulder injuries/disorders have been chosen as the area of focus because the rehabilitation period can be prolonged with some studies showing that only 50% of individuals with shoulder disorders recover completely within six months (Kelley, McClure, & Leggin, 2009; van der Windt et al., 1996; Winters, Sobel, Groenier, Arendzen, & Meyboom-de Jong, 1997). This chapter will provide an insight into the most common shoulder injuries/disorders by addressing (i) the relevant anatomy (ii) aetiology of the conditions (iii) assessment and (iv) physiotherapy management.

Anatomy of the Shoulder Complex

Full range of motion at the shoulder joint, also known as the glenohumeral joint, involves the simultaneous motion of three other joints which together comprise the shoulder complex (Moore, Agur, & Dalley, 2013). These are the acromioclavicular, sternoclavicular and scapulothoracic joints (Figure 7a). Injury or disorder of any one of these joints may result in restricted movement of the upper limb (Moore et al., 2013) affecting tasks essential to daily living such as dressing, eating and personal hygiene, and may limit participation in work and recreational activities.

The glenohumeral joint is a very mobile, ball and socket synovial joint. It has a shallow glenoid cavity on the scapula which receives a relatively large head of humerus making it inherently unstable (Standring, 2009). Joint stability is increased by the glenoid labrum, fibrous capsule, ligaments and associated muscles (Figure 7b, c and d). The glenoid labrum is a rim of fibrocartilage that surrounds and deepens the glenoid cavity. It is covered on its outer surface by the fibrous capsule that attaches to the scapula just beyond the labrum and to the anatomical neck of the humerus. The capsule helps hold the two bones together and is strengthened anteriorly by the glenohumeral ligament and superiorly by the coracohumeral ligament (Standring, 2009). These structures provide static constraints to joint movement compared to the dynamic stability offered by the four rotator cuff muscles; infraspinatus and teres minor positioned posteriorly, supraspinatus that lies above and medial to the joint and subscapularis that crosses the joint anteriorly (Figure 7c and d) (Brukner & Khan, 2002). The muscles hold the head of humerus in the glenoid cavity and work as the

main movers to laterally and medially rotate the humerus while their tendons blend with the joint capsule and reinforce it (Brukner & Khan, 2002).

Running in the bicipital groove on the front of the upper end of the humerus is the cordlike tendon of the long head of biceps brachii (Figure 7c). The tendon continues proximally to enter the joint cavity through an opening in the capsule before traversing the joint and attaching to the supraglenoid tubercle immediately above the glenoid cavity (Standring, 2009). The tendon assists in stabilising the joint especially when the glenohumeral joint is abducted. Two bony projections known as the acromion and coracoid processes lie superior to the glenohumeral joint and are spanned by the coracoacromial ligament. Together they form the subacromial arch which protects the superior aspect of the joint. A narrow gap exists between this osseofibrous arch and the glenohumeral joint which is occupied by the subacromial bursa whose fluid filled sac prevents friction between the arch and the supraspinatus tendon that lies beneath it (Figure 7e) (Standring, 2009).

The acromioclavicular joint is a small plane synovial joint that lies above and medial to the glenohumeral joint. It is formed by articular facets on the medial aspect of the acromion of the scapula and the lateral end of the clavicle. The joint is stabilised by a surrounding capsule and its associated ligaments which includes the coracoacromial ligament that runs from the coracoid process to the inferior surface of the lateral end of the clavicle (Standring, 2009). The medial aspect of the clavicle joins the manubrium of the sternum to form the sternoclavicular joint which is stabilised by a strong fibrocartilaginous disc, fibrous capsule and associated ligaments (Standring, 2009). The fourth joint of the shoulder complex is the scapulothoracic joint which is a functional joint between the anterior surface of the scapula and the posterolateral thoracic wall. Muscles that attach to the trunk and the scapula stabilise and move the scapulothoracic joint (Moore et al., 2013).

Coordinated movement of the humerus and scapula is necessary for normal shoulder function which generally requires the simultaneous movement of the four joints of the shoulder complex (Magarey & Jones, 2003; Moore et al., 2013). This kinematic interaction between the scapula and humerus is known as ‘scapulohumeral rhythm’ (Brukner & Khan, 2002). During elevation of the upper limb the scapula laterally rotates to ensure the coracoacromial arch does not block the upward movement of the humerus (Standring, 2009). Lateral rotation of the scapula is accompanied by

elevation of the lateral end of the clavicle which necessarily results in movement at both the acromioclavicular and sternoclavicular joints. The muscles responsible for lateral rotation of the scapula are trapezius and serratus anterior (Standring, 2009). On return of the upper limb to the neutral position, medial scapula rotation is accompanied by depression of the lateral end of the clavicle (Figure 7f). This movement is actively produced by the rhomboids and levator scapulae muscles (Standring, 2009). Limitation in range of movement at any one of the joints of the shoulder complex restricts elevation of the upper limb (Brukner & Khan, 2002).

Injury or weakness to muscles acting on the scapula will affect the scapulohumeral rhythm and limit the available movement at the shoulder complex (Magarey & Jones, 2003). This includes other larger muscles that attach to the humerus and act on the shoulder joint such as latissimus dorsi, pectoralis major and minor and deltoid. Contraction of these muscles impart forces that tend to move the humerus from the socket and require the rotator cuff muscles to counteract their forces by contracting to keep the head of humerus centred in the glenoid cavity. With injury or when the rotator cuff muscles are weak, torn or injured they are unable to perform this function and abnormal motion affects the normal function of the shoulder and can result in pain and weakness (Magarey & Jones, 2003).

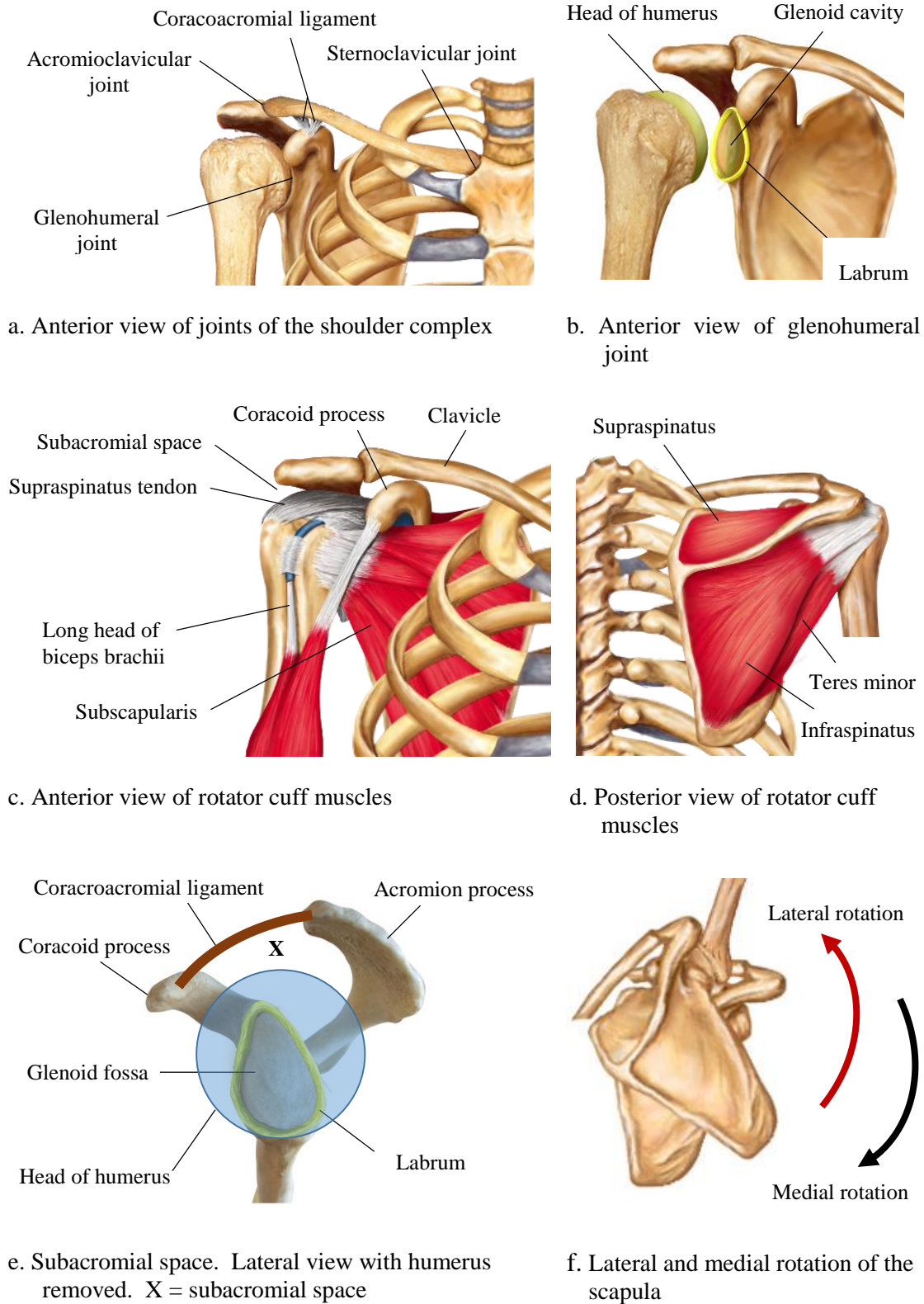


Figure 7. Anatomy of the shoulder.

Aetiology of the Shoulder Disorders and Injuries

Shoulder pain is usually the result of injury/disorder to the joints of the shoulder complex and/or the soft tissues associated with them. Clinically three categories can be identified as the source of shoulder pain: (i) subacromial pathology that includes rotator cuff pathology and impingement syndrome (ii) acromioclavicular joint pathology such as dislocation and osteoarthritis and (iii) glenohumeral joint pathology such as frozen shoulder, osteoarthritis, joint instability and labral tears.

Subacromial Pathologies

These are the most commonly reported disorders of the shoulder and account for up to 85% of shoulder pain (Ostor, Richards, Prevost, Speed, & Hazleman, 2005). Acute injuries caused from sudden and forceful movement to the rotator cuff structures such as a fall onto an outstretched arm, may result in muscle strains and partial or complete tendon rupture (Brukner & Khan, 2002). Slower onset rotator cuff diseases range from tendinopathies, tears and lesions of the muscles to impingement syndrome and can occur from extrinsic or intrinsic mechanisms (R. Ainsworth & Lewis, 2007; Grant, Arthur, & Pichora, 2004). Extrinsic factors include repetitive and overuse activities which may be caused by activities such as swimming or working above shoulder level, in contrast to intrinsic factors that can be the result of aging, postural abnormalities or poor vascularity (R. Ainsworth & Lewis, 2007; Grant et al., 2004).

Impingement Syndrome

Impingement of the rotator cuff tendons, in particular supraspinatus, occurs in the subacromial space when there is inadequate room for the tendon to pass through to the head of humerus. The structures can be encroached upon from either above or below (Brukner & Khan, 2002). From above, the space can be narrowed from subacromial spurs, osteophytes from the acromioclavicular joint and variations in the shape of the acromion. From below, narrowing can occur because of scapular dyskinesis which may have resulted from injury or loss of strength in the rotator cuff muscles. In each case impingement of the tendon can cause mechanical irritation leading to an inflammatory response with the tendon swelling and becoming damaged (Brukner & Khan, 2002). Clinically pain is elicited when the shoulder is flexed to 90 degrees and forcibly internally rotated. Other clinical symptoms are weakness and loss of range of movement at the shoulder joint.

Rotator Cuff Tears

Rotator cuff tears are a common cause of shoulder pain which is often associated with sports injuries, but the majority of tears occur gradually as a result of performing repeated overhead tasks (Brukner & Khan, 2002). Functional disability will depend on pain and the extent of the tear ranging from no weakness to being unable to raise the affected arm. Notably, the incidence of rotator cuff tears including full thickness tears increases with age, although not all tears are painful or result in individuals seeking medical care (R. Ainsworth & Lewis, 2007).

Acromioclavicular Pathologies

Acromioclavicular Joint Dislocation

The most common mechanism of injury to sustain an acromioclavicular joint dislocation is a fall on the tip of the shoulder or a fall on an outstretched hand which is associated with contact sports. Damage occurs to the joint capsule and capsular ligaments. In severe cases there is complete rupture of the coracoacromial ligament which results in the separation of the bone ends and descent of the scapula. This leaves a prominent lateral end of clavicle and gives the appearance that the lateral end of the clavicle has 'popped up' (Brukner & Khan, 2002).

Osteoarthritis

Osteoarthritis of the acromioclavicular joint is not uncommon, especially in middle age (Brukner & Khan, 2002). It may be caused by a prior trauma (secondary osteoarthritis) or occur as a chronic degenerative disorder that progresses with age (Millett, Gobeze, & Boykin, 2008). Spurs or osteophytes can develop around the joint causing damage to the ligaments and inflaming the subacromial bursa. The condition is often seen to co-exist with subacromial impingement.

Glenohumeral Pathologies

Glenohumeral joint disorders such as frozen shoulder and osteoarthritis have been found to be between 16% (Ostor et al., 2005) and 21% (van der Windt et al., 1995) of shoulder pathology seen in primary care. Other pathologies affecting the glenohumeral joint are labral tears and instability of the joint.

Frozen Shoulder

Frozen shoulder is a painful and debilitating condition of the soft tissues of the shoulder that has a spontaneous onset (see Kelley et al., 2009). It results in a fibrotic inflammatory contracture that affects the rotator interval situated on the anterosuperior aspect of the glenohumeral joint and involves the capsule and the coracohumeral ligaments. Thickening and shortening of these tissue limits the range of movement especially external rotation. It is classified as either being primary with no known cause, or secondary where it is associated with diabetes, stroke, trauma and cardiovascular disease and takes a more severe and protracted course. Clinically it has three phases: (i) a painful phase with progressive stiffness lasting two to nine months; (ii) a freezing phase where there is a gradual reduction of pain, but persistent stiffness and a restricted range of motion lasting four to 12 months; and (iii) a resolution phase where range of motion increases and there is less stiffness. This phase lasts between 12 and 42 months (Farrell, Farrell, & Cofield, 2005; Kivimaki et al., 2007).

Glenohumeral Dislocation

Glenohumeral joint dislocation is one of the most common traumatic sports injuries. Usually the dislocation is anterior and is a result of the arm being forced into excessive abduction and external rotation (Brukner & Khan, 2002). This sudden onset frequently is associated with acute shoulder pain and loss of normal shoulder contour (Brukner & Khan, 2002). Dislocations are reduced as soon as possible and often followed up with physiotherapy treatment aimed at strengthening surrounding musculature to increase glenohumeral joint stability.

Labral Injuries

Labral tears are typically associated with instability although they can occur with joint degeneration. The most frequently described labral lesions are known as superior labrum anterior to posterior (SLAP) tears which occur at the superior aspect of the labrum and have tears running in an anterior to posterior direction (Brukner & Khan, 2002). This injury may or may not involve the attachment of the long head of biceps brachii. The mechanism of injury is commonly from traction to the joint that may occur in individuals participating in overhead activities such as tennis. It may also result from compression to the joint caused for example from falling on an outstretched arm that is flexed and externally rotated (Brukner & Khan, 2002).

Biceps Brachii Rupture

Rupture of the long head of biceps brachii mainly occurs in individuals between 40 and 60 years who already have a history of shoulder problems (Brukner & Khan, 2002). Overuse and repetitive movements can lead to fraying of the tendon and ultimately tendon rupture. Younger individuals may sustain this injury but in this population it usually occurs following a traumatic incident such as a fall onto an outstretched arm or heavy weightlifting. In both cases rupture of the tendon normally follows a sudden contraction of the muscle associated with elbow flexion and supination (Brukner & Khan, 2002).

Shoulder Assessment

Accurate assessment is considered the cornerstone of patient management that leads to more targeted treatment selection and ultimately better functional outcomes (Baring, Emery, & Reilly, 2007; R. Green, Shanley, Taylor, & Perrott, 2008). Objective measures that are typically used in physiotherapy to assess return to normal function are range of motion and muscle strength testing, however these and other assessment measures specific to the shoulder have been found to have variable reliability and validity (Cadogan, 2011; Hegedus et al., 2008; Hughes, Taylor, & Green, 2008). The objective measurement for joint range of movement is usually determined by goniometry, although Williams and Callaghan (1990) have shown that in normal shoulders visual estimates of experienced clinicians were as reliable as those obtained from using a goniometer. Similar results were found in a second study that investigated participants with shoulder pathology. In this study comparable reliability for visual estimation and goniometry for both the inter-rater (visual estimation $Rho = 0.57-0.70$; goniometry $Rho = 0.64-0.69$) and the intra-rater (visual estimation $Rho = 0.59-0.67$; goniometry $Rho = 0.53-0.65$) trials was found (Hayes, Walton, Szomor, & Murrell, 2001).

The individual strength of muscles surrounding the shoulder can be assessed objectively using a hand held dynamometer. Michener, Boardman, Pidcoe, and Frith (2005) identified good intratester test-retest reliability (the ICCs ranged from .89 to .96) using the dynamometer but construct validity could not be established for all muscles. Moreover dynamometers are specialised and expensive items (Michener et al., 2005) that are out of reach of many physiotherapy practices and hence are not commonly used in daily physiotherapy practice. As well, Magarey and Jones (2003) have shown that

altered dynamic control is an important contributing factor to shoulder dysfunction and therefore suggest that the focus of assessment and management should be on the dynamic control of the shoulder complex.

In view of the difficulties associated with objective measurement of the shoulder, subjective assessment of functional activities may provide an effective additional measure. Functional activities integrate range of motion and strength and can be assessed by validated and reliable patient self-report assessments such as the Disability of Arm, Shoulder and Hand (DASH) questionnaire, the Shoulder Pain and Disability Index (SPADI) and the American Shoulder and Elbow Surgeons (ASES) score. These self-report assessments are able to provide valuable information that rely on the patients' perceptions of their functional ability that cannot be assessed by physiotherapists within the clinic environment (McDonough et al., 2013; McNair et al., 2007). Unlike the SPADI and ASES which are shoulder specific measures, the DASH assesses not only shoulder function but also upper limb function which is of value in the assessment of different shoulder conditions (Roy, MacDermid, & Woodhouse, 2009). Evaluation of the DASH has found that it is able to detect and differentiate small and large changes in patients with upper limb disorders. A 10 point difference out of a possible 210 points in the mean DASH scores is considered to represent a minimal important change (Gummesson, Atroshi, & Ekdahl, 2003). Compared to the SPADI and ASES, the DASH has been rated as the best questionnaire to assess the clinimeter properties (Bot et al., 2004; McClure & Michener, 2003), and it has good internal consistency with a Cronbach's alpha > .90 (Gummesson et al., 2003). Additionally, the DASH includes the three psychosocial areas that are assessed by the WHO International Classification of Functioning, Disability and Health (ICF) model. These are body impairments, activity restrictions and limitation in social participation (World Health Organisation, 2001). In comparison to the ICF which is a classification system the DASH is an evaluation instrument that is more suitable for assessing function.

Shoulder pain is a common reason for primary care consultation and is associated with an array of shoulder injuries/pathologies (Linsell et al., 2006; Ostor et al., 2005). Therefore it is prudent that pain is measured as an indicator of treatment progress. The visual analogue scale (VAS) and the numeric pain rating scale (NPRS) are two single-time measures that are commonly used in rehabilitation to assess pain. Assessment using the VAS requires individuals to indicate the intensity of their pain by

marking a line that extends from 0 = *no pain*, to the other end of the line where 10 = *the worst possible pain*. Although this is a quick measure for most, older individuals and those less literate may have more difficulty completing it (Kremer, Atkinson, & Ignelzi, 1981). The NPRS is also a single measure item where individuals indicate the intensity of their pain by circling a number that typically lies between 0 and 10. This measure like the VAS is simple to use but is quicker to score than the VAS (Kremer et al., 1981). The ability of the VAS and the NPRS to detect change in pain has been estimated as 27% of the range (Spadoni, Stratford, Solomon, & Wishart, 2003). However a limitation of both the VAS and NPRS is that they are single item measures that do not account for the fluctuations in pain over a 24 hour period and during activity. In response to this limitation Spadoni, Stratford, Solomon, and Wishart (2004) developed the P4 which is a 4-item measure. The items measure pain intensity in the morning, afternoon, evening and following activity over the previous two days. People respond to each item on a scale 0 = *no pain* to 10 = *worst possible pain*. In comparison to the single-item NPRS the P4 has been found more sensitive and has a minimal detectable change of 22% and an acceptable test-retest reliability (ICC = .78) (Spadoni et al., 2004).

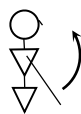
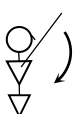




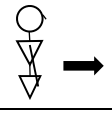
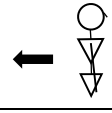
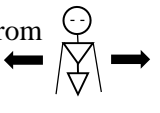
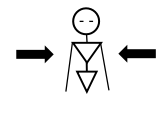
Physiotherapy Management

The most common shoulder movements affected by injury/disorder are rotation, abduction and flexion (Kuhn, 2009) (Table 1). These movements need to be treated in conjunction with the other joints of the shoulder complex to ensure coordinated scapular movement occurs to facilitate full range of motion at the glenohumeral joint. Thus the evaluation of shoulder control, especially mid-range stability is an integral part of management for all shoulder disorders (Magarey & Jones, 2003).

Physiotherapy rehabilitation follows a diagnosis of shoulder injury/disorder or is commenced after a surgical procedure to the shoulder for conditions such as a torn rotator cuff, shoulder instability or labral tears. In the acute phase of rehabilitation the goals of treatment are to reduce pain and oedema, and promote tissue healing. Physiotherapy management in this early stage often includes rest, the use of ice, simple pendulum exercises and shoulder support that may be provided by a sling. Patients may be educated on how to cope with activities of daily living such as dressing and may be advised on icing and pendulum exercise that can be continued at home each day between clinic-based sessions. Icing can be applied every two hours in the acute stage

and patients are usually advised to exercise two or three times per day, with between 10 and 15 repetitions for each strengthening exercise and 3 to 5 repetitions for each stretching exercise (see Kuhn, 2009).

Table 1.
Movements of the Shoulder and Anatomical Orientation

Shoulder Movements		
Flexion: arm moves forward 	Extension: arm moves backward 	Abduction: arm moves away from body 
Adduction: arm moves towards body 	Medial rotation: elbow bent, hand moves towards body 	Lateral rotation: elbow bent, hand moves away from body 
Anatomical Orientation		
Anterior: to the front 	Posterior: to the back 	
Lateral: away from the middle 	Medial: towards the middle 	

Once pain is controlled, treatment is progressed to the next phase which typically includes strengthening, mobilising and coordination activities. (Brukner & Khan, 2002; Kuhn, 2009). Range of motion at the glenohumeral joint should be re-established and the muscles controlling movement at the shoulder including muscles acting on the scapula should be strengthened to preserve normal scapulohumeral rhythm. Exercises are progressed from active-assisted which may utilize props such as poles and pulleys through to resisted exercises. Resistance can be increased by introducing different grades of theraband, using free weights or body weight. When soft tissue tightness is present, exercises may be performed to passively stretch structures for example muscles, ligaments or joint capsule. Throughout treatment, emphasis is placed on proper exercise techniques to ensure correct stabilization of the scapula and restoration of proper mechanics to the shoulder complex (Brukner & Khan, 2002).

Physiotherapy in the early or later phase may involve a variety of electrotherapy techniques that includes ultrasound, laser and shortwave diathermy but there is little overall evidence for the use of any particular electrotherapy modality (S. Green,

Buchbinder, & Hetrick, 2013). Non-steroidal anti-inflammatory drugs and simple analgesics such as paracetamol may be used for short-term pain relief and there is some evidence that subacromial steroid injection does provide symptomatic relief for shoulder pain (Accident Compensation Corporation, 2004).

Summary

The shoulder is the most mobile joint of the body whose full function is dependent on the integrity of the other three joints that make up the shoulder complex, namely the acromioclavicular, sternoclavicular and scapulothoracic joints. Stability of the shoulder is maintained by the surrounding joint structures and the action of the small rotator cuff muscles that hold the head of humerus on the glenoid fossa of the scapula. Full range of motion of the shoulder is obtained through the coordinated movement of all joints of the shoulder complex, the rotator cuff muscles and the larger muscles that surround the shoulder.

Injury/disorder to any of the joints of the shoulder complex or the muscles of the shoulder can result in loss of function through weakness, pain, a limitation of movement or a combination of these symptoms. Physiotherapy management involves the restoration of coordinated scapular and shoulder joint movement so that once pain is controlled strengthening, mobilising and coordination activities are initiated. Treatment is progressed until proper mechanics of the shoulder are restored.

Chapter 6. Development of Computer Based Patient Education Programme

Introduction

There has been a rapid increase in access to the World Wide Web (www.) with over 265 million people in the developed world now having access to it (OECD Communications Outlook, 2007), including 80% of New Zealanders (New Zealand Government, 2013). The growth in personal computers and 24-hour access to the World Wide Web offers enormous potential for health professionals to use this interface to deliver patient education. A variety of formats can be integrated into CBPE programmes that may include written or spoken words, video, animation, pictures and sound. Studies have shown that learners retain and understand information better when it is received using two or more formats such as text and illustration or narration and animation (see Mayer, 2001). The interactive properties that are simply not available on either video or written format alone may be built into CBPE programmes. This can lead to a diverse range of navigational pathways and result in more individualised patient education that enables patients to take greater control over their learning (Stemler, 1997).

Design of the Computer Based Patient Education Programme

The CBPE programme structure was initially planned on paper (Figure 8). The four areas identified for development were: (i) access to the website, (ii) programme content, (iii) targeting of information, and (iv) an electronic self-report diary. Provisions for website access, targeting and the self-report diary were made through navigation procedures and the content comprised of eight modular units. The headings of each module were displayed in a menu list on the introductory page alongside an overview of the content for each. The titles for the modules were: interviews, exercises, hints on exercising, activities of daily living, anatomy of the shoulder, shoulder injuries, frequently asked questions and quizzes. Once the topics to be presented in each module were finalised, the content was developed (Appendix 2, website 1).

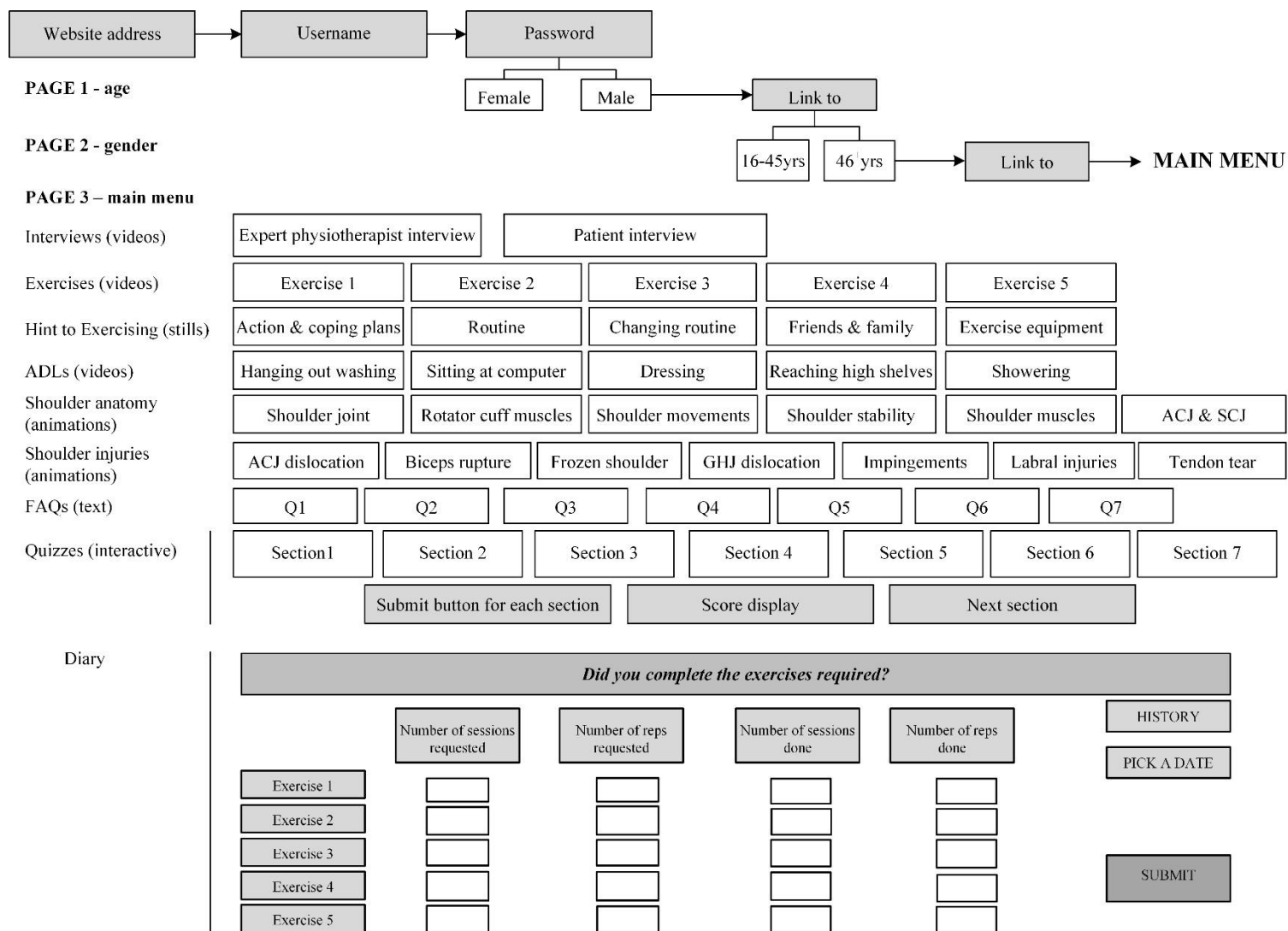


Figure 8. The layout of the website used by the intervention group.

Note: ADLs = Activities of Daily Living, FAQs = Frequent Asked Questions, ACJ = Acromioclavicular Joint, GHJ = Glenohumeral Joint, SCJ = Sternoclavicular Joint

Development of Content

The content was drawn from expert physiotherapists, patients who had sustained shoulder injuries, scientific journals and textbooks. This information was organised into a mix of video clips, animations, pictures, and text. Written and oral material was presented simply using short sentences and minimal technical and medical jargon to enhance its processing (Ley, 1988). Guidelines for effective CBPE (Keulers et al., 2006) and learning theory designed for multimedia education (see Mayer, 2001) were utilised to optimise learning and create interest as discussed in Chapter 4. Information was targeted to the gender and age of participants which was considered appropriate as much of the content was demonstrating exercises and activities. Targeted information which is a 'good fit' such as this has been found to be as effective as tailored health messaging which delivers personalised messages to individuals based on specific data they have provided (Kreuter & Wray, 2003).

To obtain good quality video material all filming was done by a professional cameraman. Videos for the interview module were made using a physiotherapist experienced in teaching and treating shoulder dysfunction, and a former patient who had sustained and recovered from a shoulder injury/disorder. Experts were used to deliver the information because it has been found to improve credibility and believability of the material being given (Gleitman, Fridlund, & Reisberg, 1999). In a seven minute video the expert physiotherapist presented general information about shoulders such as the costs incurred by shoulder injuries/disorders, common shoulder pathologies, symptoms that should alert patients to return to their doctor such as unexplained deformity or chest pain, treatment options and the role exercises commonly played in rehabilitation. In a nine minute video the former patient discussed the experience of his injury from a functional perspective, relating everyday problems he encountered and how he managed activities of daily living. Participants who observe the successful performance of former patients who have had similar disabilities to their own, can raise self-efficacy through vicarious learning (Bandura, 1977, 1982).

Filming for the exercise module followed consultation with expert physiotherapists and led to a set of 62 exercises being selected that could be prescribed by clinical physiotherapists during early, middle and later rehabilitation. Four models were used to demonstrate correct execution of the exercises, with each model representing one of four groups categorised by gender and age. The groups represented

were male or female between 16 and 44 years of age, and male or female over 45 years of age. A physiotherapist who was a specialist in treating the shoulder complex was present to ensure the exercises were performed correctly. Information was targeted to these four categories to make it more relevant to the participants' demographics. Earlier research had found that computer-based targeted information can influence behaviour change in exercise therapy (D. Lewis, 1999). Moreover, once each video had been edited, a voiceover was added explaining and giving instruction on the correct procedure being demonstrated which utilised the multimedia principle to promote learning (Mayer, 2001) and provided feedback to participants which may enhance adherence (Friedrich et al., 1996).

The third content module contained hints on exercising. The lead page showed five thumbnail photographs of common situations participants could use to remind them to do their home-based exercise programme. Clicking on the thumbnail enlarged the photograph and brought up the 'reminder to exercise' hint in text. An example showed cue cards or action and coping plans placed on the fridge door where they would be seen often and act as a reminder (Figure 9) (Sluijs et al., 1998; Sluijs & Knibbe, 1991).



Figure 9. Pictures showing hints to exercising.

The content of the activities of daily living (ADL) module contained five videos that used four actors to show an alternative way to manage common activities that are difficult to perform with a shoulder injury such as placing objects on high shelves, dressing and hanging out the washing (Ostor et al., 2005). Two men and two women whose ages fell into both age groups acted out the scenes. Once editing had been completed a voiceover conveying the same message was synchronised with the video which explained the activity as it was being acted out. Modelling the behaviour through these visual presentations may encourage greater participation in these everyday activities through vicarious learning (Bandura, 1982, 1997).

Anatomy of the shoulder and shoulder pathology modules were comprised of six and seven animations respectively to increase patient understanding of their injury/disorder which has been shown to enhance adherence (Brewer, 1998b; Nielson et al., 2010), self-efficacy (Bandura, 1986; Pajares, 2002) and functional activity (Brewer, 1998b; Yeh et al., 2005). The format of these modules was based on the principles of cognitive theory and research for multimedia learning (see Mayer, 2001). All graphics used for the animations were first developed in Adobe Photoshop CS5.1 software, brought through Adobe Firefox CS5.1 and into Adobe Flash Professional CS5.5 where the animations were created. On the CBPE programme the animations can be viewed passively by using a 'play' button or interactively by moving the cursor along a scroll bar. Selecting 'play' initiates and plays the animation through to the end, and was accompanied by a voiceover explaining the graphics. Alternatively, animations can be viewed by interacting with a scroll bar that is placed beneath the animation. Holding down the left click on the mouse enabled users to move along the scroll bar at their own pace (Figure 10). Voiceover does not accompany manual manipulation of the animation so text was used to explain the graphics. Whether viewed manually or through the 'play' button, a bottom frame on both animations gave more detailed information.

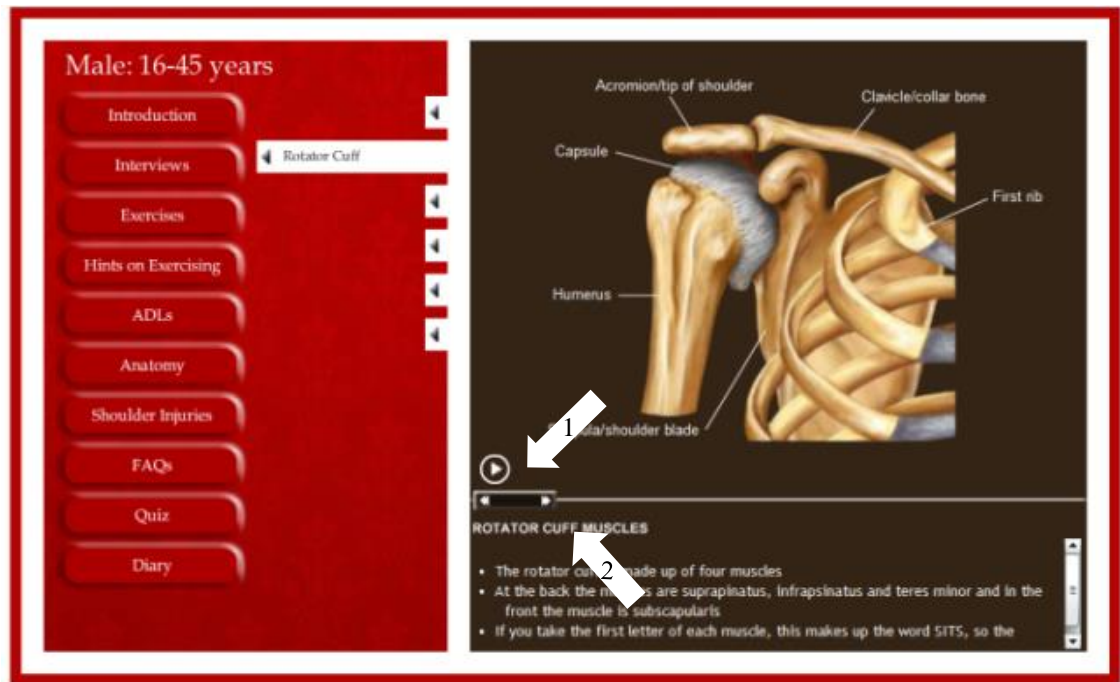


Figure 10. Method of viewing the animations.

Note: 1. Pressing the 'play' button initiates automatic running with voiceover. 2. Dragging the cursor along the scroll bar enables manual control.

The seventh module covered 'frequently asked questions' presented in two sections, one that was general information related to exercise rehabilitation and the other related to questions specific to a shoulder problem such as a rotator cuff tear or a frozen shoulder. This module consisted of text only and was written in simple everyday language using short sentences to assist understanding (Ley, 1988) (Figure 11). Answers to questions clearly gave feedback to participants which is known to enhance understanding (Ewart, Barr Taylor, Reese, & DeBusk, 1983). The questions were also personalised to the extent that they were written using the first person, such as "*What if I get pain during exercises*" which is likely to engage participants more than using the third person. There are two possible reasons for this. Firstly, it directs the information specifically to the individual, and makes it more meaningful (MacIsaac & Eich, 2002). Secondly, it has been found more effective than the third person in its ability to increase intentions to engage in the visualisation of a health related behaviour when accompanied by a health message (MacIsaac & Eich, 2002).

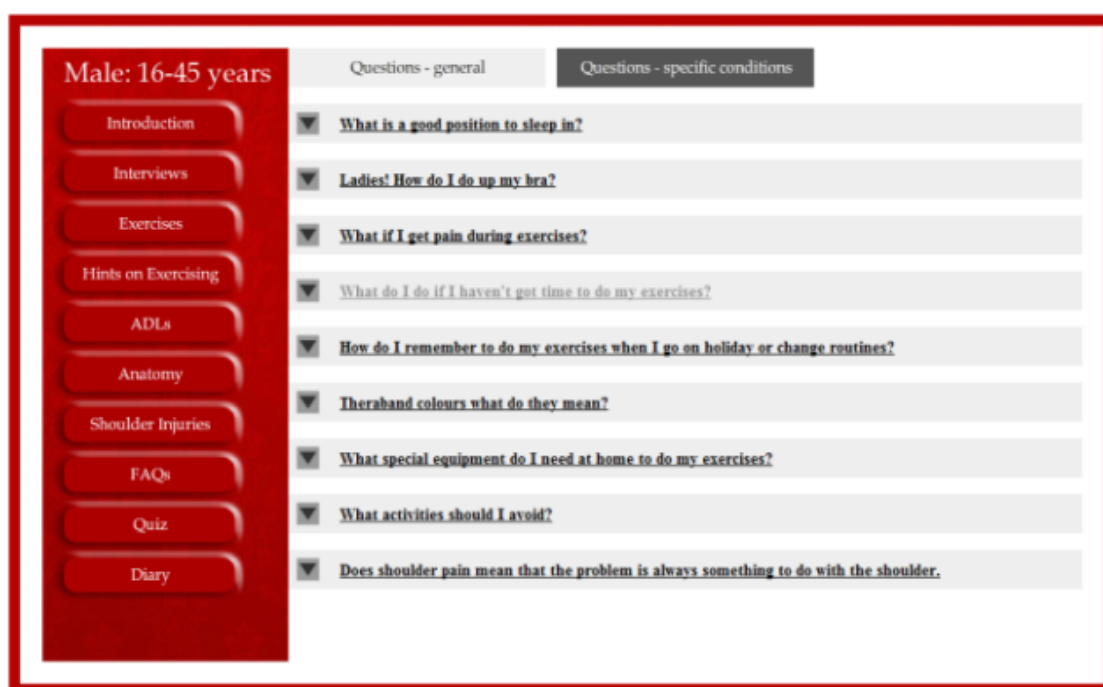


Figure 11. Frequently asked questions module.

A series of quizzes derived from all previous modular units made up the final module and consisted of nine interactive sections. There were a variety of functions available which included typing an answer into a designated box, dragging a selection into a drop zone, selecting a multiple choice option, labelling diagrams, dragging a line to answer mix and match questions and dragging muscles into the correct position on a skeleton. Participants were able to submit their answers for each section and obtain a score (Figure 12 and Figure 13). The interactivity used in this module was included to create interest and to promote learning as shown in earlier studies (D. Lewis, 1999). It also provides another educational technique for reviewing information that is different from that used by physiotherapists when patients are questioned about their understanding of their injury/disorder (Schillinger et al., 2003).

Male: 16-45 years

Introduction
Interviews
Exercises
Hints on Exercising
ADLs
Anatomy
Shoulder Injuries
FAQs
Quiz
Diary

Total Questions: 5 Correct Answers: 0 Shoulder Joint Section: 1 of 9

- The of the humerus joins with the socket of the shoulder blade (scapula).
- The shoulder joint is of the ball and variety.
- Another name for the sac that surrounds the shoulder joint is the
- Ligaments help (move/stabilise) the shoulder joint.
- Match the structure in the left column with the statement that it is best associated with in the right column by dragging a line between the two phrases. [Click Here to restart this question](#)

Shoulder joint	hicipital groove
Long head of biceps	tip of shoulder
Rim of joint	deepens socket
Joint sac	encloses joint
Acromion process	glenohumeral joint
Clavicle	collar bone

Previous Section Click 'Submit' before moving on to the next section. You can click 'Submit' multiple times during a section to check your answers or click [HERE](#) to see printable answer sheet. Submit Next Section

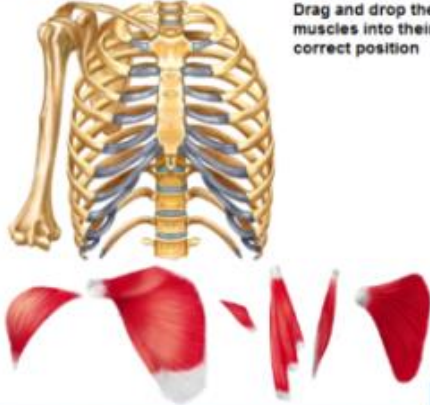
Figure 12. Examples of fill in the blank and mix and match questions.

Male: 16-45 years

Introduction
Interviews
Exercises
Hints on Exercising
ADLs
Anatomy
Shoulder Injuries
FAQs
Quiz
Diary

Bonus Question Not Recorded Shoulder Muscles Continued Section: 8 of 9

Drag and drop the muscles into their correct position



Previous Section Click 'Submit' before moving on to the next section. You can click 'Submit' multiple times during a section to check your answers or click [HERE](#) to see printable answer sheet. Submit Next Section

Figure 13. Examples of drag and drop questions.

Navigation Pathways of the Computer Based Patient Education Programme

The CBPE programme was built in consultation with the software developer over a period of six months. The navigation system was simple and intuitive yet maintained a high level of involvement. The interactive interface of the programme allowed participants to determine how they proceeded through the programme and the speed at which they did so thereby facilitating understanding and recall (Keulers et al., 2006). Thus participants were able to target the programme to their own demographics which has been found to enhance adherence (D. Lewis, 1999).

Access to the CBPE programme was through a website with each participant being issued with a username and password (Appendix 2, website 1). A secure website enabled participants to enter personal information such as their diary reports. Following the login participants were required to select an age group and gender. This linked to the main page that listed the modules in the programme and gave a short explanation of the information contained in each one (Figure 14). Participants were able to select modular units in a nonlinear sequence which allowed them to work through the programme in a self-determined order.

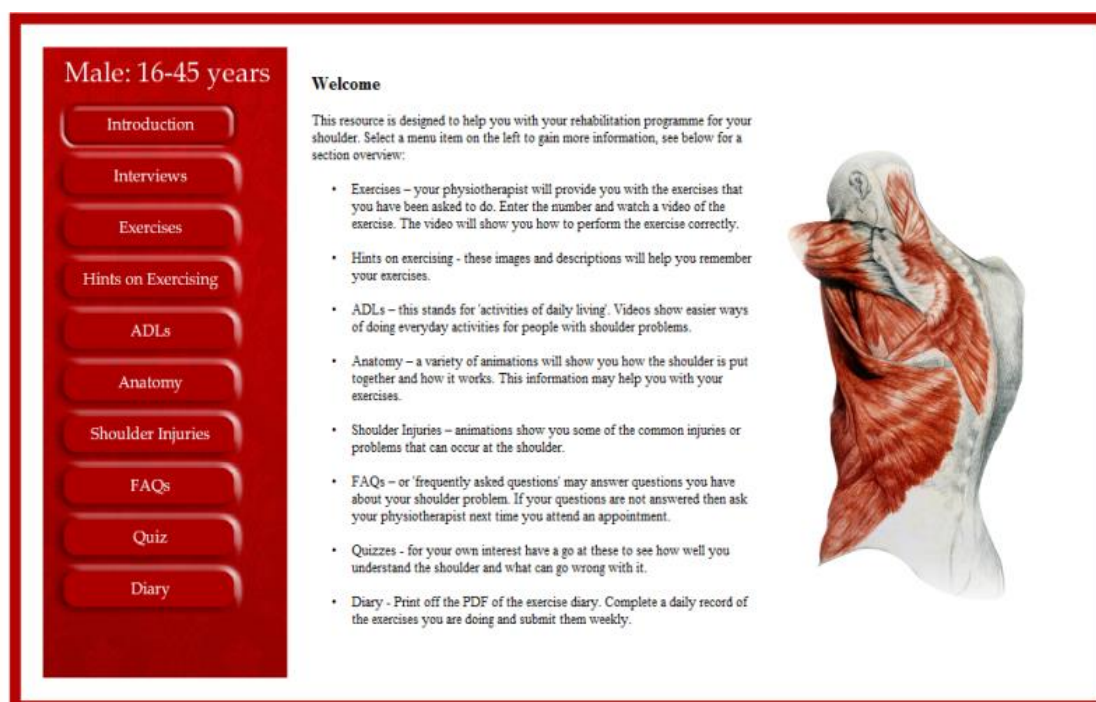


Figure 14. Introductory page of the CBPE programme.

The content under each of the modules was accessed by interactive buttons with the targeted information linked only to the exercise module. Participants selected the exercises in their home-programme by entering the number of the exercise onto a keypad (Figure 15). This number was given to the participant by the physiotherapist who had the exercise mastercard with associated exercise numbers (Appendix 3). Video clips of prescribed exercises enabled vicarious learning and gave participants confidence that the exercise was being performed correctly. All exercises were targeted to age group and gender so that role-modelling behaviour could occur which has been shown by Bandura (1982) to successfully raise self-efficacy.



Figure 15. Exercise video page.

The participant's self-report adherence behaviour was recorded electronically in the diary section (Figure 16). The information requested was the exercise prescribed by the physiotherapist (identified only as exercise 1, exercise 2 to a maximum of 5 exercises), the number of sessions requested by the physiotherapist, the number of sessions completed, the number of repetitions requested by the physiotherapist and the number of repetitions completed. Participants selected the date of entry by clicking on an interactive calendar. In order for participants to keep track of their diary entries a history button was created to review but not alter the information.

Did you complete the exercises required?

pick up date

	Number of sessions for each day	Number of repetitions for each exercise
Exercise 1	N/A	N/A
Exercise 2	N/A	N/A
Exercise 3	N/A	N/A
Exercise 4	N/A	N/A
Exercise 5	N/A	N/A

Click the box once for 'yes' and twice for 'no'

submit

Figure 16. Exercise diary page.

Modifications as a Result of Pilot Study

A pilot study (see chapter 7) comprised of 20 participants was conducted over a four week period to test the functionality and navigation of the CBPE programme. As a consequence of the study, and feedback from the participants and physiotherapists several changes were made to the CBPE programme prior to the main study. The most notable of these was a reduction in the total number of exercise videos from 62 to 17. Thirteen of the exercises were spread across early, middle and late rehabilitation stages and four exercises were specifically shoulder stretches which may have been prescribed during any of the stages (Appendix 4). Having exercises for early, middle and late rehabilitation was intended to make it easier for physiotherapists to recall the exercise videos on the CBPE programme and prescribe them as part of the total treatment programme.

Another change was made to the electronic diary. The information requested in the pilot study for each prescribed exercise was: date, sessions requested by physiotherapist, sessions completed, repetitions requested by physiotherapist and repetitions completed. For the main study this remained the same but a history button was added so participants could review but not change earlier entries. To accommodate

the larger number of participants in the main study, 108 compared to 20 in the pilot study, programming revisions were made so data entries could be exported directly into excel software allowing more efficient management of the information. After all changes to the CBPE programme used in the pilot study had been made, the software was utilised for the intervention group in the main study.

Attention Control Computer Based Patient Education Programme

An attention control website was also developed which was comprised of the same template as the intervention CBPE programme but had only two interactive buttons (Figure 17) (Appendix 2, website 2). The purpose of this website was to ensure that it was the content of the CBPE programme that had an effect on the study outcomes and not the possibility of using the website, and the interaction with the researcher and physiotherapist (Kazdin, 1980). One of the buttons linked to the same interview with the expert physiotherapist as in the intervention CBPE programme. The information given in the interview covered general facts about shoulder injuries/disorders and was information that physiotherapists would typically give their patients so there was nothing that patients had not already been told. The second menu button enabled access the diary. No additional information was made available to the attention control group.

Website address

Username

Password

Link to

→

MAIN MENU

PAGE 1 – main menu

Interview (videos)

Expert physiotherapist interview

Diary

Did you complete the exercises required?

	Number of sessions requested	Number of reps requested	Number of sessions done	Number of reps done	
Exercise 1	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	
Exercise 2	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	
Exercise 3	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	
Exercise 4	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	
Exercise 5	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	<input style="width: 30px;" type="text"/>	

HISTORY

PICK A DATE

SUBMIT

Figure 17. The layout of the website used by the control group.

Summary

The growing use of personal computers with access to the World Wide Web has provided a unique opportunity to deliver patient education via this interface. For the purpose of the current study a CBPE programme was developed for the World Wide Web based on the Cognitive Theory of Multimedia Learning and the HAPA to enhance self-efficacy. The programme that was targeted to age and gender was made up of eight modular units: interviews, exercises, hints on exercising, activities of daily living, anatomy, shoulder injuries, frequently asked questions and quizzes. A menu button linked to an electronic diary for participants to record their adherence to prescribed home-based exercises. Participants were able to interact with the programme and access individual modules through multiple navigational pathways. The CBPE was tested in the pilot study which led to several modifications before being used as the CBPE programme for the main study. To ensure interaction with the computer and the website per se did not have any effect, a second website was developed as an attention control that had the same design as the CBPE programme but only featured a single interview and a link to the electronic diary.

Chapter 7. Pilot Study

Purpose

The primary purpose of this pilot study was to test the feasibility of the protocols and procedures for the main study that will test the effectiveness of the CBPE programme and action and coping planning as an adjunct to home-based rehabilitation. A secondary purpose was to investigate the feasibility of extending the HAPA model to explain adherence to physiotherapy and, ultimately, functional outcomes.

Hypotheses

The primary hypotheses were that:

1. The CBPE programme and the formulation of action and coping plans based on the HAPA model will result in:
 - (i) high scores for maintenance and recovery self-efficacy
 - (ii) high levels of adherence to the clinic- and home-based component of the physiotherapy rehabilitation
 - (iii) improved shoulder function and reduced pain
2. The CBPE programme based on the Cognitive Theory of Multimedia Learning will:
 - (i) improve the participant's knowledge of their shoulder injury
 - (ii) produce high levels of participant satisfaction

The secondary hypothesis was that:

3. There will be significant strong correlations amongst the sequential HAPA variables of the extended model.

Methods

Participants

Twenty four people with soft tissue injuries of the shoulder were recruited from two private physiotherapy clinics between their first and second appointments. Participants were required to be at least 16 years or older, have access to a computer, be able to comprehend written and spoken English, and not have any cognitive disorders

that could impede their learning. The sample comprised of 14 males and 10 females whose ages ranged from 18 to 89 years. Four participants withdrew from the study: two because they were unable to access the CBPE programme online due to difficulties with their internet connection, one because she was overseas for an extended period and one because of work commitments.

Study Design

This was a single group prospective design in which participants were followed for the first four weeks of their physiotherapy programme. All participants made action and coping plans with the assistance of the researcher and were shown how to use the CBPE programme between the first and second visit to the physiotherapist. For the remaining four weeks the participants used the CBPE programme which was accessed online or via digital versatile disc (DVD) to guide the home-based component of their physiotherapy.

The dependent variables embedded in the HAPA were action, maintenance and recovery self-efficacy, risk perception, treatment outcome expectancies, behavioural intentions and adherence behaviours. Risk perception, outcome expectancies, action self-efficacy and behavioural intentions were tested at the beginning of the study (Time 1), and maintenance and recovery self-efficacy were tested at the end of the study (Time 2). Adherence was measured over the duration of the four week trial. The HAPA was extended to incorporate functional outcomes. This was based on the assumption that adherence should lead to improved function of the shoulder (Brox et al., 1993; Ginn et al., 1997). The shoulder functional outcomes were measured pre- and post- intervention by the Disability of the Arm, Shoulder and Hand (DASH) questionnaire and the P4 pain scale.

Dependent variables associated with the Cognitive Theory of Multimedia Learning were knowledge and patient satisfaction with the CBPE programme. Knowledge was tested pre-and post-intervention, and patient satisfaction was tested post-intervention only. Feedback from participants about the CBPE programme, and from physiotherapists and their receptionists about the procedures and protocols was obtained at the end of the research period.

Measures

Demographic and Shoulder Injury Characteristics

The demographic and shoulder injury characteristics were measured by questionnaires that used closed ended responses. The personal demographic characteristics collected were age, gender, ethnicity, occupation, employment status, and highest academic qualification. Participants were also asked to indicate the approximate number of hours they used a computer per week. The characteristics of the shoulder injury recorded were the date of onset, previous history of shoulder injury and associated physiotherapy treatment, and whether the injury occurred during a sporting activity (Appendix 5).

HAPA Variables

All questionnaires measuring the HAPA model variables except adherence were psychometric scales that were scored on a 4 point response format, 1 = *completely false*, 2 = *sometimes false*, 3 = *sometimes true*, 4 = *completely true*.

Risk Perception. Four items assessed vulnerability to poor shoulder function (Appendix 6). The stem was, “*If I don’t do my home physiotherapy programme...*” and related to how the participant perceived the importance of their physiotherapy programme. For example “*If I don’t do my home physiotherapy programme it will be harder for me to move my arm.*” Scholz et al., (2005) reported an internal consistency of Cronbach’s alpha = 0.79. In this study the Cronbach’s alpha = 0.90.

Treatment Outcome Expectancies. Treatment outcome expectancies assessed the beliefs about the benefits of the home physiotherapy programme (Appendix 7). These were measured by six items with each item starting with, “*If I follow my home exercise programme as recommended ...*” and was followed, for example, by “*I will get better quicker.*” Scholz et al. (2005) report an internal consistency of Cronbach’s alpha = 0.92. In this study the Cronbach’s alpha = 0.75.

Behavioural Intentions. Behavioural intentions assessed how the participants intended to undertake the components of the physiotherapy programme. This was assessed by four items (Appendix 8). The stem was “*I intend to ...*” followed, for example, by “*do my home exercises programme as recommended by my physiotherapist.*” Scholz et al. (2005) reported a Cronbach’s alpha = 0.82. In this study the Cronbach’s alpha = 0.64.

Phase Specific Self-efficacy. Three phases of self-efficacy were measured:

Action Self-Efficacy. Three items assessed action self-efficacy and related to the participants' perceived ability to cope with the prescribed exercise programme (Appendix 9). The stem "*I am confident I can do my home physiotherapy programme...*" was followed by a statement such as, '*the number of times recommended each day.*' The Cronbach's alpha from Scholz et al. (2005) was 0.75. In this study the Cronbach's alpha was 0.84 which was measured at Time 1 only.

Maintenance Self-Efficacy. Four items assessed maintenance self-efficacy and related to the participants' perceived ability to maintain the prescribed exercise programme (Appendix 10). The stem was "*I was confident I would perform my home programme daily over the four weeks....*" This was followed by a statement such as '*even if I was tired.*' Scholz et al. (2005) report a Cronbach's alpha = 0.73 at Time 1 and 0.75 at Time 2. In this study the Cronbach's alpha was 0.90 which was measured at Time 2 only.

Recovery Self-Efficacy. Recovery self-efficacy was assessed by four items. The stem "*I was confident that I could return to the home physiotherapy programme...*" was followed by a statement assessing the participants' perceived ability to resume their exercise programme following a lapse such as "*even if I had not done my exercise for a couple of days*" or "*even if I felt weak after a period of illness.*" (Appendix 11). Scholz et al. (2005) report a Cronbach's alpha = 0.85 at Time 1 and 0.93 at Time 2. In this study the Cronbach's alpha was 0.87 which was measured at Time 2 only.

Adherence. Adherence was assessed in three ways:

Percentage Attendance to Scheduled Rehabilitation Appointments. This was calculated by dividing the number of rehabilitation sessions attended by the number of rehabilitation sessions scheduled and multiplying this number by 100. The method has been successfully used in earlier research (Bassett & Prapavessis, 2011; Brewer, Van Raalte, Cornelius, et al., 2000).

The Sport Injury Rehabilitation Adherence Scale. The SIRAS (Brewer, Van Raalte, Petitpas, et al., 2000) assessed adherence during clinic-based rehabilitation sessions (Appendix 12). This required the physiotherapist to assess the participants' degree of involvement during the physiotherapy session. It consisted of three items with a 5 point increment scale where 1 = *minimum effort/never/very unreceptive* to 5 = *maximum effort/always/very receptive*. An example of a statement that was assessed is "*The intensity with which the patient completed the rehabilitation exercises during today's appointment.*" Brewer et al. (2000) report a Cronbach's alpha coefficient of 0.82 and a test-retest intraclass correlation coefficient of 0.77. In this study the Cronbach's alpha was 0.90.

Diary or Daily Log Reporting on Home Exercises. This required the participant to report *Yes* or *No* to two questions: "*Did you complete the exercises requested by your physiotherapist?*" and "*Did you complete the number of repetitions for each exercise requested by your physiotherapist?*" (Appendix 13).

Functional Outcomes. Functional outcomes were assessed by two measures:

Disabilities of the Arm, Shoulder and Hand. The DASH questionnaire consisting of 21 items that measured and rated the functional ability of the upper limb. Participants responded to each item using a 5 point Likert response scale (1 = *no difficulty*, to 5 = *unable*) with high scores indicating more disability. An example of the type of statement rated is "*Put on a pullover sweater.*" Bot et al. (2004) reported that the DASH had the best clinimetric properties for shoulder disability questionnaires and recommended it for outpatient clinics. High internal consistency has been reported with a Cronbach's alpha > 0.90 (Gummeson et al., 2003) (Appendix 14). In this study the Cronbach's alpha at Time 1 and 2 were both 0.92.

Pain. The P4 scale (Spadoni et al., 2004) rated level of pain associated with the shoulder injury over the past two days in the morning, afternoon, evening and when doing activity. Participants responded to the four statements by circling a number between 0 (*no pain*) and 10 (*pain as bad as it can be*) (Appendix 15). Spadoni et al. (2004) found test-retest reliability scores = 0.78 when tested on two separate occasions 72 hours apart. They estimated a minimal detectable change of the P4 to be a change of 22% of the scale range (9 points) at a confidence level of 90%. In this study the Cronbach's alpha = 0.88 at Time 1 and Cronbach's alpha = 0.84 at Time 2.

Cognitive Theory of Multimedia Learning Variables

Knowledge. Knowledge consisted of 10 multiple choice questions about structure and function of the shoulder, and about behavioural change strategies. For example “*The bones that comprise the shoulder complex are ...*”, “*The best way to put a jersey on when your shoulder is painful is to put your ...*” and “*Making action plans ...*” (Appendix 16). Prior to use, face and content validity were checked by a panel of experts that included patients, physiotherapists and academics.

Patient Satisfaction. Patient satisfaction was measured quantitatively and qualitatively. Quantitative measurement used a patient satisfaction questionnaire to measure how satisfied the participant was with the behavioural and educational aspects of the CBPE programme using a 7 point response (*very strongly disagree* to *very strongly agree*) (Appendix 17). It was assessed by seven items adapted from the original 17 item Patient Satisfaction with Computer-Based Patient Education Scale (Bassett, Clark, McNair, & Harman, 2010). An example of the type of question asked is “*The CBPE programme gave me all the information I wanted to know about my injury/disorder.*” The ten items that were removed from the original questionnaire were inappropriate for a CBPE programme as they required participants to interact with the physiotherapist. An example is “*I felt free to talk to my physiotherapist about the things that were bothering me*”. The internal consistency reported was a Cronbach’s alpha = 0.91 (Bassett et al., 2010). In this study the Cronbach’s alpha = 0.87.

Open ended questions assessed the participant’s satisfaction with the CBPE programme. An example of a statement participants were asked to comment on was the *Acceptability and impact of the CBPE programme.*

Physiotherapist/Receptionist Feedback

Open ended questions gathered information from physiotherapists and the receptionists regarding their perceptions about the procedures and protocols of the pilot study (Appendix 18). This was analysed qualitatively. An example of a question physiotherapists were asked about was *Were there sufficient exercises offered on the CBPE programme?*

Intervention

All participants were given access to the CBPE programme at the first meeting with the researcher. Those with broadband were given access to a website requiring a

password to enter and those that did not have broadband had the CBPE programme installed onto the hard drive of their computer. Instruction was given to familiarize participants with the targeting of groups to gender and age, navigation, interactive features of the programme and with diary reporting. Participants who accessed the CBPE programme on the internet were asked to submit their diary electronically on a daily basis and participants without internet access were required to complete a manual diary and submit it to the researcher weekly. There were no restrictions on the length of time that participants could spend using the CBPE programme.

Each participant with the assistance of the researcher formed a realistic goal of what they would like to achieve by the end of their physiotherapy, such as “*return to sporting activities*.” The contribution of the prescribed exercise programme in achieving this goal was discussed with the researcher. Action and coping plans based on the HAPA model (Schwarzer, 2008a; Sneihotta et al., 2006a) were then formulated with the assistance of the researcher. Action plans addressed where, when and how they were going to do their exercise programme (Appendix 19). Any barriers the participants foresaw that might prevent them completing the programme were identified and coping plans were made to overcome these obstacles (Appendix 20). The participant’s overall goal, and their action and coping plans were recorded on cards that were given to the participant for their reference over the duration of the pilot study. The cards were brightly coloured so they acted as a cue to exercise when seen, but small enough to fit inside a wallet so they could be accessed easily.

Procedure

Ethical approval was obtained from Northern Region Y Ethics Committee, NTY/09/12/116, and from Auckland University of Technology Ethics Committee (AUTEC) Application Number 10/59 (Appendix 21). The participants’ physiotherapist diagnosed the shoulder injury and prescribed an exercise programme that was available on the CBPE programme. Once notified by the physiotherapist of the potential participant’s suitability for the pilot study, the receptionist invited the patient to take part in the study. Those who were interested met with the researcher at either the physiotherapy clinic or at a place and time convenient to both potential participants and researcher prior to their second appointment. At this visit the researcher provided prospective participants with verbal and written information about the study (Appendix

22). Those who agreed to take part were required to sign a consent form (Appendix 23), and were enrolled on the study.

At the initial research assessment participants completed questionnaires pertaining to demographics, characteristics of shoulder injury and pain, upper limb function, knowledge of shoulder disorder, risk perception, treatment outcome expectancies, action self-efficacy and behavioural intentions. Access to the CBPE programme using a username and password was then given to participants. If a specific exercise was not on the CBPE programme and the physiotherapist felt it necessary to include, they were able to do so. The researcher played no part in the physiotherapy treatment plan or practice.

Throughout the four week period home-based adherence was reported by the participant using self-report diaries. Clinic-based adherence was measured using percentage of scheduled appointments attended to those not attended at the physiotherapy clinic and the physiotherapist measured adherence to aspects of the clinic-based programme using the SIRAS (Brewer et al, 2000).

At the end of the four weeks the participants meet with the researcher at the physiotherapy clinic or their home where they completed the DASH, P4 and knowledge questionnaires that were assessed pre-intervention. In addition they answered questionnaires pertaining to maintenance- and recovery self-efficacy and satisfaction with the CBPE programme. Feedback was also obtained from physiotherapists and receptionists about the administration of the questionnaires, procedural aspects of the protocol and the acceptability of the CBPE programme.

Data Analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) software version 19 (IBM Corporation, 2010) with the alpha level set at 0.05. Prior to hypothesis testing, data were screened for outliers and tested for normal distribution and as it was distributed normally parametric testing was used. Descriptive statistics evaluated demographic information and injury characteristics of the participants. Prior to correlations being analysed data was plotted using scatterplot to rule out any curvilinear relationships. The strength of the correlations was based on Table 2 (J. Cohen, 1988). The process used to analyse the data is described below.

Table 2
Cohen's Correlation Strengths

.10 to .29 or -.10 to -.29 = small
.30 to .49 or -.30 to -.49 = medium
.50 to 1.0 or -.50 to -1.0 = large

Hypothesis 1: The CBPE Programme and the Formulation of Action and Coping Plans Based on the HAPA Model will result in:

(i) High Scores for Self-Efficacy.

Scores for action, maintenance and recovery self-efficacy were analysed descriptively using means and standard deviations (SDs).

(ii) High Levels of Adherence to the Clinic- and Home-Based Component of the Physiotherapy Rehabilitation. The three measures of adherence that is, percentage attendance, and home- and clinic-based adherence were tested using mean and SDs.

(iii) Better Shoulder Function. This was tested using means and SDs, paired sample *t*-tests and effect sizes calculated to indicate the magnitude of the difference between pre- and post-intervention scores for the DASH and P4. The DASH scores were used as continuous data to indicate group differences over time as there is no non-parametric tests to compare groups in this manner.

Hypothesis 2: The CBPE Programme Based on the Cognitive Theory of Multimedia Learning will:

(i) Improve the Participant's Knowledge of their Shoulder Injury. A paired sample *t*-test from the pre-and post-intervention scores was used to test knowledge.

(ii) Produce High Levels of Participant Satisfaction. A quantitative assessment was made using means and SDs for the patient satisfaction questionnaire. Scores were calculated by taking the mean of seven items from a seven point response scale. The 10 open ended questions on the CBPE programme were analysed

qualitatively. Responses were grouped into themes to reflect the opinions of the participants.

Hypothesis 3: There will be Significant Strong Correlations amongst the Sequential HAPA Variables of the Extended Model

Pearson correlations tested the sequential order in the two distinct phases of the HAPA model. Thus the relationships were tested within the motivational phase, followed by the relationships in the volitional phase and lastly the adherence behaviour-functional outcomes relationship of the extended portion of the HAPA model.

Feedback from Physiotherapy Clinics

Feedback from the physiotherapists and the two clinics' receptionists were analysed qualitatively using two themes: study procedure and CBPE exercises. The method of analysis followed the steps described by Braun and Clarke (2006) which involved the researcher reading through the feedback sheets to become familiar with the comments made by the participants. Codes were generated that were based on these findings. The feedback was reread and coded by the researcher. Themes were identified and named from the reoccurring interconnected comments of the participants. The two themes were called 'study procedure' and 'CBPE exercises'.

Results

Demographic and Shoulder Injury Characteristics

The majority of participants identified themselves as New Zealand born Europeans (Pakeha). Most of participants were either employed or students and more than half had educational qualifications beyond secondary school. Fifty percent of the participants spent more than 10 hours per week on a computer and only three used a computer for less than three hours per week. Of the 20 participants who completed the study 11 were male and nine were female. Shoulder injuries were of sudden onset in 18 of the 20 cases with only five having experienced a previous shoulder injury. Of these five, four participants had physiotherapy previously for their shoulder injury but only two felt this was successful (Table 3).

Health Action Process Approach Variables**Risk Perception, Treatment Outcome Expectancies and Behavioural Intentions**

The descriptive data for three of the dependent variables in the motivational phase of the HAPA model are presented in Table 4. The scores were measured on a four point response scale, 1 to 4. The mean scores across the three variables were between three and four.

Table 3.
The Demographic and Shoulder Injury Characteristics of the Participants

	<i>n</i> = 24
Mean age (years)	43.2 (\pm 20.0)
Gender	
Female	10
Male	14
Ethnicity	
Pakeha	19
Maori	1
Pacific Islander	1
Other	3
Employment status	
Employed	16
Unemployed	1
Student	5
Retired	2
Highest Qualifications	
Secondary school	10
Tertiary (except University)	9
University	5
Hours/week on computer	
<1	3
1-5	4
5-10	5
>10	12
Onset of shoulder injury	
Gradual	4
Sudden	20
Previous shoulder injury	5
Physiotherapy for previous shoulder injury	4
Successful previous physiotherapy treatment	2

Table 4.
Risk Perception, Outcome Expectancies and Behavioural Intentions Mean Scores at Baseline

N = 24	Mean (\pm SD)
Risk perception	3.31 (\pm 0.81)
Outcome expectancy	3.71 (\pm 0.35)
Behavioural intentions	3.40 (\pm 0.51)

Phase Specific Self-Efficacy

Action self-efficacy was tested at Time 1 and maintenance and recovery self-efficacy were tested at Time 2. The means and standard deviations of the three different phases of self-efficacy are presented in Table 5. The scores for each self-efficacy were high.

Table 5.
Action, Maintenance and Recovery Self-Efficacy Descriptive Statistics

	Time period (n = 24)	Mean (\pm SD)	Time period (n = 20)	Mean (\pm SD)
Action self- efficacy	T1	3.53 (\pm 0.53)		
Maintenance self-efficacy			T2	2.97 (\pm 0.80)
Recovery self-efficacy			T2	3.44 (\pm 0.76)

Adherence

The descriptive data for percentage of clinic attendance, adherence to the clinic based component (SIRAS) and home-based adherence measuring self-report diary are presented in Table 6. The mean scores of the three adherence measures were uniformly high, however only 10 of the 20 participants completed the self-report diary.

Table 6.
Mean Scores for Percentage of Clinic Attendance, Clinic Attendance, and Clinic- and Home-

	n	Mean (\pm SD)
Percentage clinic attendance	23	91.1 (\pm 14.03)
SIRAS (out of a total of 15)	20	13.68 (\pm 1.12)
Diary (% adherence)	10	87.20 (\pm 15.01)

Based Adherence Measures

Functional Outcome Variables

DASH. There was a decrease in the score of the DASH from Time 1 ($M = 51.25$, $SD = 15.16$) to Time 2 [$M = 38.45$, $SD = 15.39$, $t(19) = 3.82$, $p < 0.001$, $\eta_p^2 = 0.43$]. Changes in the mean scores, and the standard deviations at each time point are graphically represented in Figure 18.

Pain. An analysis of pain showed that the pain scores decreased significantly from Time 1 ($M = 15.70$, $SD = 8.27$) to Time 2 [$M = 8.25$, $SD = 5.64$, $t(19) = 3.85$, $p < 0.001$, $\eta_p^2 = 0.44$] (Figure 19).

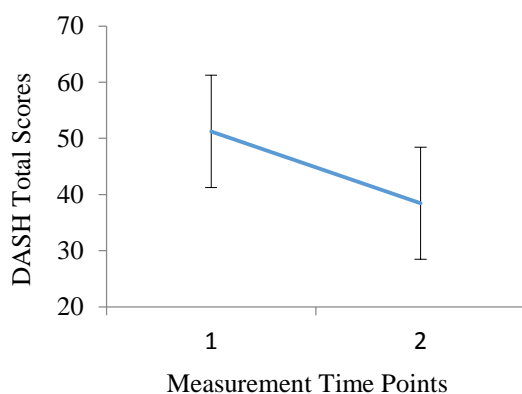


Figure 18. Mean DASH scores at Times 1 & 2.

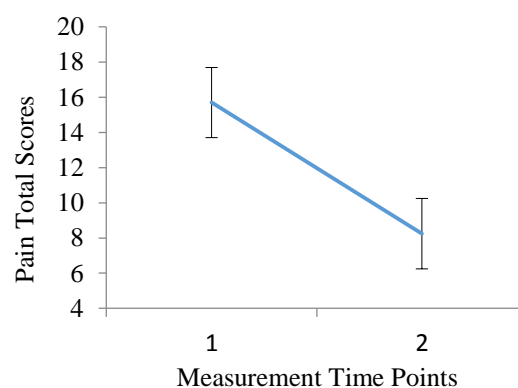


Figure 19. Mean Pain scores at Times 1 & 2.

Correlations of the Variables of the HAPA Model

The Pearson correlation coefficients amongst the HAPA variables that is action, maintenance and recovery self-efficacy, risk perception, outcome expectancies, behavioural intentions, and adherence behaviours are depicted in Figure 20. Action self-efficacy at Time 1 had a significant positive correlation of high magnitude with behavioural intentions. Outcome expectancies and behavioural intentions were weakly correlated and there was no relationship between risk perception and behavioural

intentions. In addition no significant relationships were found amongst the three antecedents of behavioural intentions that is action self-efficacy, outcome expectancies and risk perception.

At Time 2 moderately strong, significant correlations were identified between the two volitional phase self-efficacies. Behavioural intentions had significant and strong correlations with each of these measures and a strong significant correlation with the self-report diary. Maintenance self-efficacy was also positively correlated with the self-report diary, but this was the only adherence measure that was significantly related to either of the self-efficacies in the volitional stage. These weak non-significant correlations not shown in Figure 20 were: maintenance self-efficacy-percentage attendance = $-.09$; maintenance self-efficacy-SIRAS = $.13$; recovery self-efficacy-percentage attendance = $-.02$; and recovery self-efficacy-SIRAS = $.27$.

Relationship of Function Outcomes to HAPA Model

Five of the six correlations between the three adherence measures and the functional outcomes were negative with the percentage of attendance-DASH relationship ($r = -0.49$) being the only one to reach significance. A non-significant positive correlation occurred between the DASH and the self-report diary. To further clarify the percentage of attendance-DASH relationship an independent t -test compared the DASH scores of participants who attended all their appointments with those who did not. It was found that those who attended all their appointments had significantly lower DASH scores compared to those who did not [$t(18) = -.21, p < 0.04$].

The relationships between the HAPA and the extension of this model to include functional outcomes are shown in Figure 20.

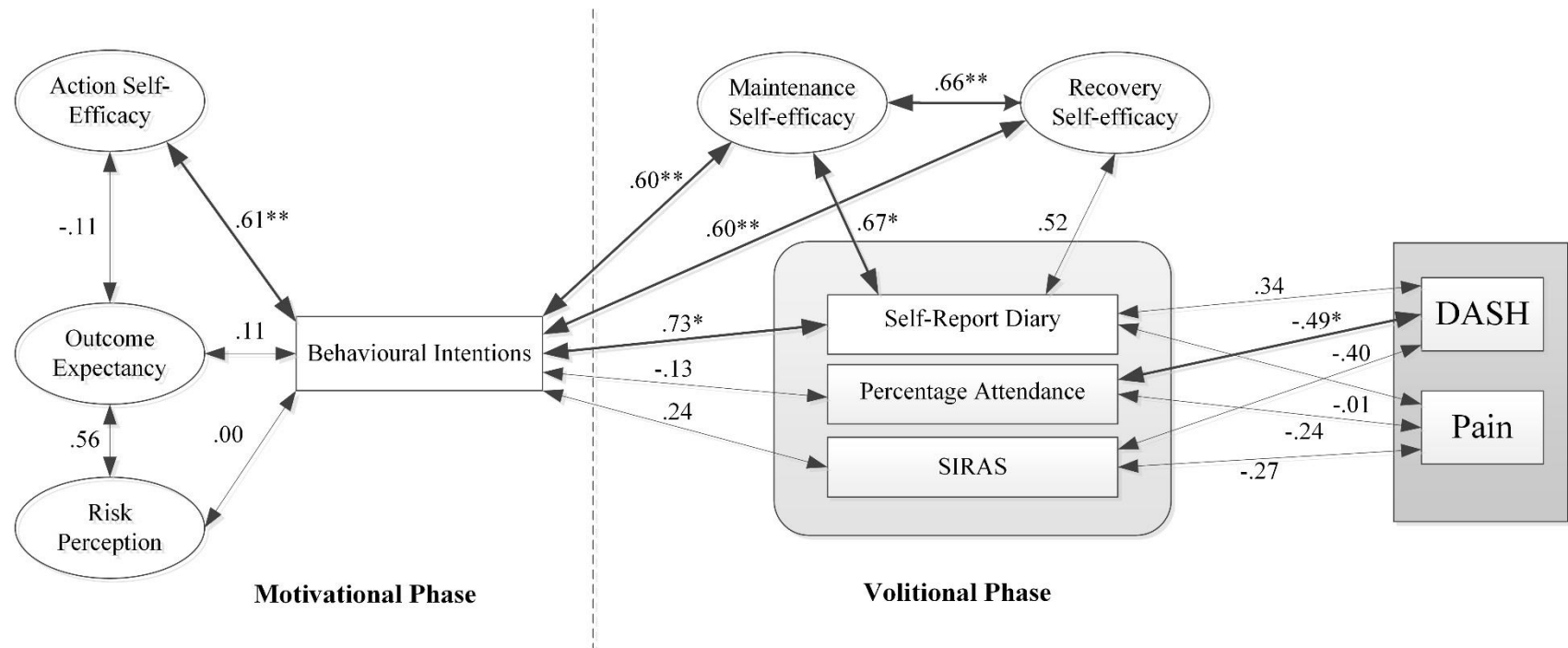


Figure 20. Pilot study correlations of the extended Health Action Process Approach.

Note: Adapted from a generic diagram of the Health Action Process Approach from 'Modeling Health Behavior Change: How to Predict and Modify the Adoption and Maintenance' by R. Schwarzer, 2008, *Applied Psychology*, 57, p.6. * $p < .05$, ** $p < .01$, thick lines = significant correlations, thin lines = non-significant correlations

Cognitive Theory of Multimedia Learning Variables

Knowledge

There was no significant difference in pre- and post-testing although there was an increase in the number of correct responses in eight out of the 10 questions at Time 2 (Figure 21).

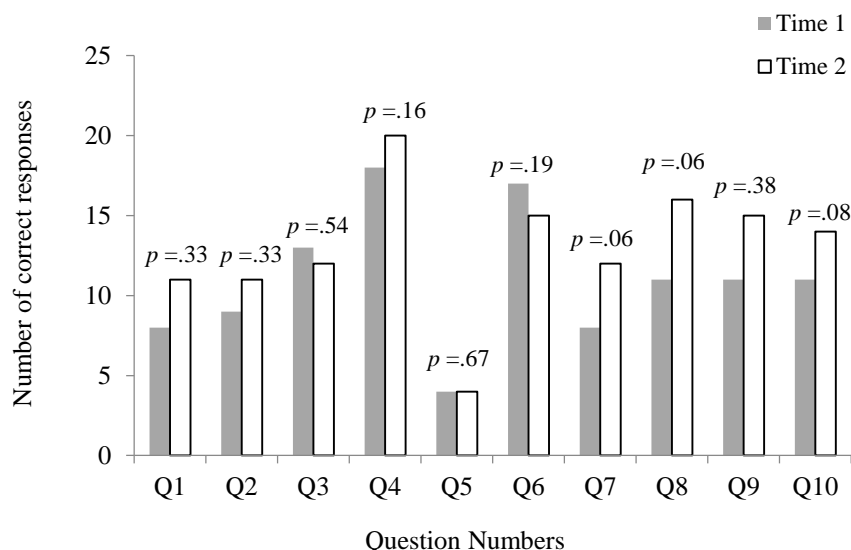


Figure 21. Correct question responses of pre- and post-knowledge test.

Patient Satisfaction

Descriptive statistics for patient satisfaction were 5.42 ± 0.77 , out of a maximum of 7. Qualitative analysis of the open ended questions revealed a number of themes. These were educational value, adherence factors, computer design, and delivery of physiotherapy.

Educational Value. The majority of participants identified the CBPE programme as being educational and that it was useful for gathering information and performance of exercises. For example comments ranged from it “*enabled correct performance of exercises,*” and that it was “*very good and I liked the videos to clarify the exercises.*” One participant specifically stated that it was a “*very useful adjunct – a picture is worth a 100 words.*”

Adherence Factors. Comments from four participants that typified responses, suggested that the CBPE helped them to adhere to their home-based exercise programme: *“Definitely helped me keep on track of my exercises”*; *“educational and reminded me to do exercises more regularly”*; *“encourages you to continue your physio programme”*; and *“encourages you to do tasks and complete the programme.”*

Programme Design. Responses from three participants that characterised other participants’ opinions, indicated that the computer programme was well designed and that the navigation was simple. Written comments included *“easy to find way through programme”*; *“easy to understand and follow”*; and *“great, clear purpose and benefitted from the programme.”*

Delivery of Physiotherapy. Fourteen of the 20 participants indicated that they would like a combination of both the CBPE programme and clinic-based physiotherapy. One participant suggested the *“DVD + physiotherapist to review progress from time to time.”* Another commented that the information on the CBPE was useful but *“... can’t replace face to face, one on one.”* Four of the participants answered that they would like CBPE delivery only.

Feedback from Physiotherapy Clinic

Responses from receptionists indicated that there was no difficulty approaching patients to participate in the study. Two of the four physiotherapists commented that the variety of video exercises offered on the CBPE were not sufficiently specific for their patient’s needs. Informal verbal feedback indicated that there were too many exercises on the programme making it difficult to become familiar with them.

Discussion

The pilot study provided support for using the extended HAPA model to explain the attitudinal and behavioural processes contributing to treatment adherence and functional outcomes in people undergoing physiotherapy for soft tissue injuries of the shoulder. The CBPE programme that was designed and developed using the Cognitive Theory of Multimedia Learning produced high levels of patient satisfaction and presented material to supplement the patient education prescribed by the physiotherapists. Factors thought to underpin these findings will be discussed by first considering the variables and correlations associated with the HAPA model and second,

the variables associated with the Cognitive Theory of Multimedia Learning. Strength and weaknesses will be outlined and recommendations made for the larger study.

Hypothesis 1: The CBPE Programme and the Formulation of Action and Coping Plans Based on the HAPA Model will result in:

(i) High Scores for Maintenance and Recovery Self-Efficacy

Overall the mean scores for the volitional self-efficacies were high pointing to participants feeling efficacious about their ability to maintain the exercises and overcome the barriers to them. This may have been facilitated by action and coping plans that were made at Time 1. It is also possible that other variables not part of the HAPA such as the participants' health beliefs influenced the scores.

The mean score for maintenance self-efficacy was relatively high (2.97 out of 4.00), although it was the lower of the two volitional self-efficacy scores. This could have been because participants became more aware of the commitment required to adhere to the rehabilitation programme over the four week study period which was undertaken before completing the questionnaire at Time 2. Any doubts about their ability to maintain the activities over a further time period may have been reflected in a lower score. A second factor, but one that may have lessened this influence was diary keeping. Such activities have been shown to foster self-efficacy (Muraven, Baumeister, & Tice, 1999; Sniehotta, Scholz, Schwarzer, et al., 2005), and may have buffered the maintenance self-efficacy score.

Seventy percent of the participants lapsed from their home-based rehabilitation programme over the four week study period but were able to resume the rehabilitation programme which corresponds to the high mean recovery self-efficacy score (3.55 out of a possible 4.00). It is likely that their successful recovery would have given the participants confidence thereby leading to their high recovery self-efficacy at Time 2 (Sniehotta, Scholz, & Schwarzer, 2005). It could also indicate that participants found the treatment beneficial and obtained symptomatic relief, which in turn motivated them to restart the exercise programme.

(ii) High Levels of Adherence to the Clinic and Home-Based Component of the Physiotherapy Rehabilitation

Participants had high scores on the three adherence measures as predicted. Formulating action and coping plans at baseline may have influenced the adherence

scores by increasing awareness of the participants' role in the exercise programme. This could have occurred through action planning that determined where, when and how participants would do their exercise programme, and has been found important in bridging the gap between behavioural intentions and actual behaviour (Gollwitzer, 1999; Luszczynska & Schwarzer, 2003; Orbell & Sheeran, 2000). Coping plans on the other hand, would have increased awareness by devising strategies that assisted participants overcome any barriers or obstacles that may have prevented their adherence to the rehabilitation programme (Sniehotta, Scholz, & Schwarzer, 2005). It is likely that making coping plans alerted participants to potential barriers and this helped prepare them for overcoming these barriers.

Clinic-based treatment continued over the duration of the study enabling face-to-face contact with the physiotherapist and allowing the physiotherapist to oversee and progress the home-based component of the treatment programme. A systematic literature review undertaken by Roddy, Zhang et al. (2005) found that close supervision of clients undergoing an exercise programme was associated with high levels of adherence. The results of the present study where percentage attendance to clinic-based physiotherapy was 91% is consistent with these findings and is in line with that of Bassett and Prapavessis (2007) who reported a slightly higher rate of 92%, and Kolt and McEvoy (2003) where percentage attendance was 87.7%.

Only 50% of participants submitted diaries but within this group adherence to home-based rehabilitation was high. There are several reasons that may have accounted for the high adherence score. One, non-adherers were less likely to submit a report. Meichenbaum and Turk (1987) found that response bias could be due to participants wanting to be seen positively, so rather than reporting non-adherence, participants may not have submitted a report at all. Two, submitting electronic diaries each day may have acted as a cue to exercise (Brewer, 1999; Meichenbaum & Turk, 1987). Three, participants may have overestimated their adherence to the home programme. Moseley (2006) reported a 10% overestimation to home-based adherence in patients who had been referred to physiotherapy clinics. It should also be noted that failing to return a diary report may not always indicate that participants were non-adherent, only that they were non-adherent in returning the adherence report (Roddey et al., 2002).

In the current study 87% of participants who submitted a diary adhered to the home programme measured by a self-report diary which compares to 78% adherence

found by Moseley (2006) and 93% found by Bassett and Prapavessis (2011). While adherence is high in all three studies the result reported in this study should be viewed with caution since the sample size was small ($n = 20$), with only 10 of the participants returning an electronic self-report diary. No reminder notices were sent out to participants over the four week study period which may account for the low number of returns. To confirm the level of adherence a larger study would be required.

Physiotherapists used the SIRAS questionnaire to evaluate the participants' clinic-based adherence which was found to be high (mean = 13.68 out of 15). The SIRAS uses just three items to measure adherence behaviour in the clinical setting which may fail to capture the full range of adherence behaviours and be one reason for the high score (Granquist et al., 2010). The presence of the physiotherapist may further have influenced these scores as participants like to be seen doing what has been requested (Meichenbaum & Turk, 1987). Moreover, the scale may be susceptible to response bias by physiotherapists as noted by Brewer, Van Raalte, Petitpas, et al. (2000) although Kolt et al. (2007) have found high inter-rater agreement and reliability and satisfactory test-retest reliability.

There are two additional factors that may have influenced adherence in this study. First, participant recruitment may have been a factor contributing to home-based exercise adherence. Research has shown that participants who agree to be part of studies are likely to be more adherent than those undertaking a normal course of treatment (Moseley, 2006). Additionally, Lonnqvist et al. (2007) found that volunteers are in general better adjusted than non-volunteers in undertaking research activities which may moderate the effects of a dependent variable. The implication for clinical studies is that the characteristics of people recruited may not be representative of the general population. Second, the CBPE programme was informative and designed to be an educational resource that participants could access at any time during the rehabilitation period. Feedback suggested that the CBPE programme itself may have assisted adherence to the home-based component of the treatment programme with a typical comment from participants that the CBPE programme reminded them to do their exercises. Weeks, Brubaker et al. (2002) found that videotape modelling motivated subjects more than static diagrams to learn and correctly perform exercises. The dynamic elements of the CBPE programme used in this study may similarly have encouraged the participants to adhere to their physiotherapy rehabilitation.

(iii) Better Shoulder Function and Reduced Pain

There was a significant increase in upper limb function and a significant decrease in pain over the four week research period. There are four possible reasons that may have accounted for this: one, clinic-based physiotherapy treatment was efficacious as found by Brox, Staff, Ljunggren, & Brevik (1993) and Ginn, Herbert, Khouw, Lee, & Wilk (1997); two, the home-based programme was effective (K. L. Miller, Magel, & Hayes, 2010; Thomas et al., 2002); three, the CBPE programme, and action and coping plan intervention changed behaviour resulting in better adherence that is likely to have led to better outcomes (Sniehotta, Scholz, & Schwarzer, 2005; Ziegelmann et al., 2006); and four, healing of the shoulder injury occurred naturally. It is probable that a combination of these factors resulted in better shoulder function and reduced pain.

Hypothesis 2: The CBPE Programme Based on the Cognitive Theory of Multimedia Learning will:

(i) Improve the Participant's Knowledge of their Shoulder Injury

There were no significant differences identified between pre- and post-knowledge test scores but the number of correct responses increased in eight out of the 10 questions between Time 1 and Time 2. Although a larger sample size may be required to identify a significant difference, the improvement in knowledge lends support to findings of five studies in a systematic review undertaken by Beranova and Sykes (2007). They found from a total sample size of 650 people that computer-based education could successfully increase knowledge in coronary heart disease patients. A greater differential in knowledge scores may also have been identified if simple lay terminology had been used in the animations depicting shoulder anatomy and pathology. Nomenclature such as collar bone and shoulder blade could have been used rather than clavicle and scapula respectively. Although the anatomical terminology in the quiz section and in the knowledge questionnaire was consistent with the animations, it may have made understanding more difficult. Ley (1988) found that simplification of text such as simple wording, short sentences and avoiding jargon was positively correlated with better comprehension. These principles can be applied to the content of multimedia programmes which includes videotapes and computer programmes.

(ii) Produce High Levels of Participant Satisfaction

Patient satisfaction with the CBPE programme was high and did not appear to be influenced by age, suggesting that the CBPE was a suitable media for all ages. Besides interest being generated by graphical material (Meade et al., 1994), patient satisfaction may have been enhanced by the programme being accessible at any time and by the opportunity to study the material at the participant's own pace (J. Miller et al., 2009). These features could account for three of the five studies reviewed by Beranova and Sykes (2007) that reported patients preferred computer education to standard education methods such as dialogue or the use of leaflets. Feedback from participants in the current study indicated that they particularly liked the videos showing the exercises which appeared to give them confidence that they were doing them correctly and the graphics that they felt made the information easier to understand. Satisfaction with the CBPE programme is also likely to have made interaction with the programme worthwhile for the participant which in turn has acted as a cue to exercise and enhanced exercise adherence (Sluijs et al., 1998; Sluijs & Knibbe, 1991).

There were two major areas that required examination in the development of a CBPE programme. One was embedding the programme in a model that encouraged adherence of the programme and the other was constructing the programme to ensure that the material could be understood by a diverse group of patients. To date the HAPA model has been used in rehabilitation settings to predict whether patients are likely to adhere to treatment (Luszczynska et al., 2011; Scholz et al., 2005; Schuz, Sniehotta, Wiedemann, & Seemann, 2006), while other studies have used the HAPA as an intervention to enhance the variables such as self-efficacy which may improve treatment adherence (Luszczynska et al., 2006; Luszczynska et al., 2011; Sniehotta, Scholz, & Schwarzer, 2005). Harnessing educational methods to deliver patient education programmes amongst the health professions on the other hand, has been limited although there are research groups such as Keulers, Keulers, Scheltinga, and Spauwen (2006) who have been proactive in the development of health education programmes for patient use. This study has developed a CBPE encompassing both models but extends the HAPA to account for functional outcomes which have been shown to directly relate to treatment adherence (Bassett & Prapavessis, 2011; Brox et al., 1993; Ginn et al., 1997).

Hypothesis 3: There will be Significant Strong Correlations amongst the Sequential HAPA Variables of the Extended Model

The findings of this pilot study lend support for the use of the HAPA model to explain the relationships between the HAPA variables that contribute to adherence. In addition they provide evidence for extending the HAPA model through the association of adherence and functional outcomes in people undergoing physiotherapy for soft tissue injuries of the shoulder. Nevertheless it should be noted that the role of the motivational variables were only assessed at Time 1 and therefore have no direct implications on the findings of the intervention. Aspects of these relationships that warrant further comment are discussed below.

The antecedents of behavioural intentions such as action self-efficacy, outcome expectancies and risk perception were required for participants to form behavioural intentions prior to starting physiotherapy. However once participants have begun their physiotherapy treatment they were acting upon their behavioural intentions so it was presumed they had entered the volitional stage of the HAPA (Lippke et al., 2004a). Furthermore participants were attending physiotherapy to reduce their symptoms so they would have been motivated to adhere to treatment prescriptions. Hence, validating the volitional portion of the model is especially important if the HAPA is to provide a theoretical framework that can be used to enhance adherence behaviour and improve functional outcomes in physiotherapy patients.

The significant strong correlation between action self-efficacy and behavioural intention in the motivational stage is in line with correlational findings of previous research (Bandura, 1982; Bassett, 2006; Lippke et al., 2004a; Schwarzer et al., 2007), and supportive of the predictive ability that action self-efficacy has been found to have on behavioural intentions (Barg et al., 2012; Luszczynska & Schwarzer, 2003; Scholz et al., 2005). These findings point to people who feel efficacious about undertaking their exercises being likely to follow through with their intentions (Sniehotta, Scholz, & Schwarzer, 2005) and therefore the demands of treatment such as adhering to an exercise programme. Furthermore, in addition to self-efficacy it should not be overlooked that the questionnaires themselves were likely to have impacted on behavioural intentions and informed participants which has been found to assist in the development of their intentions (Ogden, 2003). Interestingly, in this study those who dropped out of the programme had slightly lower scores for action self-efficacy and

behavioural intentions at Time 1 than those who completed it. Sniehotta et al. (2005) also found slightly lower exercise intentions at baseline between those who completed the questionnaires and those that did not. Despite this, the mean scores for behavioural intentions of both groups in the two studies was high (between 3.00 and 4.00), so it could be assumed that even those that dropped out were highly motivated.

There needs to be some caution when interpreting the motivational stage correlations involving behavioural intentions because of its questionnaire's moderate Cronbach's alpha (0.64). Scrutiny of the data analysis revealed the Cronbach's alpha would only have been improved minimally by removing item four from the questionnaire therefore all items were retained for the analyses. A reason for the less than desirable Cronbach's alpha could be that the items measured different behavioural intentions such as those relating to rest, exercise or advice given by the physiotherapist. Bassett (2006) also had moderate Cronbach's alphas for questionnaires asking about behavioural intentions to follow clinic- and home-based physiotherapy. The behaviours nevertheless typified the activities participants may have to undertake over the duration of treatment. Also the number of items in the questionnaire was less than 10 which often results in low internal consistency (Pallant, 2013). Furthermore, negative wording in one question may have influenced the Cronbach's alpha. Wilson and Park (2008) found that negatively worded health information can impact on memory with patients, especially older adults, and that they are more likely to misinterpret negatively worded health statements.

No significant correlations were found between risk perception, outcome expectancies and action self-efficacy. Risk perception, outcome expectancies and action self-efficacy are thought to be in a causal order with risk perception the most distal and action self-efficacy the strongest predictor of behavioural intention (Conner & Norman, 2005). Schwarzer (2011) has shown however, that personal experiences may play a role and change this pattern. In this study the weak correlations between behavioural intentions and risk perception, and behavioural intentions and outcome expectancies provides further evidence of the limited impact both risk perception and outcome expectancies had on the formation of behavioural intentions once participants had begun their rehabilitation programme. Scatterplots were used to further inspect the relationship between behavioural intentions and risk perception, and behavioural

intentions and outcome expectancies. This confirmed the weak relationship although greater participant numbers would be required to validate the correlation.

While no significant correlations were found between the three antecedents of behavioural intention, each variable had a high mean score. Factors leading to these scores may reflect events or beliefs that fall within and outside the HAPA model. For example high scores for risk perception may indicate that participants would have been very aware of the risk and consequences of not doing their home-based component of their physiotherapy especially at Time 1 when symptoms such as pain and movement dysfunction were most severe. As symptoms reduced and normal function returned risk perception may become less important to the participant. Outcome expectancies on the other hand, could be influenced by previous experience of physiotherapy treatment, personal beliefs regarding physiotherapy or advice from others about seeking physiotherapy (Bassett & Prapavessis, 2011). Moreover, physiotherapists are ethically obliged to inform patients about their treatment and the possible outcomes which are likely to be relevant and tailored to the participants' needs further influencing their outcome expectancies.

The moderate to strong correlations between maintenance and recovery self-efficacy point to participants feeling efficacious about overcoming any barriers to their home-based physiotherapy or resuming their exercise programme if they have a lapse from it. These correlational findings may point to a common underlying general self-efficacy construct underpinning each self-efficacy may have been operating. This underlying self-efficacy concept has also been reported in other studies (Luszczynska, Gutierrez-Dona, & Schwarzer, 2005; Sherer et al., 1982). Similarly there were strong correlations between each of the self-efficacies and behavioural intentions which is consistent with other physiotherapy research where moderate to strong correlations were found between self-efficacy and behavioural intentions (Bassett & Prapavessis, 2011).

The relationship between both the volitional self-efficacies and adherence was mixed. A strong significant correlation was found between maintenance self-efficacy and the self-report diary. This is not surprising given that diaries are reported to be just as much a measure of adherence as a prompt to undertaking the prescribed treatment activities (Brewer, 1999). Other correlations between percentage attendance and each of the volitional self-efficacies and between the SIRAS scores and each of the volitional self-efficacies were weak. This was not unexpected as the adherence measures related

to the clinic-based rehabilitation programme and the two self-efficacy measures focused on the beliefs about coping with the home exercises programme. These findings reinforce the importance of using a multifaceted approach to measuring treatment adherence both in research and the clinical setting (Brewer, 1999).

There is mounting support that formulating action and coping plans bridges the gap between behavioural intentions and a specific behaviour (Brandstatter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Sheeran, 2006; Luszczynska & Schwarzer, 2003; Luszczynska et al., 2011; Schuz et al., 2006; Sniehotta, Scholz, & Schwarzer, 2005). This appears to have occurred in the current study and may have alerted participants to the potential barriers to successfully undertaking a home exercise programme. The impact of planning could therefore have increased the participants' awareness of their role in their rehabilitation which is likely to have contributed to the high stable levels of treatment adherence and indirectly to functional outcomes. The significant correlation between behavioural intentions and the self-report diary may also have been facilitated by participants interacting with the CBPE programme each time a diary entry was made. Increasing familiarity with the CBPE programme may have prompted further inspection of the material which was designed to promote understanding and self-efficacy, and resulted in strengthened behavioural intentions.

On the whole the correlations between the adherence measures and the two functional outcomes (DASH and P4) support the extension of the HAPA model to include functional outcomes. The most notable of the adherence-functional outcome relationships was the significant moderate correlation between percentage of attendance and the DASH. Interestingly participants who attended all clinic appointments had significantly better functional outcomes as measured by the DASH scores than participants who did not attend all appointments. Similar findings were identified by Bassett and Prapavessis (2011) who investigated adherence to physiotherapy for ankle sprains. While attendance at physiotherapy is not a measure of adherence during clinic-based treatment it does allow more frequent evaluation and progression of clinic- and home-based physiotherapy which should lead to better recovery. Significant relationships between adherence to physiotherapy and functional outcomes have been identified in other studies that includes osteoarthritis of the knee (Thomas et al., 2002), anterior cruciate reconstruction (Brewer et al., 2004) and the prevention of falls in older adults (K. L. Miller et al., 2010). The correlation may signify the importance of the

physiotherapist-patient relationship in terms of the physiotherapist supporting and progressing the patient through their rehabilitation (Rindflesch, 2009). It may also imply that planning clinic appointments strategically to coincide with treatment changes and progressions should provide the most effective scheduling sequence (Bassett & Prapavessis, 2007). These studies strengthen the notion that the HAPA model could be extended to include functional outcomes.

Strengths and Limitations

There were four main strengths of this research. One, the measures used in the study were valid and reliable. The psychometric measures were adapted from the HAPA model (Schwarzer et al., 2008), functional outcomes were measured by the DASH (Gummeson et al., 2003) and P4 (Spadoni et al., 2004) questionnaires and the Patient Satisfaction with Computer-Based Patient Education Scale (Bassett et al., 2010) measured the patients' satisfaction with the CBPE programme. Two, a multifaceted approach was used to measure adherence. The areas assessed were attendance at scheduled physiotherapy appointments, and adherence to clinic- and home-based physiotherapy (Brewer, 1998a). Three, the use of theoretical models in the development of the CBPE programme.

There were several limitations to this study. One, the use of self-report diaries poses a well-recognised problem in adherence research as inaccuracies may arise from overestimating adherence (Moseley, 2006; Sluijs et al., 1998). Moreover, if diary information is submitted for more than one day at a time errors can result through inaccurate recall (Meichenbaum & Turk, 1987; Myers & Midence, 1998). In the present study this information was not retrieved so it is unknown if inaccuracies occurred from multiple entries. Two, the SIRAS may also be subject to adherence inaccuracies as it is limited by the number of behaviours it can capture in three items and it may be subject to response bias by the physiotherapist (T. Shaw et al., 2005). Three, the small range on the psychometric scale, 1-4, may have led to a ceiling effect (L. Cohen, Manion, & Morrison, 2000).

Implications for the Main Study

The pilot study has identified several areas where changes need to be made for a larger study. These include modification to the adherence measures and psychometric

scales, minor changes to the CBPE programme, adjustments to self-report submission page and change to the recruitment protocol to facilitate participant recruitment.

A difficulty in the pilot study was that only 50% of participants submitted diary information. This may indicate that the arrangement of the diary page on the CBPE programme was not user friendly so modifications to simplify this page will be made in an attempt to increase diary use. Additional measures that will be taken to enhance submission of the self-report diary will be weekly emails to participants. For those participants who may be reluctant to fill in the electronic diary a manual version will be offered at Time 1.

Adherence to clinic-based physiotherapy was measured by the SIRAS. A more extensive 16 items questionnaire, the Rehabilitation Adherence Measure for Athletic Training (RAdMAT) that uses three subscales (attendance/participation, communication, and attitude/effort) will be used in addition to the SIRAS for the main study. This measure has good internal consistency and covers a broader array of adherence behaviours (Granquist et al., 2010) but was unable to be used at the inception of the pilot study because the questionnaire had not yet been published. In addition, since there has been limited research in a physiotherapy setting using the RAdMAT, correlations of this clinic-based measure with other HAPA variables will be compared to those using the SIRAS.

A ceiling effect could have been operating in the psychometric variables in this pilot study as evidenced by the high motivational scores in particular as these were prior to the action and coping planning intervention. The 4-point Likert scale may not have been sufficiently discriminative or sensitive so a 7-point Likert scale will be used for the main study to overcome this limitation (L. Cohen et al., 2000; Zimmermann, Bandura, & Martinez-Pons, 1992).

Medical and anatomical terminology throughout the programme will be simplified and where possible changed to everyday language, for example the scapula will be changed to shoulder blade or acromion process to the point of the shoulder. Quiz questions will be modified to reflect this. The frequently asked questions component will be expanded. This will take into account comments made by participants during the pilot study and include for example suggestions about sleeping, the different colours of theraband, and more dressing hints. Enhancing self-efficacy

will be boosted by increasing information about the link between adherence and functional outcomes on the introductory page of the CBPE programme and by providing more verbal persuasion through a video clip that will be delivered by an expert in physiotherapy.

Three of the knowledge questions will be changed from those in the pilot study because the answers to questions 5, 7 and 10 were not addressed on the CBPE programme. The content validity was therefore compromised as the information had not been made available to the participants on the CBPE programme.

Summary

Overall the combination of the CBPE programme, and action and coping planning appeared to be successful in raising self-efficacy scores which may have led to improved adherence and ultimately better functional outcomes. The Cognitive Theory of Multimedia Learning provided a suitable model to guide the development of the CBPE programme which participants indicated they were satisfied using. It was evident from the correlations that the extended HAPA was an appropriate model for investigating soft tissue injuries/disorders and that self-efficacy was a strong predictor of behavioural intentions which appears to be a prime factor in the initiation and maintenance of adherence behaviour. Factors that warrant additional comment are discussed below.

The correlations from this study point to the HAPA model as being suitable for explaining attitudinal and behavioural processes that influence treatment behaviours that may impact on functional outcomes of physiotherapy patients in a rehabilitation setting. These strategies were able to be embedded in the Cognitive Theory of Multimedia Learning and have resulted in a programme that participants have found understandable, comprehensive and useful. It also indicates that the HAPA model has the potential to provide a framework that physiotherapists could use to improve patients' adherence to treatment and ultimately improve their functional outcomes. The strong correlation between maintenance self-efficacy and self-report diary recordings points to people who believe they can overcome obstacles to doing the prescribed home exercises are likely to adhere to them. Hence the action and coping plans may be a valuable adherence enhancing adjunct to physiotherapy for patients who have problems adhering to their home exercises. The importance of treatment adherence is further emphasised by the

significant percentage of attendance-shoulder function relationship. While regression analyses have not been done because of the small sample size, a larger study may confirm its value in an acute clinical setting. Validation of the expanded HAPA model could provide a pathway that physiotherapists could adopt to improve adherence to treatment with subsequent improved functional outcomes for their patients.

Chapter 8. Main Study

Purpose

The purpose of this study was threefold. The primary purpose was to evaluate the effectiveness of combining a web-based CBPE programme with an action and coping planning intervention to enhance rehabilitation adherence in participants with shoulder injuries/disorders. The CBPE programme was compiled using the principles of the Cognitive Theory of Multimedia Learning (Mayer, 2001) and the content was grounded in the HAPA model (Schwarzer, 2011). One secondary purpose investigated the influence of attitudes and beliefs represented by the HAPA variables as a way of explaining rehabilitation adherence and on functional outcomes. The other secondary purpose assessed the utility of the RAdMAT questionnaire to measure adherence to clinic-based adherence.

Hypotheses

The primary hypothesis was that:

1. In comparison to the attention control group the intervention group which was exposed to the CBPE programme, and action and coping planning will have significantly
 - (i) higher maintenance- and recovery self-efficacy
 - (ii) higher rehabilitation adherence
 - (iii) improved shoulder function and decreased shoulder pain
 - (iv) better knowledge of shoulder anatomy and function, and behaviour change strategies to improve rehabilitation adherence
 - (v) high levels of satisfaction with the CBPE programme

Secondary hypotheses were that:

2. There will be significant strong associations amongst the sequential HAPA variables of the extended model.
3. There will be significant strong positive correlations amongst the RAdMAT and clinic- and home-based adherence measures.

Methods

Participants

One hundred and eight participants with an injury/disorder of the shoulder were recruited from eleven private physiotherapy clinics between their first and third appointment. Clinics were selected from four different geographical regions of the metropolitan area in order to provide a mixed socioeconomic profile of the sample. The inclusion criteria were that participants were 16 years or older which was part of the legal informed consent process, able to comprehend written and spoken English, and have access to broadband internet. People were excluded if they had any cognitive disorders that could impede their participation in the study.

The 108 participants who started the study comprised of 54 males and 54 females whose ages ranged from 17 to 83 years of age (mean = 50.6 ± 17.6 years). Of the 95 participants who completed the study 47 were male and 48 were female. Reasons given for 13 participants withdrawing included work and family commitments, health problems or they were unable to be contacted (see Figure 22). Shoulder injuries/disorders were of sudden onset in 70 of the 95 participants and 31 participants had suffered a previous shoulder injury/disorder. The number of physiotherapy appointments attended ranged from one to 14 (mean = 6 ± 2.72). More details of the sample characteristics is presented in the results sub-section titled Group Equivalency.

The sample size was based on the power calculation using the post intervention patient knowledge scores in a study undertaken by Keulers et al. (2007), in which they compared standardised information given by a doctor ($n = 49$) to information delivered by a CBPE programme ($n = 47$). Using G power (Faul, Erdfelder, Lang, & Buchner, 2007) a post hoc analysis using two independent means, *t*-tests on the means for knowledge scores (20.2 ± 3.9 , 23.5 ± 4.5) with the alpha set at 0.05 and power at 0.95 an effect size of 0.91 was found. To overcome the possibility of a 10% attrition rate a sample size of 108 participants was required.

Study Design

This study was a randomised, controlled, repeated measures experimental design in which participants were followed for the first eight weeks of their physiotherapy programme (Figure 23). Based on computer generated numbers, participants were randomly allocated to either the intervention or the attention control group. The researcher was not blinded to the group allocation. The role of the attention control group was to control for the possibility that website delivery of information may affect participants' attitudes and behaviours rather than the content of the website itself that was offered to the intervention group. Both intervention and control groups completed the same questionnaires except the intervention group answered an additional questionnaire about patient satisfaction with the CBPE programme. Feedback forms were given to both groups to complete at the end of the study and although there were questions in common, the intervention group were asked for additional feedback on areas pertaining specifically to the CBPE programme.

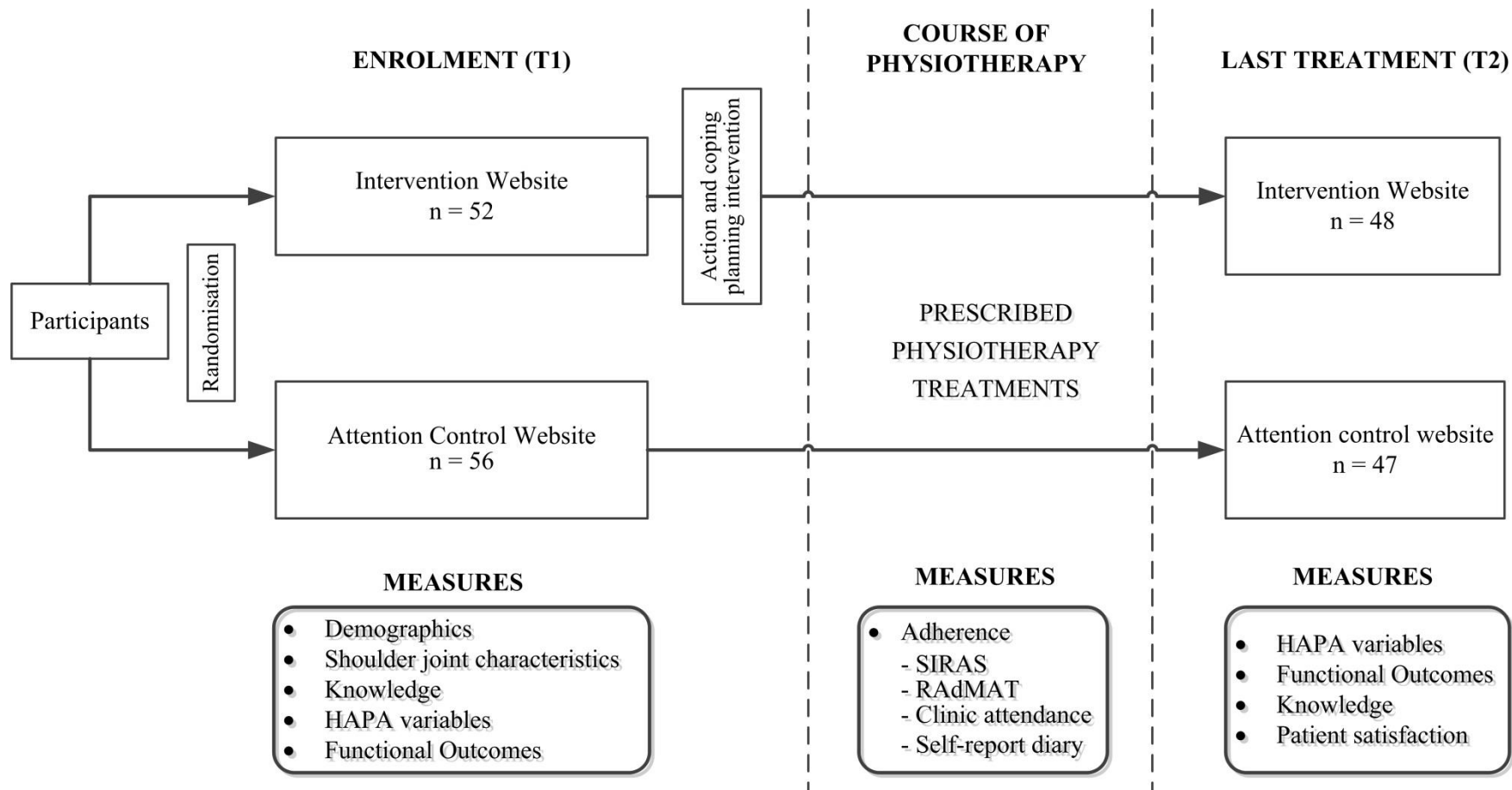


Figure 23. Design of study that investigated the effectiveness of the HAPA intervention.

Note: HAPA = Health Action process Approach, SIRAS = Sports Injury Rehabilitation Adherence Scale, RAdMAT = Rehabilitation Adherence for Athletic Training

Measures

Demographic and Shoulder Characteristics

Demographic and shoulder injury characteristics were measured by both closed- and open-ended questions. The participant's age, gender, ethnicity, occupation, highest educational qualification, hours spent using a computer each week, and reason for selecting the physiotherapy clinic were collected. The shoulder injury characteristics recorded were the date of onset, average number of appointments, whether the injury occurred during a sporting activity, previous history of shoulder injury and earlier attendance at physiotherapy for any other injury/disorder (Appendix 5).

HAPA Variables

Antecedents of Adherence

The items in the questionnaires used to measure the HAPA variables with the exception of adherence were worded the same in this study as those used in the pilot. Each questionnaire used a 7-point response format in line with some of the measures used by Luszczynska and Schwarzer (2003). For the purpose of this study the wording differed to those used by Luszczynska and Schwarzer (2003) with 1 = *very strongly disagree*, 2 = *strongly disagree*, 3 = *disagree*, 4 = *neither disagree or agree*, 5 = *agree*, 6 = *strongly agree*, 7 = *very strongly agree*. The Cronbach's alphas for each scale were .78 for risk perception (Appendix 24), .81 for treatment outcomes (Appendix 25), .81 for behavioural intentions (Appendix 26), .87 for action self-efficacy (Appendix 27), .92 for maintenance self-efficacy (Appendix 28), and .88 for recovery self-efficacies (Appendix 29).

Adherence

Adherence to clinic- and home-based rehabilitation was assessed throughout the study. Clinic-based adherence was measured using (i) the percentage of attendance at the scheduled rehabilitation appointments (ii) the SIRAS questionnaire and (iii) the RAdMAT questionnaire. Home-based adherence was measured using an electronic self-report diary.

Clinic-Based Adherence

The percentage of attendance at scheduled rehabilitation was calculated by dividing the number of appointments attended by the number of appointments scheduled and multiplying this number by 100. The method has been successfully used

in earlier research (Bassett & Prapavessis, 2011; Brewer, Van Raalte, Cornelius, et al., 2000).

The Sport Injury Rehabilitation Adherence Scale (SIRAS: Brewer, Van Raalte, Petitpas, et al., 2000) assessed adherence at each clinic-based rehabilitation session. This required the physiotherapist to assess the participants' degree of involvement during each treatment session using three items with a 5 point increment scale to give a total out of 15 points. The items related to the participant's exercise intensity, frequency at following instructions or advice and receptiveness to changes in the rehabilitation session which were rated using 1 = *minimum effort/never/very unreceptive* to 5 = *maximum effort/always/very receptive* respectively (see Appendix 12). Brewer, Van Raalte, Petitpas, et al. (2000) reported a Cronbach's alpha coefficient of 0.82 and a test-retest intraclass correlation coefficient of 0.77. In this study the Cronbach's alpha was 0.98.

The Rehabilitation Adherence for Athletic Training questionnaire (RAdMAT: Granquist et al., 2010) was completed by the physiotherapist at the end of the eight week study period or the course of treatment whichever came first (see Appendix 30). Clinicians rated each of the 16 items on a four point Likert Scale with 1 = *never true*, 2 = *sometimes true*, 3 = *usually true*, 4 = *always true*. The questionnaire had three adherence subscales: factor 1 related to attitude/effort (items 9 to 16) and rated statements such as "*shows interest in the rehabilitation process*"; factor 2 concerned attendance/participation (items 1 to 5) that assessed behaviours such as "*arrives at rehabilitation on time*"; and factor 3 involved communication (items 6 to 8) which measured statements such as "*asks questions about his/her rehabilitation*". The Cronbach's alpha for the total and three subscales were all greater than 0.75 indicating that the items contribute to the subscale and the total (Granquist et al., 2010). In this study the Cronbach's alpha for the RAdMAT were: total scale = 0.92; factor 1, attitude and effort = 0.92; factor 2, attendance and participation = 0.77; and factor 3, communication = 0.88.

Home-Based Adherence

The home-based diary required all participants to fill in a daily electronic report. This entailed answering four questions for each exercise with a maximum of five exercises prescribed by the physiotherapist. The questions asked about (i) how many sessions were set each day (ii) how many sessions had been completed (iii) the number

of repetitions that were given for each exercise and (iv) the number of repetitions that were completed. Participants responded by entering a numerical value against each of the four questions for each exercise. For example, if a participant was asked by their physiotherapist to do three sessions per day, and repeat each exercise 10 times and on a particular day they did only two sessions but the completed correct number of repetitions they would enter: 3, 10, 2, 10 in the corresponding boxes as shown in Figure 24.

Male: 16-45 years

Introduction
Interviews
Exercises
Hints on Exercising
ADLs
Anatomy
Shoulder Injuries
FAQs
Quiz
Diary

Did you complete the exercises required ?

history

pick up date

	Number of times/day you were asked to do your exercises	Number of repetitions/ex you were asked to do	How many times did you do your exercises today?	How many repetitions did you do for each exercise?
Exercise 1 prescribed by your physio	3	10	2	10
Exercise 2 prescribed by your physio	3	10	2	10
Exercise 3 prescribed by your physio	3	10	2	10
Exercise 4 prescribed by your physio				
Exercise 5 prescribed by your physio				

submit

Figure 24. Example of diary entries on the self-report electronic diary page.

Extended HAPA Variables – Shoulder Functional Outcomes

The methods of assessing shoulder function and pain were the same as for the pilot study. The DASH questionnaire (Gummesson et al., 2003) measured shoulder function and in this study had a Cronbach's alpha coefficient of .95 at Time 1 and .96 at Time 2 (Appendix 14). Pain was measured by the P4 scale (Spadoni et al., 2004) and in this study the Cronbach's alpha coefficient was .90 at Time 1 and .92 at Time 2 (Appendix 15).

Cognitive Theory of Multimedia Learning Variables

Knowledge

Knowledge was measured by ten multiple choice questions relating to the structure and function of the shoulder, and about behaviour change strategies that could

be used to enhance adherence. Four options were given for each multiple choice question with each having only one correct answer. A point was awarded for a correct answer with a total possible score of 10 (Appendix 31).

Satisfaction and Feedback about the Two Levels of Computer-Based Programmes

Patient satisfaction with the behavioural and educational aspects of the CBPE programme was only measured in the intervention group who had access to it. The quantitative questionnaire used was adapted from the Physiotherapy Patient Satisfaction Scale questionnaire also used in the pilot study (Bassett et al., 2010) (Appendix 17). The questionnaire was comprised of seven questions such as “*After using the CBPE programme I felt confident that I was accurately performing the exercises the physiotherapist had given me.*” The internal consistency reported by Bassett et al. (2010) was a Cronbach’s $\alpha = 0.91$ compared to this study where the Cronbach’s $\alpha = 0.87$.

Quantitative feedback from the intervention group was also obtained from three additional questions. Two were ‘yes’ or ‘no’ questions asking (i) if the diary was easy to complete and (ii) whether the participants would expect fewer physiotherapy appointments if they had the aid of a CBPE programme. The third question used multiple choice and gave participants four options about how they would like their physiotherapy delivered such as by “*physiotherapy plus an online programme*’ or ‘*online programme only.*” As in the pilot study qualitative open ended questions asked about the acceptability and impact of the CBPE programme, navigation through the programme, if additional information was obtained other than from their physiotherapist or the online CBPE programme and if there were any other comments about the study (Appendix 32).

Feedback from the attention control group who had access only to the attention control website was assessed using three of the same questions that were given to the intervention group. These questions asked (i) if the diary was easy to complete (ii) whether additional information was obtained other than from their physiotherapist and (iii) if there were any other comments about the study. A fourth question that was given only to the attention control group enquired about “*What other information could have been included on the website that may have helped you with your physiotherapy?*” (Appendix 33).

Intervention

Each participant made action and coping plans with the assistance of the researcher and was provided with a unique username and password to access the website www.computer.vinova.co.nz. Participants were required to select a gender and an age group above or below 45 years before linking to the CBPE homepage that displayed ten menu buttons. The topics displayed were *Interviews*, *Exercises*, *Hints on Exercising*, *ADLs*, *Anatomy*, *Shoulder Injuries*, *FAQs Quiz* and *Diary*. Alongside each button on the introductory page was a simple explanation of the content in each section (see Chapter 6 for more information). There was no restriction on the amount of time participants could spend viewing the information on the CBPE programme.

Attention Control

The attention control group used a different website address to the intervention group although the layout and colours of both programmes were identical. To gain access to the website www.video.vinova.co.nz required a unique username and password which linked directly to the homepage. There were two menu buttons on the homepage, one titled *Video* and the other *Diary*. The video was the same as that presented under *Interviews -Physiotherapist* on the intervention website. It consisted of an expert physiotherapist who gave general information about shoulder injuries/disorders (see Chapter 6 for more information). Information such as this could have been given to patients by their physiotherapist as clearly informing patients is required to comply with the Code of Ethics and Professional Conduct of Physiotherapists Practising in New Zealand (Physiotherapy Board of New Zealand & Physiotherapy New Zealand, 2011). The second menu button labelled *Diary* linked to an identical diary page as that on the CBPE programme and had the same data entry requirements.

Procedure

Ethical approval for the study was obtained from the Northern Y Regional Ethics Committee (reference NTY/12/06/056) and Auckland University of Technology Ethics Committee (AUTECH) (Appendix 34). The study was registered with the Australian New Zealand Clinical Trial Registry (reference ACTRN12612000611820). Eleven metropolitan private physiotherapy clinics agreed to take part and provide access to potential participants. Meetings were held with clinic staff and the receptionist to inform them about the study and to establish a method of facilitating contact between

the researcher and new participants. Staff were provided with information for prospective participants, and clinicians were given instruction on the use of the SIRAS and RAdMAT questionnaires for recording clinic-based adherence for each participant. The researcher played no role in the physiotherapy treatment. Exercise cards that identified 17 commonly prescribed shoulder exercises were left at each clinic and clinicians were asked to include at least one of these exercises in the home-based exercise programme prescribed for all potential participants. Prior to data collection computer generated random numbers determined whether participants would be assigned to the intervention or attention control group.

Patients diagnosed with a shoulder injury/disorder were treated and prescribed a home-based exercise programme by the physiotherapist on their first physiotherapy visit. This included at least one exercise from the exercise card. If patients met the study's inclusion criteria the physiotherapist informed the receptionist who gave the patient a brief outline of the study at the end of their treatment session and asked if they would be interested in taking part. For those who expressed an interest the receptionist passed on the contact details to the researcher who then arranged a meeting with potential participants before their third physiotherapy appointment. At this meeting the researcher provided potential participants with more detailed information about the study and their expected role in it. All participants who agreed to take part provided written informed consent and completed the pre-study questionnaires on personal demographics, shoulder injury characteristics, and HAPA variables. Neither physiotherapists nor receptionists were aware of the participants' group allocation.

Participants randomly assigned to the intervention group made action and coping plans with the assistance of the researcher. This required setting an achievable goal that could result from their physiotherapy rehabilitation such as returning to sport, followed by specific planning of where, when, and how they would do their home-based rehabilitation programme. On completion of the action and coping plans participants were given an exercise card that matched the one left at each clinic. The researcher identified any of the exercises in the home-based rehabilitation programme prescribed by the physiotherapist and marked these on the card. Participants were then given the website address and provided with a login name and password. Instructions were delivered on accessing the programme that was targeted to gender and age, the navigational pathways and the interactive features. This included (i) running the videos

(ii) using the key pad to view prescribed exercises (iii) viewing animations (iv) answering quizzes and (v) completing the diary.

Participants assigned to the attention-control group were given the website address and assigned a login name and password. The login page linked directly to the homepage where participants were instructed on (i) running the interview video and (ii) entering diary information. On completing the eight week study period all attention control participants were given access to the intervention website using the same username and password as they had for the attention control website.

Clinic- and home-based adherence for all participants was measured throughout the eight weeks. Clinic-based adherence was evaluated by clinicians who completed a SIRAS questionnaire at the end of each treatment session. Home-based adherence was measured by the self-report diary that participants were asked to complete daily. The researcher emailed participants at the end of each week to acknowledge their diary entries or remind them to update the entries if necessary. They were also informed of the number of weeks that they had completed.

At the end of eight weeks all participants were contacted and arrangements were made to meet at either the physiotherapy clinic or their home to repeat the pain and DASH questionnaires, and answered maintenance- and recovery self-efficacy questionnaires. In addition participants in the intervention group answered a patient satisfaction questionnaire which related specifically to the CBPE programme. Both intervention and attention control participants gave feedback of their respective websites. Physiotherapists completed the RAdMAT for each participant to evaluate clinic-based adherence over the entire eight week period, and provided the researcher with the number of appointments scheduled and the number of appointments attended for each participant.

Data Processing

The data file was checked for correctness of data entry by exploring the descriptive statistics for each categorical and continuous variable. This entailed checking the frequencies for categorical data and the range, means and standard deviations for continuous variables. Since normal distribution at baseline is assumed for parametric testing the distribution of continuous data was also examined using skewness and kurtosis statistics, histograms and stem and leaf plots. A positively

skewed distribution was found between the time of onset of shoulder symptoms and the seeking of treatment, with the Kolmogorov-Smirnov statistic being significant ($p < .0001$). However, this is to be expected as participants will normally seek relief from their symptoms as soon as possible after an acute injury/disorder. Two extreme outliers were also identified where the participants had waited 24 months before beginning physiotherapy treatment. There was one participant in each group and as the groups did not differ significantly both participants were retained for analysis. This is considered acceptable when the sample size is greater than 30 (Pallant, 2013). Prior to data analysis the knowledge scores and information on occupations was processed. First, knowledge scores were assessed by counting the number of correct responses for each participant at Time 1 and Time 2. The total number of correct scores was then treated as a continuous variable with a total score out of 10. Second, the list of occupations was collapsed into six broad categories, namely (i) professional (ii) skilled (iii) unskilled (iv) retired (v) student and (vi) unemployed.

Data Analysis

All data analysis was conducted using SPSS software version 22 (IBM Corporation, 2013) with an alpha level set at $p = .05$.

Group Equivalence at Baseline

Prior to hypothesis testing the data were screened at baseline. Chi-squared tests compared the groups' categorical data and one-way analysis of variance (ANOVA) with 95% confidence intervals compared continuous data. Group equivalency for gender, ethnicity, employment status, educational qualifications, the amount of time per week spent using a computer and all but one shoulder injury/disorder characteristic was assessed by Chi-squared tests. Age, time since shoulder injury/disorder, HAPA variables in the motivational stage (risk perception, outcome expectancies, action self-efficacy and behavioural intentions), knowledge, the DASH and pain scores were assessed by one-way ANOVAs.

Test of Hypothesis 1. In Comparison to the Attention Control Group the Intervention Group which was Exposed to the CBPE Programme, and Action and Coping Planning will have Significantly

(i) *Higher Maintenance and Recovery Self-Efficacy.* Group differences in these volitional variables of the HAPA were tested at time 2 using one-way ANOVAs.

(ii) *Higher Rehabilitation Adherence.* Comparisons were made between the

intervention and control groups using one-way ANOVAs.

(iii) ***Better Shoulder Function and Decreased Shoulder Pain.*** These functional outcomes assessed by the pain and DASH questionnaires were tested over time using mixed between-within subjects ANOVAs.

(iv) ***Better Knowledge of Shoulder Anatomy and Function, and Behaviour Change Strategies to Improve Rehabilitation Adherence.*** Once the correct knowledge scores for each participant had been counted group differences were tested over time using mixed between-within subjects ANOVAs.

(v) ***High Levels of Satisfaction with the CBPE Programme.*** A descriptive statistical analysis was made of the patient satisfaction questionnaire using means and standard deviations and the closed-ended responses on the feedback sheets were analysed by counting the responses to each of the questions. Open ended questions were analysed by grouping responses into themes to reflect the opinions of the participants.

Test of Hypothesis 2: There will be Significant Strong Associations Amongst the Sequential HAPA Variables of the Extended Model.

The correlation strengths were graded using Cohen's classification, the same as was used for the pilot study.

(i) Pearson correlations were undertaken to examine the intra-relationships amongst the four HAPA motivational variables (risk perception, outcome expectancies, action self-efficacy and behavioural intentions) and the three HAPA volitional variables (maintenance self-efficacy, recovery self-efficacy and adherence). The relationship between behavioural intention and each volitional variable was then examined.

(ii) Pearson correlations were undertaken to examine the relationships between adherence and function outcomes (DASH and pain) of the extended HAPA model.

(iii) Where there were significant correlations amongst variables in a temporal sequence, multiple regression analyses were used. This was based on the assumption that there was a significant correlation between at least two independent variables and the dependent variable of the model.

Test of Hypothesis 3. There will be Significant Correlations Amongst the RAdMAT, and Clinic- and Home-Based Adherence Variables

Pearson correlations examined the relationships between the RAdMAT and SIRAS; the SIRAS and each of the home-based adherence variables; the RAdMAT and each of the home-based variables and the RAdMAT and the three RAdMAT subscales.

Results

Results are presented initially with the baseline comparisons followed by the results of the testing of Hypotheses 1 to 3.

Group Equivalency at Baseline

Demographics

The demographic characteristics of the intervention and control groups were equivalent across the variables as can be seen in Table 8. The ages ranged from 17 to 83 with the majority of participants being New Zealand European which made up 77% of the sample. The remaining 23% were comprised of Maori, Pacific Island and other nationalities. Sixty four percent of the participants were employed and the remaining 36% were retired, students or unemployed. The most common reason given for selecting the physiotherapy clinic attended was (i) it was recommended (37 participants) (ii) the clinic was known (26 participants) or (iii) convenience as it was either on route or close to work or home (35 participants). Other reasons given were that there was no physiotherapy surcharge over and above the ACC payment and that the clinic was found using the internet.

Present and Previous History of Shoulder Injuries/Disorders

Significant differences were found between the two study groups for the gradual and sudden onset of shoulder injury/disorder and the number of participants who had been treated for a previous shoulder injury (Table 9). The onset of shoulder injuries/disorders was sudden for 81 of the 108 participants with over one third of the participants seeking treatment within the first 2 months. Two participants waited approximately 240 weeks before beginning treatment, one participant was in the intervention group and the other was in the attention control group. Analysis of the two groups with the outliers included showed the mean number of weeks before beginning treatment were 11.36 weeks \pm 34.06 for the intervention group and 16.41 weeks \pm 40.52 for the attention control group. Both the means and the standard deviations dropped

when the two outliers were removed, with the mean falling to 6.98 weeks \pm 10.74 for the intervention group and 12.28 weeks \pm 26.98 for the attention control group. There were no significant differences between the groups on time since onset of the injury/disorder whether the outliers were retained ($F(1,105) = .48, p = .487$) or removed ($F(1,103) = 1.744, p = .190$). The large majority of participants (92) had received physiotherapy before for an injury/disorder that was not necessarily the shoulder and of these participants 82% reported that the treatment was successful. The groups were equivalent on pain and DASH scores at baseline (Table 9).

HAPA Motivational Variables

There were no significant differences between the two groups. Both the intervention and the control groups had high baseline scores for all HAPA variables in the motivational stage at baseline which were risk perception, outcome expectancies, action self-efficacy and behavioural intentions (Table 9).

Knowledge Group Comparisons

There were no significant differences in knowledge scores between the intervention and control groups at Time 1 ($F(1,106) = .04, p = .834$). The mean score out of a total of 10 for the intervention group was slightly lower (mean = 7.29, SD = 1.65) compared to the control group (mean = 7.43, SD = 1.44).

Test of Hypothesis 1. In Comparison to the Attention Control Group the Intervention Group which was Exposed to the CBPE Programme, and Action and Coping Planning will have significantly

(i) Higher Maintenance and Recovery Self-Efficacy

There were no significant differences between the intervention and control groups at Time 2. The scores for both groups were moderately high for maintenance and recovery self-efficacy, with the intervention group scoring slightly higher on both HAPA variables (Table 10).

Table 7.
Statistical Comparison of the Intervention and Group Demographic Characteristics

	Group		<i>Statistic</i>	<i>p value</i>	<i>95% CI</i>
	Intervention (<i>n</i> = 52)	Control (<i>n</i> = 56)			
Age (years)	50.33 (±16.40)	50.77 (±18.73)	$F(1,106) = .02$	.90	47.21,53.91
Gender					
Female	25	29	$\chi^2(1) = .15$	.70	
Male	27	27			
Ethnicity					
New Zealand European	43	40	$\chi^2(3) = 7.53$	.06	
Maori	3	0			
Pacific Islander	1	3			
Other	5	13			
Employment status					
Professional	22	18	$\chi^2(5) = 2.81$	.73	
Skilled	12	12			
Unskilled	1	4			
Unemployed	3	3			
Student	3	4			
Retired	11	15			
Highest Qualifications					
Secondary school	14	16	$\chi^2(2) = .48$	.79	
Tertiary (except University)	19	17			
University	19	23			
Hours/week on computer					
<1	2	4	$\chi^2(3) = 3.43$	.33	
1-5	6	13			
5-10	12	10			
>10	32	29			

Note: IV = Intervention, CI = Confidence Interval

Table 8.
Group Comparisons of Present and Past History of Shoulder Injury and Functional Outcomes

	Group		Statistic	p value	95% CI
	Intervention (n = 52)	Control (n = 56)			
Onset					
Gradual	18	9	$\chi^2(1) = 4.46$	.035	
Sudden	35	46			
Number of appointments	5.96 (± 2.40)	5.58 (± 2.27)	$F(1,95) = .63$	.430	5.30,6.24
Time since onset of injury/disorder	11.36	16.41	$F(1,105) = .48$	.487	6.79,21.14
Sport Onset					
Yes	25	20	$\chi^2(1) = 1.70$	.193	
No	27	36			
Physiotherapy before					
Yes	46	46	$\chi^2(1) = .85$	.356	
No	6	10			
Physiotherapy successful					
Yes	37	38	$\chi^2(1) = .07$	.788	
No	9	8			
Shoulder injury before					
Yes	22	15	$\chi^2(1) = 2.88$	.089	
No	30	41			
Shoulder injury treated	n = 37				
Yes	14	14	$\chi^2(1) = 4.27$	.039	
No	8	1			
Shoulder treatment successful	n = 28				
Yes	11	11	$\chi^2(1) = .00$	1.00	
No	3	3			
Pain	3.77 (± 2.20)	4.26 (± 2.09)	$F(1,106) = 1.41$	.238	3.61,4.43
DASH	2.48 ($\pm .83$)	2.55 ($\pm .75$)	$F(1,106) = .21$	.649	2.37,2.67

Note: IV = Intervention, CI = Confidence Interval, DASH = Disability of the Arm, Shoulder and Hand

Table 9.
Group Comparisons of the Motivational HAPA Variables at Baseline

	Group		<i>Statistic</i> <i>F</i> (1,106)	<i>p value</i>	<i>95% CI</i>
	Intervention (<i>n</i> = 52)	Control (<i>n</i> = 56)			
HAPA variables					
Risk perception	5.84 (±.94)	5.76 (±.94)	.163	.688	5.62,5.98
Outcome expectancies	6.12 (±.65)	6.08 (±.80)	.100	.753	5.94,6.30
Action self-efficacy	6.14 (±.90)	6.02 (±.95)	.480	.490	5.90,6.25
Behavioural intentions	6.12 (±.92)	6.08 (±.85)	.043	.835	5.93,6.27

Note: IV = Intervention, CI = Confidence Interval, HAPA = Health Action Process Approach

Table 10.
Comparison of the two Groups' Post-Intervention Self-Efficacies' Scores

	Group		<i>Statistic</i> <i>F</i> (1,106)	<i>p</i> <i>value</i>	<i>95% CI</i>
	Intervention (<i>n</i> = 52)	Control (<i>n</i> = 56)			
HAPA variables					
Maintenance self-efficacy	5.33 (±1.02)	5.24 (±1.07)	.19	.664	5.07,5.50
Recovery self-efficacy	5.90 (±.85)	5.80 (±1.06)	.26	.612	5.49,6.11

Note: CI = Confidence Interval, HAPA = Health Action Process Approach

(ii) Higher Rehabilitation Adherence

Descriptive data for clinic attendance, clinic-based adherence (SIRAS and RAdMAT) and home-based adherence (self-report diary sessions and repetitions) are presented in Table 11. SIRAS scores are expressed as a mean total of the three items out of a possible score of 15. RAdMAT total, RAdMAT factor 1, RAdMAT factor 2 and RAdMAT factor 3 are expressed as the average points scored across the items associated with each scale or subscale, each having a maximum of four points. Attendance and self-reports are presented as percentages. The only adherence variable to reach significance was the SIRAS. All other adherence measures were not significant including the three factors of the RAdMAT. Nevertheless it is noted that the scores for the intervention group are higher than they are for the control group across all adherence measures with the exception of factor 2 of the RAdMAT where both scores were the same.

Table 11.
Group Comparisons of Adherence Measures

	Group		<i>Statistic</i> <i>F</i> (1,106)	<i>p</i> <i>value</i>	<i>95% CI</i>
	Intervention (<i>n</i> = 52)	Control (<i>n</i> = 56)			
SIRAS	14.08 (±1.16)	13.47 (±1.68)	4.34	.040	13.49,14.08
RAdMAT – total	3.63 (±.40)	3.60 (±.42)	.23	.632	3.53,3.70
RAdMAT – factor 1 (attitude/effort)	3.67 (±.46)	3.62 (±.52)	.24	.628	3.55,3.75
RAdMAT – factor 2 (attendance/participation)	3.56 (±.38)	3.56 (±.47)	.00	.955	3.48,3.65
RAdMAT – factor 3 (communication)	3.67 (±.59)	3.59 (±.54)	.45	.505	3.50,3.84
Percentage attendance	96.26 (±9.69)	95.21 (±10.79)	1.05	.309	93.14,97.28
Self-report sessions	79.24 (±19.41)	76.52 (±21.34)	.42	.520	73.71,82.04
Self-report repetitions	96.18 (±8.02)	94.18 (±13.75)	.74	.393	92.88,97.48

Note: CI = Confidence Interval, SIRAS = Sport Injury Rehabilitation Adherence Scale, RAdMAT = Rehabilitation Adherence Measure for Athletic Training

(iii) Improved Shoulder Function and Decreased Shoulder Pain

Disabilities of Arm, Shoulder and Hand. The mean scores out of a possible five for the DASH questionnaire reduced over the study period (Table 12). A mixed between-within subjects ANOVA was conducted to assess the impact of the CBPE, and action and coping plans on shoulder function over the eight week study period. For the DASH there was no significant interaction between the groups over time [Wilks' Lambda = 1.00, $F(1,93) = .000$, $p = .998$, $\eta^2 = .0001$]. There was a significant main effect for time [Wilks' Lambda = .47, $F(1,93) = 105.93$, $p < .0005$, $\eta^2 = .53$] with both groups showing a decrease in DASH scores across the two time points. The main effect comparing the intervention and control groups was not significant [$F(1,93) = 260$, $p = .61$, $\eta^2 = .081$].

Pain. As can be seen in Table 12, the mean scores out of a possible 10 for pain reduced over the study period for both the intervention and control groups. There was no significant interaction between the groups over time [Wilks' Lambda = .97, $F(1,93) = 2.95$, $p = .09$, $\eta^2 = .031$], but there was a significant main effect for time (Wilks' Lambda = .93, $F(1,93) = 7.34$, $p < .008$, $\eta^2 = .07$). The main effect comparing the intervention and control groups was not significant [$F(1,93) = .34$, $p = .56$, $\eta^2 = .004$].

Table 12.

Mean Functional Outcomes Scores for Intervention and Control Groups at Time 1 & Time 2

	Intervention (n = 48)		Control (n = 47)	
	T1	T2	T1	T2
DASH	2.48 ±.85	1.73 ±.70	2.55 ±.73	1.81 ±.75
P4	3.66 ±2.23	1.97 ±1.79	4.14 ±1.96	2.25 ±2.23

(iv) Better Knowledge of Shoulder Anatomy and Function, and Behaviour Change Strategies to Improve Rehabilitation Adherence

The knowledge scores showed there was no significant interaction between the intervention and control group across the two time points [Wilks' Lambda = 1.00, $F(1,93) = .23$, $p = .63$, $\eta^2 = .002$]. There was a significant main effect for time (Wilks' Lambda = .56, $F(1,93) = 72.63$, $p < .0005$, $\eta^2 = .44$) with both groups showing an increase in knowledge scores across the time points. The main effect comparing the

intervention and control groups was not significant ($F(1,93) = 1.08, p = .30, \eta_p^2 = .011$). The mean score at Time 1 for the intervention group was 7.29 ± 1.65 and at Time 2 it was 8.06 ± 1.48 compared to the control which was 7.43 ± 1.44 at Time 1 and 7.61 ± 1.51 at Time 2.

(v) **High Levels of Satisfaction with the CBPE Programme**

Participants in the intervention group were satisfied with the CBPE programme, mean = 5.59 ($\pm .87$) on a 7 point scale.

Quantitative Analysis

Forty five intervention and 43 control participants completed the feedback questionnaire. Ninety four percent from the intervention and 86% from the attention control group found the diary was easy to use. There was no significant difference between the two groups, $X^2(1, 91) = 1.69, p = .293$.

Participant feedback indicated that a total of 22 participants sought information other than that given by the physiotherapist or doctor. Seven of the participants from the intervention group and nine from the control group acquired the additional information through the internet. Friends provided extra information for three intervention and two control group participants, and one participant from the intervention group obtained additional information from a book.

In the intervention group 30 participants felt that the number of physiotherapy appointments should be reduced if they were given the option to do more of their physiotherapy at home with the aid of a CBPE programme comparable to the one they had used during the study period. The preferred delivery of physiotherapy indicated by 35 of the 45 participants that used the CBPE programme was a combination of face-to-face appointments and an online CBPE programme.

Qualitative Analysis

Qualitative analysis of the open ended questions revealed three main themes. These related to the programme structure, educational value and adherence factors.

Programme Structure

Eight participants in the intervention group commented on the layout of the programme with comments such as '*enjoyable program, well structured*', '*programme*

easy to follow.” and *“easy to move around programme.”* One participant in the control group commented that the programme was *“good to follow, easy to navigate, simple.”*

Educational Value

Seventeen participants in the intervention group identified the CBPE programme as being educational. Comments ranged from *“great information diagrams etc.”*, *“good explanation of shoulder parts and movements”* *“gave insight into shoulder and injury”* and *“very easy to follow programme and informative.”* One participant specifically stated that the *“video helped with one of the exercises.”*

Nine participants in the control group who commented on what could have been included on the website felt that pictures or videos of exercises they were prescribed would have been helpful and five participants would have liked more information on how the shoulder worked. Comments included *“a description of exercises would have been helpful”* and *“pictures of how the shoulder works.”*

Adherence Factors

Nineteen participants in the intervention group felt the CBPE programme was motivating and made comments such as *“helped keep me on track and increased my compliance”* to *“this programme made me disciplined in adhering to my exercise plan.”* One participant specifically noted that the diary motivated her to do the exercises and another participant that the cue card was a good reminder. The influence of the CBPE was maintained longer than the study period for two participants, one of whom commented that it was a *“great incentive and informative to do exercise programme and will continue to do it beyond the study”* and another participant asked at the end of the study period *“would it be OK to carry on with the home programme?”*

Comments from a participant in the attention control included that the website *“made me more adherent”* and that the programme was *“good, motivated me to do my exercises.”* It was not clear whether it was the video on the attention control website or the action of filling in the diary that prompted such comments.

Test of Hypothesis 2 - There will be Significant Strong Associations Amongst the Sequential HAPA Variables of the Extended Model.

(i) Correlations within the HAPA Model

Pearson correlations for the HAPA variables are presented in Figure 25. Significant positive correlations were found between all motivational constructs. The strength of the relationship between action self-efficacy and behavioural intentions, and outcome expectancies and behavioural intentions was strong and that between risk perception and behavioural intentions was on the cusp of medium to strong.

At Time 2 strong significant correlations were found between behavioural intentions and the volitional self-efficacies and there was a strong significant relationship between behavioural intentions and the diary session (Table 13). All RAdMAT adherence measures except factor 1 which assessed attitude/effort were significantly correlated with behavioural intentions. Both maintenance- and recovery self-efficacy were associated with the daily self-report diary sessions, with maintenance self-efficacy being significantly correlated with factor 3 (communication) of the RAdMAT although this was of small strength.

(ii) Correlations between Adherence and Functional Outcomes

There were significant inverse relationships between the scores of the SIRAS, pain ($r = -.23$) and the DASH ($r = -.20$) at Time 2. No other significant relationships were found between the adherence measures and functional outcomes (Table 14).

Table 13.
Correlations of Adherence Measures and HAPA Volitional Variables

	1	2	3	4	5	6	7	8	9	10	11
1. Behavioural intentions											
2. Maintenance self-efficacy	.30**										
3. Recovery self-efficacy	.36**	.57**									
4. Diary sessions	.34**	.48**	.32**								
5. Diary repetitions	.10	.05	.10	.09							
6. Percentage attendance	.13	.01	.07	.11	-.01						
7. SIRAS	.13	.12	.03	.23*	.13	-.07					
8. RAdMAT total	.25 *	.16	.09	.29**	.21*	.18	.61**				
9. RAdMAT factor 1 attitude/effort	.17	.14	.33	.24*	.16	.09	.68**	.94**			
10. RAdMAT factor 2 attendance/participation	.20*	.06	.06	.16	.19	.22*	.41**	.76**	.58**		
11. RAdMAT factor 3 communication	.33**	.21*	.18	.35**	.21*	.22*	.29**	.73**	.61**	.76**	

Note: HAPA = Health Action Process Approach, * $p < .05$, ** $p < .01$

Table 14.
Correlations of Adherence Measures and Functional Outcomes at Time 2

Adherence Measures	DASH	Pain
Diary sessions	.16	.08
Diary repetitions	-.03	.03
Percentage attendance	.14	.08
SIRAS	-.20*	-.23*
RAdMAT total	-.12	-.05
RAdMAT factor 1	-.15	-.08
RAdMAT factor 2	-.10	-.11
RAdMAT factor 3	.03	.12

Note: * $p < .05$

(iii) Predictors of Behavioural Intentions and Adherence to Physiotherapy

The assumptions were met for three dependent variables; behavioural intentions, adherence to diary sessions and RAdMAT factor 3 (communication).

(iv) Predicting Behavioural Intentions

The standard multiple regression analysis predicting behavioural intentions was significant ($F(3,104) = 29.47, p < .0005$), adjusted $R^2 = .44$, with action self-efficacy ($\beta = .42, p = .0005$), and risk perception ($\beta = .27, p = .005$) being significant predictors. However outcome expectancies was not a significant predictor ($\beta = .19, p = .060$).

(v) Predicting Adherence to Daily Diary Sessions

The standard multiple regression analysis predicting the daily diary sessions was significant ($F(3,90) = 11.45, p < .0005$), adjusted $R^2 = .25$, with maintenance self-efficacy ($\beta = .41, p = .0005$), and behavioural intentions ($\beta = .22, p = .028$) being significant predictors. However recovery self-efficacy was not a significant predictor ($\beta = .01, p = .95$).

(vi) Predicting Adherence to RAdMAT Factor 3 (Communication)

The standard multiple regression analysis predicting RAdMAT factor 3 (communication) was significant ($F(2,92) = 6.49, p < .002$), adjusted $R^2 = .11$, with behavioural intentions ($\beta = .29, p = .005$) being a significant predictor but not maintenance self-efficacy ($\beta = .13, p = .226$).

Test of Hypothesis 3. There will be Significant Correlations Amongst the RAdMAT, and Clinic and Home-Based Adherence Variables

Pearson correlations of clinic- and home-based adherence can be seen in Table 13. All measures of clinic-based adherence were either moderately or strongly correlated. This included the RAdMAT total, the three RAdMAT factors and the SIRAS. There was a moderate association between percentage of attendance and factors 2 and 3 of the RAdMAT. The self-report diary sessions of the home-based adherence correlated moderately with all clinic-based measures except factor 2 (attendance/participation) of the RAdMAT. The most consistently correlated scores were between factor 3 (communication) of the RAdMAT and all home- and clinic-based adherence measures. The RAdMAT total scores correlated with all adherence measures except for percentage attendance. There were strong correlations amongst the RAdMAT total and the three RAdMAT subscales.

Discussion

The results of this study found some support for hypothesis 1 with clinic-based adherence as measured by the SIRAS being significantly higher in the intervention group compared to the control group and high levels of patient satisfaction were found with the CBPE programme. Hypothesis 2 was supported to some extent with significant correlations amongst all motivational variables. In the volitional stage significant relationships were found between behavioural intentions and the two self-efficacies, and behavioural intentions and the home-based diary sessions. The extension of the HAPA model to include functional outcomes had limited support with both the DASH and pain variables being significantly associated with the SIRAS. There was strong support for hypothesis 3 where significant correlations were found between the SIRAS and RAdMAT, and the RAdMAT and the diary sessions. In this section the findings of the study will be discussed by interpreting them within the context of the research and the relevant literature in the area. Strengths and limitations of the study will be outlined followed by a summary of the main findings.

Demographics, Shoulder Injury Characteristics and Previous Physiotherapy Treatment

The participant age range was wide, extending from 17 to 83 years with a mean age of 50.5 years. The age group of this sample could have been expected to have a higher prevalence of shoulder pain from pathologies such as rotator cuff disease as it is

known to increase with age (Chard & Hazleman, 1987; Ostor et al., 2005). Shoulder injuries/disorders had a more sudden than gradual onset across all age groups although inspection of the data revealed that a higher percentage of participants who were more than 55 years of age had a gradual onset.

The average time between the onset of the shoulder injury/disorder and seeking treatment in this study was 13.9 weeks despite 78 participants seeking treatment within the first eight weeks. The reasons for this positively skewed distribution can in part be explained by patient behaviours and beliefs. Of the 108 participants, 81 had a sudden onset of shoulder injury/disorder which is likely to have led them to seek physiotherapy as soon as possible to relieve symptoms. Patients who had a gradual onset of shoulder symptoms such as those with frozen shoulder (Guyver, Bruce, & Rees, 2014) may have been more reluctant to pursue treatment initially believing that the symptoms would spontaneously resolve or that the symptoms were not severe enough to warrant consultation (Hudak et al., 2002). Further the distribution may be a reflection of age with older patients appearing to accept their symptoms as an inevitable part of getting older (Hudak et al., 2002; Ostor et al., 2005). This may explain why two elderly participants who had a gradual onset of shoulder symptoms waited 240 weeks before seeking physiotherapy. A similar lapse in time was found in another shoulder study where one participant waited 208 weeks before attending primary care (Ostor et al., 2005).

Ninety-two participants in the present study had attended physiotherapy before and therefore were likely to understand the behaviours required for undertaking treatment, such as the demands of an exercise programme as has been suggested in other studies (Bassett & Prapavessis, 2011; Hall, Fallon, Quinn, & Reeve, 2002). Seventy five of the participants indicated that their previous physiotherapy treatment had been successful which could have had a positive effect on their involvement in subsequent physiotherapy treatments and was thought to influence outcome expectancies and self-efficacy of participants in the study by Bassett and Prapavessis (2011). Fleig, Lippke, Pomp, and Schwarzer (2011) also found that patients who have positive experiences during rehabilitation are more likely to be satisfied with the treatment and that this may influence subsequent behaviours. Although the remaining 17 participants in the current study had not had a successful outcome from previous

physiotherapy, they were seeking physiotherapy again which suggests they considered it would be helpful for this injury/disorder.

Hypothesis I: In Comparison to the Attention Control Group the Intervention Group which was Exposed to the CBPE Programme, and Action and Coping Planning will have significantly

(i) Higher Maintenance and Recovery Self-Efficacy

No significant differences were found between the intervention and attention control groups on maintenance and recovery self-efficacy. There are four notable reasons for this. One, most participants (46 intervention, 46 control group) had experienced physiotherapy previously and therefore were aware of the rehabilitation requirements. These participants had high maintenance and recovery self-efficacy scores indicating that they felt equipped to overcome any obstacles associated with the home-based rehabilitation component and restart the rehabilitation following any lapse over the study period. Two, the study was conducted over a relatively short period of time (eight weeks) so participants were less likely to experience a lapse in their adherence to the home-based treatment component in the time frame (Sluijs et al., 1998; Sluijs & Knibbe, 1991). Sluijs et al. (1998) found adherence dropped off dramatically when physiotherapy was extended and unsupervised over long periods. Moreover, recovery self-efficacy is of most benefit to participants who have had to resume the behaviour (Scholz et al., 2005), but as some of the participants in this study had not experienced a lapse they had little idea about the behaviours needed to restart. This may have biased results in favour of high scores for recovery self-efficacy in both groups since participants irrespective of their experiences like to be seen in a favourable light (Rand & Wise, 1994). Three, in this study physiotherapists provided ongoing support during clinic appointments for all participants as would be expected during routine care which is in line with previous research where physiotherapists typically provided information about treatment and progress (Chase et al., 1993). Four, participants reported in their feedback that they felt supported by weekly emails received from the researcher who usually commented on the self-report diary entries and the amount of time participants had been on the study. Communication via email may have enhanced the self-efficacy of participants which aligns with findings of Luszczynska, Tryburcy, and Schwarzer (2007) who successfully targeted self-efficacy through email messaging.

Interestingly, although the maintenance self-efficacy scores were high (mean score = 5.33 for the intervention group and 5.76 for the control group out of a possible 7) they were the lowest mean scores of all the HAPA variables in both the motivational and volitional stages. This may have been because the volitional variables were measured at Time 2 after participants had some experience of the behavioural requirements of their rehabilitation. Being aware of the required behaviours may have made participants less confident in their ability to sustain the behaviours in the future. Although maintenance self-efficacy was only measured at the end of the study period in this investigation, these scores would fit with earlier research that found maintenance self-efficacy declined over the duration of the study (Morgan et al., 2010; O'Brien et al., 2013; Wesch et al., 2011).

The making of action and coping plans did not appear to enhance maintenance and recovery self-efficacies which was surprising given the success of this intervention in earlier studies (Lippke et al., 2004a; Sniehotta, Scholz, & Schwarzer, 2005; Sniehotta, Scholz, Schwarzer, et al., 2005; Ziegelmann & Lippke, 2007). All participants received advice and encouragement from their physiotherapist during clinic-based treatment sessions which may have boosted maintenance and recovery self-efficacies of both groups and may in part have accounted for the lack of differentiation between the groups. Patient support has also been found to lead to higher self-efficacy when interviewers assisted participants making action and coping plans (Ziegelmann et al., 2006) as occurred in this study. However, because maintenance and recovery self-efficacies scores of both groups were similar and high, further increments did not result in a significant difference.

(ii) Higher Rehabilitation Adherence

The intervention group had significantly higher scores on the SIRAS than the control group indicating they had a higher rate of clinic-based adherence. This could be attributed to the combination of the CBPE programme and the making of action and coping plans. Action and coping plans have been shown in other studies to increase adherence (Gollwitzer, 1999; Sniehotta et al., 2006b), and the CBPE programme may have enhanced the antecedents of adherence such as knowledge (Beranova & Sykes, 2007) and self-efficacy (Bandura, 1997). Comprehension of the content on the CBPE programme was facilitated by using simple terms and short sentences (Ley, 1988) and a theoretical framework to guide the layout and design. For example words and pictures

were used together with the words being placed close to the pictures which has been shown to produce deeper understanding (see Chapter 4). The topics chosen for the CBPE programme may also have impacted on adherence with menu items including hints on exercising, an interview with a patient about managing activities of daily living and information about shoulder anatomy and pathology. Categorisation of the information using menu buttons made it readily accessible, and has been thought to provide greater incentive for participants to adhere to their rehabilitation in other studies (Bassett, 1996). It should also not be overlooked that all exercise videos were targeted to the participants by age and gender which made demonstrations more personally relevant to each participant and may have enhanced their rehabilitation behaviour (Kreuter & Wray, 2003; van Stralen et al., 2011). Nevertheless, no firm conclusions can be made about the contribution of either the CBPE programme or action and coping planning to adherence because they were given as a package making it impossible to separate out the effects of each one.

There were no significant differences found between the intervention and control groups on any of the other adherence measures, although the intervention group scored slightly higher across all the clinic- and home-based variables. For example, the intervention group were 79.2% adherent to home-based diary sessions compared to 76.5% for the control group, and the intervention group scored 3.63 out of a possible 4 points on the RAdMAT for clinic-based adherence compared to 3.60 for the control group. An indication that participants in both groups were motivated to undertake and adhere to their physiotherapy was likely to be reflected in the high scores for behavioural intentions and percentage of attendance. A large percentage of participants (85%) had also undertaken previous physiotherapy which may have alerted them to the importance of adhering to the prescribed exercise programmes. Furthermore participants were enrolled into the study between their first and third physiotherapy appointment when high adherence could be expected because the severity of the symptoms and pain were acting as behavioural cues (Sluijs & Knibbe, 1991). Participants will try following most suggested interventions during this acute stage in an endeavour to find relief (Sluijs et al., 1998).

Feedback from participants in the current study suggests that the self-report diary and weekly emails from the researcher may have encouraged adherence to home-based rehabilitation. Knowing that the home-based component of treatment was being

monitored may have motivated participants to adhere which aligns with findings from Sluijs, Kok, et al. (1993) who reported adherence was influenced by feedback. Findings also support those of Torstensen et al. (1998) who monitored participants involved in home-based exercise programmes by telephone communication finding that this encouraged attendance at clinic appointments at follow-up. In addition, entering information in the self-report diary may in itself have acted as a reminder and has been found in earlier studies to increase adherence (Myers & Midence, 1998; Rand & Wise, 1994).

Cue cards are an adherence enhancing strategy that was used to improve adherence to the home-based rehabilitation component for the intervention group in this study. It could have been a reason these participants scored slightly higher than the attention control group on the home-based measures, namely the self-report diary sessions and repetitions variables. One intervention group participant specifically commented that the cue cards acted as a reminder to do the exercises. This strategy has been thought to contribute to relatively high adherence in other home-based rehabilitation studies (Bassett & Prapavessis, 2007; Sweeney et al., 2002) and has been advocated by Sluijs and Knibbe (1991) as a way of improving adherence to home-based exercise programmes.

It cannot be discounted that response bias may have been a factor in the high self-report home-based scores of both the intervention and control groups which were 96.3% and 95.2% respectively. This was higher than adherence to home-based physiotherapy exercises in other similar studies where adherence was reported as 78% (Bassett, 2006) and 71.6% (Kolt & McEvoy, 2003). Participants want to be seen in a positive light and are therefore prone to over-estimate their adherence (Myers & Midence, 1998). Despite this Moseley (2006) did find that overestimation was only in the realm of 10% and seldom greater than 17%.

(iii) Improved Shoulder Function and Decreased Shoulder Pain

Over the eight week study period both the intervention and the control groups had significant improvement in shoulder function and reduction in pain. The amount of improvement in functional outcomes was similar for both groups. One reason may have been because both groups were highly adherent to home- and clinic-based physiotherapy which could have been responsible for better functional outcomes.

Previous studies do support the relationship that has been found between adherence and functional outcomes for shoulder injuries/disorders (Brox et al., 1993; Ginn et al., 1997). A second reason for there being no differentiation between the two groups could be due to the spontaneous and sequential manner that accompanies tissue repair (Watson, 2014). While intervention therapies normally facilitate or promote this process (Watson, 2014), time may have had an impact on return to function.

(iv) Better Knowledge of Shoulder Anatomy and Function, and Behaviour Change Strategies to Improve Rehabilitation Adherence

The intervention did not lead to the CBPE group having better knowledge scores with regard to functional anatomy of the shoulder and behaviour change strategies than the control group although both groups did have significant improvement in knowledge scores over the study period. This differs from other studies that have shown CBPE did result in significant increases in knowledge scores (for review see Fox, 2009). The difference in part may have been because physiotherapists are required to obtain patient consent to treat as part the Code of Ethics and Professional Conduct (Physiotherapy Board of New Zealand & Physiotherapy New Zealand, 2011) and therefore all patients must be informed about their treatment and the possible outcomes that could result from it. Additionally, physiotherapists regard patient education as an essential part of treatment (Chase et al., 1993) and have been found to make on average 20 educational statements at each treatment session (Sluijs, van der Zee, et al., 1993). Thus the physiotherapists' patient education and provision of other home-based treatment strategies may have enhanced their patients' knowledge and adherence irrespective of the additional information provided by the CBPE programme.

(v) High Levels of Satisfaction with the CBPE Programme

There was a high level of patient satisfaction with the CBPE programme in the intervention group which was the only group to answer the Patient Satisfaction with Computer-Based Education questionnaire. There are three possible reasons that may explain the level of satisfaction. One, the CBPE programme was designed using the Cognitive Theory of Multimedia Learning which was integral for presenting multimedia in a clear and informative format (Mayer, 2001), and it used simple everyday language which has been found to promote understanding (Ley, 1988; Meade, 1996). Two, a physiotherapist experienced in treating shoulders and a patient who had experienced and recovered from a shoulder injury/disorder were interviewed. These communications

provide credibility and are able to alter peoples' knowledge and beliefs (Gleitman et al., 1999). Three, the CBPE was targeted to age and gender categories making it more personally relevant which has been found to increase satisfaction with treatment (Hudak, Hogg-Johnson, Bombardier, McKeever, & Wright, 2004).

Feedback in the intervention group identified a preference for less clinic appointments if there was a CBPE available that was similar to the one in the current study but they also felt face-to-face treatments were necessary. Reduced clinic-based appointments have been found not to disadvantage patients if home-based programmes were designed to promote understanding and included strategies to enhance adherence (Bassett & Prapavessis, 2007). The CBPE programmes developed for this study included such strategies by providing video clips of exercises and showing useful ways of coping with everyday activities which could have contributed to self-efficacy through vicarious learning (Bandura, 1977).

Electronic diaries added to participant satisfaction with the home-based rehabilitation component of this study with most participants indicating that it was user friendly and easy to enter information. However one participant did suggest that it would have been helpful to be able to change the calendar date and to see the previous entries on the same screen while entering information. Despite this, the electronic diary meant that diary sheets did not require organising or filing, nor was there any extra effort required to transfer the information to the researcher at the end of each week. These factors may have contributed to more accurate diary recordings as recalling information to be entered also called hoarding entries, has been shown to occur less frequently when electronic diaries are used (Stone et al., 2002). Patients also knew from the weekly feedback provided by the researcher that their diary entries were being monitored. They indicated that this led them to feel the home-based component of treatment was being supervised which in turn has been found to produce better outcomes for patients (Friedrich et al., 1996).

Most participants in the intervention and control groups did not seek additional information other than what was given to them by their physiotherapist and the CBPE programme for the intervention group or the attention control website for the control group. Unlike a study that reported 52% of patients gathered information about their diseases on the internet (van Uden-Krann et al., 2009), this study found less than 25% of participants sought additional information with 16 of the 22 participants using the

internet as their source. This points to participants being satisfied with CBPE programme and the patient education given by physiotherapists. It also signals that acquiring health information through electronic devices is acceptable which strengthens the use of a computer based interface for patient education.

Comments from the control group indicated that the ability to observe the correct performance of the exercises they had been prescribed would have been valuable on their website. This suggests that participants may have been lacking confidence in their ability to remember and perform the exercises correctly in an unsupervised environment or that they would have appreciated exercise videos from which they could model their own performance. Videos of the exercises may have enhanced their self-efficacy and confidence in the correct exercise performance which supports earlier findings of Meade et al. (1994). Observation of exercises was likely to have given participants confidence and feedback about their exercise performance through vicarious learning which in turn may have resulted in improved adherence (Bandura, 1977).

CBPE programmes that are able to inform and reassure patients about their home-based rehabilitation may allow clinic-based sessions to be reduced in favour of strategically scheduled appointments that could be used to monitor and progress treatment. Bassett and Prapavessis (2007) successfully reduced clinic appointments in favour of a larger home-based treatment component without disadvantaging participants. Treatment booklets were issued to participants that included information about the injury/disorder, diary grids, progress sheets and adherence enhancing strategies. The findings from the current study also point to electronically delivered home-based programmes being a successful intervention in physiotherapy rehabilitation. The advantage of such programmes over other formats is that they can be targeted to groups of individuals (van Stralen et al., 2011) and diary reports can be monitored.

Hypothesis 2: There will be Significant Strong Associations Amongst the Sequential HAPA Variables of the Extended Model

Partial support was found for the second hypothesis with the relationships between the HAPA motivational variables fitting the model. Unlike earlier investigations where many correlations between risk perception and the other motivational variables were either weak or not significant (Lippke et al., 2004a;

Schwarzer et al., 2007; Sniehotta, Scholz, & Schwarzer, 2005), this study found moderate to strong correlations between all motivational variables including risk perception. An explanation for the different magnitude in the correlations may be that participants who have sustained an injury/disorder and were undertaking treatment perceived their risk as more threatening than individuals who were carrying out an activity to prevent an injury/disorder such as wearing a seat belt (Schwarzer et al., 2007) or exercising to reduce the risk of maternal-foetal disease (Gaston & Prapavessis, 2009). Furthermore, because physiotherapists are required to inform patients at their first appointment about the injury/disorder and how physiotherapy could help resolve it (Physiotherapy Board of New Zealand & Physiotherapy New Zealand, 2011), they would have been aware of the risks of not adhering to treatment. It is likely that this information could have contributed to the formation of their behavioural intentions. Participants would also have been required to provide informed consent to treatment and therefore they would have been aware of the anticipated treatment outcomes. For these reasons it was not surprising to find significant correlations between risk perception and the other motivational variables.

The strong correlations between behavioural intentions and maintenance self-efficacy, and behavioural intentions and recovery self-efficacy indicate that once behavioural intentions have been formed participants feel efficacious about being able to maintain their rehabilitation programme and recover from any lapses that may occur over the rehabilitation period which is similar to other studies (Luszczynska & Schwarzer, 2003; Sniehotta, Scholz, & Schwarzer, 2005). Reasons that may have contributed to these beliefs are (i) most participants in this study had a previous successful encounter with physiotherapy which could have reinforced their beliefs that they would be able to maintain the home-based programme, (ii) participants were symptomatic with pain and shoulder dysfunction which are known to act as cues or reminders to exercise (Sluijs & Knibbe, 1991), (iii) the maintenance and recovery self-efficacy questionnaires were assessed after eight weeks of prescribed clinic- and home-based rehabilitation so participants were aware of the barriers that could be encountered and were confident of their ability to overcome any obstacles or recover from any relapse should they occur; and (iv) confidence in maintaining the home-based rehabilitation may have been reinforced by their progress over the duration of the treatment programme.

A moderate association ($r = .34$) was found between behavioural intentions and adherence to home-based rehabilitation assessed by diary sessions. This aligns with the findings of Bassett (2006) where behavioural intentions were significantly associated with adherence to a home-based exercise programme ($r = .25$). These findings also support many earlier studies which have shown significant correlations between behavioural intentions and the actual behaviour (Graham, Prapavessis, & Cameron, 2006; Luszczynska & Schwarzer, 2003; Schwarzer et al., 2008; Schwarzer et al., 2007; Sniehotka, Scholz, & Schwarzer, 2005). Moreover, participants were more likely to have positive attitudes about treatment effectiveness through previous successful physiotherapy encounters which have been shown to have a beneficial influence on adherence (Brewer et al., 2003).

Behavioural intentions were significantly related to the home-based component of treatment as assessed by recorded diary exercise sessions. Commonly reported obstacles responsible for not adhering are forgetting, being too busy, or being too tired (Sluijs et al., 1998) which could have been operating in this study. Therefore developing a routine to accommodate rehabilitation recommendations may assist adherence to prescribed programmes (Sluijs & Knibbe, 1991). In contrast, the association between behavioural intentions and the recorded diary exercise repetitions was not significant. This may have indicated that the main obstacle to adhering to the prescribed exercise programme was initiating the sessions and once it had begun completing the number of repetitions required presented no barrier. An earlier investigation into adherence of home exercise programmes for neck and low back pain had similar findings and provided support for the main obstacle to adherence being the initiation of the exercise session (Medina-Mirapeix et al., 2009).

The only significant correlations between behavioural intentions and clinic-based adherence were associated with the RAdMAT questionnaire. Significant but weak or moderate correlations occurred between behavioural intentions and RAdMAT total ($r = .25$); behavioural intentions and RAdMAT factor 2 (attendance/participation) ($r = .20$) and behavioural intentions and RAdMAT factor 3 (communication) ($r = .33$). This was unexpected as the behavioural intentions questionnaire related to the home-based exercise programme and activities outside clinic appointments, whereas the RAdMAT questionnaire assessed adherence during clinic appointments. Inspection of the questionnaire identified an overlap between items on the behavioural intentions

questionnaire and those of the RAdMAT which may account for these findings. For example, RAdMAT factor 2 (attendance/participation) assesses items such as *“follows the prescribed treatment plan”*. This is similar to the behavioural intentions item *“I intend to do my home exercise programme as recommended by my physiotherapist.”* While the overlap between these items is clear there are other items that are specific to the questionnaire such as *“arrives at rehabilitation on time”* on the RAdMAT which can only be applied to clinic appointments. Therefore it is not surprising that although a significant correlation has been found between behavioural intentions and RAdMAT factor 2 the similarity and differences between the items of the two questionnaires has resulted in correlations of low magnitude. A similar overlap was found between behavioural intentions and RAdMAT factor 3. For example one item of the behavioural intentions questionnaire was *“take the advice of my physiotherapist”* which is not dissimilar to an item in the RAdMAT factor 3 questionnaire which assesses the item *“...how frequently did the patient follow your instructions and advice?”* This may account for the significant and moderate association between these two variables.

There were no significant relationships found between behavioural intentions and RAdMAT factor 1 (attitude/effort); behavioural intentions and the SIRAS; and behavioural intentions and percentage of attendance. It is likely that this was because all items of the RAdMAT factor 1 such as *“gives 100% in rehabilitation session”*, the SIRAS which includes *“... during today’s appointment ...”* in each of the three items and percentage attendance relate directly to clinic-based activities.

There was a significant moderate correlation between maintenance self-efficacy and the home-based diary sessions ($r = .48$). This was likely to be because (i) the maintenance self-efficacy questionnaire focussed on the home-based programme which participants related to the exercise diary sessions and (ii) self-report diaries are reputed to be both a measure and a prompt to undertake prescribed treatment activities (Brewer, 1999). A weak association was also found between maintenance self-efficacy and the RAdMAT factor 3 (communication) variable ($r = .21$). This was the only one of the six clinic-based adherence scores to reach significance. The correlation may be the result of RAdMAT factor 3 items such as *“communicates with the physiotherapist if there is a problem with the exercises”* being associated with participants discussing obstacles they encounter during home-based rehabilitation with the physiotherapist during clinic appointments.

Recovery self-efficacy was significantly correlated with the diary sessions ($r = .32$). This correlation was not as strong as the relationship between maintenance self-efficacy and the home-based diary sessions and could be due to a large number of participants not having lapsed and therefore not experiencing the behaviours that would be required to resume the rehabilitation programme. Nevertheless they did feel efficacious about their ability to resume the programme which may indicate that they were satisfied with the current rehabilitation programme.

The extension of the HAPA to include functional outcomes was partially supported by two significant negative correlations between clinic-based adherence as assessed by the SIRAS and both functional outcomes, namely pain and the DASH score. The negative correlations signify that the higher the adherence scores the better the adherence, and the lower the functional outcome scores the better the recovery. The effort patients put into treatment and their adherence to instructions given by the physiotherapist reinforces the importance of the relationship between therapist and patient to gain optimum recovery (Chase et al., 1993; Pizzari et al., 2002). Face-to-face treatment enables on-going assessment and treatment progressions to occur which impacts on the home-based exercise programme and the expectation of better recovery. Although correlations do not imply causation, the clinic-based component of rehabilitation is important for progressing treatment which may be reflected in the SIRAS-functional outcomes correlation (Bassett, 2006).

It is surprising that other adherence measures to clinic- and home-based adherence did not result in significant associations with shoulder function. There are two possible reasons for this. One, it may be a reflection of the prolonged duration of some shoulder injuries/pathologies such as frozen shoulder which can take many years to resolve (Farrell et al., 2005; Kivimaki et al., 2007). Participants in this situation may have been adherent over the eight week study period but functional improvements and pain relief may not have been evident over the time interval. Two, the mean age of the sample in this study was 50.5 years and soft tissue healing rates are slower in people over the age of 30 years (Kivimaki et al., 2007; Pizzari et al., 2005).

The multiple regression analyses identified the three antecedents of behavioural intentions, action self-efficacy, outcome expectancies and risk perception accounted for 44% of the variance in behavioural intentions. Of these three variables, action self-efficacy was the most influential and contributed 42% of variance, followed by risk

perception at 27%. This adds further evidence to the role of self-efficacy in undertaking rehabilitation behaviours as action self-efficacy has been found to be a primary precursor of adherence (Scholz et al., 2005; Sniehotta, Scholz, & Schwarzer, 2005). Outcome expectancies was not significant which may have occurred because once physiotherapy treatment had been sought, participants had formed their behavioural intentions and moved into the volitional stage of the model (Lippke et al., 2004a). Thus the antecedents of behavioural intention may have become less important or the influence of personal beliefs may have changed the pattern of the three motivational variables (Luszczynska & Schwarzer, 2003). These findings are supported by other research although different amounts of behavioural variance have been found (Schwarzer et al., 2008; Schwarzer et al., 2007).

Hypothesis 3: There will be Significant Strong Positive Correlations Amongst the RAdMAT and Clinic- and Home-Based Adherence Variables

The moderate to large significant correlations between the RAdMAT total and each of the three RAdMAT factors with the SIRAS scores support hypothesis 3. The RAdMAT total and SIRAS correlation in this study was 0.61 compared to 0.90 in an athletic setting (Granquist et al., 2010). Although the SIRAS questionnaire is more parsimonious with only three items compared to the 16 item RAdMAT, the association indicates it is still able to capture some of the same behaviours. This is likely to be because of the overlapping questionnaire items that relate to the intensity of participants' adherence, the degree that instructions were followed during the clinic appointment and the communication of their rehabilitation with the clinician.

The correlations between RAdMAT factor 1 and the SIRAS was .68. This was not unexpected as RAdMAT factor 1 assesses attitude/effort and has some overlap with items from the SIRAS. For example a factor 1 item on the RAdMAT is "*gives 100% effort in rehabilitation sessions*" which is likely to elicit a similar response to the SIRAS item which asked "*The intensity with which the patient completed the rehabilitation exercises during today's appointment.*"

Factor 2 of the RAdMAT which assessed attendance/participation had a medium strength correlation with the SIRAS. Items on the RAdMAT such as "*completes all task assigned by the physiotherapist*" was not unlike one of the three SIRAS items which was "*during today's appointment how frequently did the patient follow your instructions and advice?*" Hence it was understandable that the overlap between these

two items resulted in a moderately strong correlation. A significant correlation but of small magnitude ($r = 0.22$) was also found between RAdMAT factor 2 and percentage attendance. Although the RAdMAT factor 2 assessment consists of four items, one of them “*attends scheduled rehabilitation sessions*” should align directly with the calculation for percentage attendance. As expected there were no significant correlations between RAdMAT factor 2 and either of home-based adherence measures, which was the diary sessions and diary repetitions.

The significant correlation between factor 3 (communication) of the RAdMAT and the SIRAS in this study was 0.29 which provided limited support for the findings of Granquist et al. (2010) where the correlation was 0.74. The reason for the large difference in magnitude of this correlation may relate to items measuring this adherence factor. The SIRAS assesses communication with “*During today’s appointment how frequently did the patient follow your instructions and advice*” compared to the RAdMAT that evaluates communication with three items. These are (i) “*asks about his/her rehabilitation*” (ii) “*communicates with the physiotherapist if there is a problem with the exercises*” and (iii) “*provides the physiotherapist with feedback about the rehabilitation program*”. Different behaviours were captured with each of the questions. There was a significant correlation of low strength between percentage of attendance and RAdMAT factor 3 which may indicate the importance of communication between the patient and physiotherapist and the need for this face-to-face interaction to monitor and progress treatment.

Overall, the significant correlations between the RAdMAT and other clinic- and home-based variables increase the validity of this more recently developed adherence questionnaire. There are three advantages of using the RAdMAT over the SIRAS. One, it captures a broader spectrum of adherence behaviours thereby giving a more comprehensive view of patients general adherence. Two, the assessment generally occurs across a number of physiotherapy sessions or at the end of rehabilitation, unlike the SIRAS that assesses patient adherence at the completion of each treatment session. This gives a perspective of participants’ behaviours across a longer duration and not just the one treatment session which is likely to smooth any single session aberrations. Three, the subscales identify specific behaviours such as attitude and effort which can be addressed by the physiotherapist to enhance patient adherence as a whole. Finally, findings from this study support the suggestion of Granquist et al. (2010) that the

SIRAS could be used as a quick, single session measure or when evaluating repeated treatments and gives validation to the utility of the RAdMAT as a measure of clinic-based adherence in a physiotherapy setting.

Strengths and limitations

There were five main strengths of this study. One, the study was a randomised control trial. Two, validated and reliable measures assessed the HAPA variables (Schwarzer et al., 2008), shoulder function (Gummesson et al., 2003) and pain (Spadoni et al., 2004). Three, a multifaceted approach ensured that the behavioural demands required to undertake clinic- and home-based physiotherapy were measured. Four, a relatively homogeneous sample group was used so the rehabilitation programmes had similar strengthening and stretching exercises and outcome measures for all participants were uniform. Five, the programme was targeted to age and gender which made it more relevant to each participant.

The study had six limitations which warrant comment. One, self-report diaries were used to assess home-based adherence which may be prone to response bias, although some studies have indicated that self-report measures of physical exercise are valid (B. E. Ainsworth et al., 2000) and are comparable to objective measures (Johnston, Johnston, Pollard, Kinmonth, & Mant, 2004). Objective measures to assess home-based exercise would be preferable but it is difficult to collect in this context. Two, many participants had undertaken physiotherapy before which may have contributed to high HAPA motivational and volitional measure scores and limited group differentiation following the intervention. Three, high adherence scores may have accounted for the limited association between adherence and functional outcomes, given that a relationship has been found between these two variables. Four, all motivational HAPA questionnaires including behavioural intentions were focussed on the home-based component of treatment which may have affected the correlations with clinic-based adherence. To assess both clinic-and home-based components of treatment questionnaires a two subscale questionnaire representing both treatment components may be preferable for future studies. Five, a larger sample size may have satisfied the assumptions for multiple regression analysis to be undertaken in the volitional stage of the HAPA thereby enabling predictions to be tested. Six, this study did not take a true intention-to-treat approach, which may have affected the magnitude of its outcomes. However the sample size calculation accounted for a 10% attrition rate, which is

anticipated in studies of this duration. To overcome the attrition rate, participants were recruited until there were 108 complete sets of data. It was decided not to carry forward the lost participants' last sets of data, in particular their functional outcomes because they may not have represented the true extent of these peoples' recovery.

Summary

In summary, CBPE can be used as an adjunct to home-based physiotherapy when HAPA variables are embedded in the programme. Adherence scores to the physiotherapy programme were high which resulted in the intervention being unable to differentiate between the two groups except on SIRAS scores for clinic-based adherence. The high scores for all motivational and volitional variables were likely to have occurred because most participants had successfully undertaken physiotherapy previously.

Correlations between the sequential variables of the HAPA indicate that this model is suitable to use within a physiotherapy setting. The extension of the HAPA to include functional outcomes was partly supported by associations with the clinically-based SIRAS. This may indicate the importance of communication between the physiotherapist and patient during clinic appointments to effectively monitor and progress home-based and clinic-based rehabilitation. Further the correlations between the SIRAS and the RAdMAT and its three subscales point to both being valid measures of clinic-based adherence, however the RAdMAT does provide a more global perspective of patients' clinic-based adherence behaviours.

Chapter 9. Overall Discussion, Recommendations and Conclusions

This final chapter will (i) draw together the principal findings from the pilot and main studies (ii) outline the strengths and weaknesses of the thesis, (iii) make recommendations for future research into adherence and delivery of adherence enhancing strategies, (iv) discuss the clinical implications of the research and (v) present the conclusions drawn from the research.

Discussion

This thesis had three purposes. The first was to develop and test the effectiveness of a CBPE programme as an adjunct to physiotherapy rehabilitation. The CBPE was underpinned by two theoretical models: one was the Cognitive Theory of Multimedia Learning designed to enhance the delivery of the information, and the other was the HAPA which was intended to improve the participants' self-efficacy and ultimately their adherence to physiotherapy rehabilitation. The second purpose of the thesis was to establish whether the relationships amongst the variables of an extended version of the HAPA are a way of understanding adherence behaviours during rehabilitation of musculoskeletal disorders. The third purpose of the thesis arose in response to the need to validate the use of the RAdMAT as a more comprehensive measure of clinic-based rehabilitation adherence in comparison to the SIRAS. Broadly the findings of this thesis showed that participants found the CBPE was a valuable adjunct to their home-based physiotherapy. Those exposed to the CBPE and planning intervention were also significantly more adherent to their clinic-based rehabilitation than the attention control participants. While there was support for the HAPA's ability to explain the participants' attitudes and behaviours during their rehabilitation, it was not consistent across both the pilot and main studies. With regard to the third purpose, it was found the RAdMAT is a valid measure of clinic-based adherence, but the SIRAS still has a role to play in this measurement. Beyond these observations this discussion will address a number of notable issues stemming from the design and testing of the CBPE programme, the use of the HAPA in physiotherapy rehabilitation and the measurement of adherence. (Altmaier et al., 1993).

The effectiveness of the CBPE programme can in part be attributed to the structure and compilation of the material that used the Cognitive Theory of Multimedia

Learning as the framework to facilitate understanding (Mayer, 2001; Mayer & Anderson, 1992; Mayer & Moreno, 2002a). Application of this theory enabled information to be provided to participants that was easy to understand and interesting as indicated by the Patient Satisfaction with Computer Based Patient Education Scale and feedback in the pilot and the main studies. The best use of pictures and words were made for example, by placing written words close to graphics, presenting information simultaneously and not using background graphics or sounds that could have been distracting (Mayer, 2001). Thus the correct performance of exercises and the acquisition of knowledge was facilitated by the manner in which videos, animations, and labelled graphics were compiled. This is consistent with the only other CBPE research known to the author that used the Cognitive Theory of Multimedia Learning to investigate Carpal Tunnel Syndrome and found it increased patient knowledge as well as patients being satisfied with the programme (Keulers et al., 2007).

Another characteristic of CBPE that may have contributed to its success was the use of simple everyday language. In the CBPE the voiceover explanations accompanying the animations and videos were straightforward to make understanding easier (Ley, 1988; Mayer, 2001; Mayer & Anderson, 1992; Mayer & Moreno, 2002b). However the anatomical names that were likely to have been used by physiotherapists were included in the shoulder anatomy and pathology animations, but using these terms in combination with the animations and voiceover explanations made them more meaningful. Previous research has applied these educational techniques in a DVD (Bassett & Prapavessis, 2011) and a booklet (Bassett & Prapavessis, 2007), and found they could be successfully used to support physiotherapy rehabilitation aimed at restoring ankle function following sprains. Furthermore, videos have been shown to enhance the ability of participants to complete exercises correctly (J. Miller et al., 2009) and when used to provide instructions about home-based rehabilitation they did not disadvantage participants (Bassett & Prapavessis, 2007; Roddey et al., 2002).

As with the acquisition of knowledge, strategies to enhance self-efficacy and adherence were embedded throughout the CBPE programme and were directed particularly at increasing maintenance self-efficacy. This was accomplished by increasing understanding and using vicarious learning through targeted videos. For example, shoulder animations facilitated understanding of structures around the shoulder that may have been involved in the injury/disorder and vicarious learning

occurred through models of the same gender and approximate age group demonstrating exercises. Previous research has indicated that understanding and vicarious learning enhanced self-efficacy (Bandura, 1997; Jenny & Fai, 2001; Yeh et al., 2005) and increased adherence behaviours (Wetstone et al., 1985).

Despite the strategies used to increase self-efficacy and adherence in the main study there was a lack of differentiation between the groups. There are two possible reasons for this. One, the majority of participants in the main study (85%) had undertaken physiotherapy previously, and had been given exercises and advice on these occasions which made them aware of the behaviours that were required. Of these participants, many had been treated successfully which is known to positively affect future treatment expectations (Fleig et al., 2011). In addition, to be seeking physiotherapy again it is likely that they were satisfied with their previous experience (Hall et al., 2002) and were confident in their ability to undertake treatment and in the ability of their physiotherapist. Reports indicate the important role of these past behaviours and have found that they are predictors of subsequent health behaviours (Alewijnse, Mesters, Metsemakers, & van den Borne, 2003; Fleig et al., 2011; Medina-Mirapeix et al., 2009) including high levels of adherence (Hall et al., 2002). Thus the high self-efficacy and adherence scores in both the intervention and attention control groups may be a reflection of these past experiences. Two, the video of the physiotherapist who was an expert in the treatment of shoulder injuries/disorders was available to both the intervention and the attention control group. Although the information on the interview was general, such as the cost per annum of shoulder injuries to New Zealand ACC and information normally delivered by physiotherapists, it is known that presentation by experts adds credibility to the content. This may have enhanced participants self-efficacy and adherence (Gleitman et al., 1999).

The higher level of information in the CBPE failed to significantly increase the level of knowledge of the participants who were exposed to the programme in comparison to those who were not. The inability to influence knowledge may have occurred because physiotherapists typically provide information as part of their education of patients. Ethically physiotherapists are bound to inform patients about their diagnosis, the treatment plan and its likely effects, and in return patients must consent before treatment is initiated (Physiotherapy Board of New Zealand & Physiotherapy New Zealand, 2011). As a consequence of this ethical requirement,

participants irrespective of their grouping commenced the study with an understanding of their injury/disorder and the rehabilitation. Hence the ability of the CBPE programme to bolster the intervention group's knowledge in comparison to the attention control group would have been reduced. Furthermore, to ensure the information given to patients is easily understood physiotherapists are required to communicate in a simple easily understood manner. This has been shown to occur amongst New Zealand physiotherapists (Bassett & Petrie, 1999; Bassett & Prapavessis, 2007), therefore it is probable that in this study information conveyed to all participants by their physiotherapists improved their knowledge. It is also noteworthy that increasing knowledge is one method that may enhance self-efficacy (Bandura, 1997) and that the information may lead to increased adherence (Medina-Mirapeix et al., 2009).

All material on the CBPE programme was categorised into topics that allowed participants to select different navigational pathways to gather information and the computer based delivery provided flexibility that enabled material to be revisited and available over any 24 hour period. While no conclusions can be drawn about the effect that these features had on self-efficacy and adherence, participants did find the CBPE programme easy to use, informative and interesting which could have contributed to their satisfaction with it. Other studies that have investigated CBPE have also found that participants were satisfied with this method of delivery including older adults (Enzenhofer et al., 2004; Stromberg et al., 2002). While health literacy was not evaluated in this study, participants with low health literacy would have benefitted from the ability to repeat and review information at their own pace as has been found in earlier research (Ley, 1988). Moreover, presenting exercises based on gender and age ensured that demonstrations were meaningful for each group and is consistent with findings from other investigations (Kreuter & Wray, 2003).

Participants' satisfaction with the CBPE programme was high in both the pilot and main studies. Feedback indicated that the information on the website and the monitored self-report diary motivated them to adhere to their home-based programme. They also identified that the demonstration of exercises was the most useful menu category. Interestingly, the feedback from the participants in the attention control group of the main study reported that they would have liked the inclusion of videos demonstrating their exercises. It is highly likely that exercise demonstrations and the activities of daily living videos increased the participants' confidence that they were

performing the exercises correctly. As a consequence self-efficacy may have been influenced through vicarious learning (Bandura, 1997), and their satisfaction with the CBPE programme increased. This supports the notion of Sluijs and Knibbe (1991) that positive reinforcement is required for patients undertaking home-based rehabilitation.

The use of CBPE may become commonplace as computer based communication grows in popularity through programmes such as those developed as applications (apps) for use on mobile devices. Apps are growing rapidly and it is speculated that their impact could be far reaching as patients could have access to rehabilitation programmes at any time provided there is an internet facility. It is also envisaged that as the number of CBPE programmes increase they will be the preferred method for delivery of patient education outside of face-to-face contact with clinicians (Demiris et al., 2008). The features that make this CBPE a suitable and effective adjunct to physiotherapy treatment include information targeted to the participants; multiple navigational pathways through different menu categories and related topics; the interactive properties, for example the shoulder anatomy animations and quizzes; and the provision to monitor self-reports entries in real time. Previous research has found that computer-tailored information increased an individual's awareness of their activity levels and had a positive influence on behaviour (van Stralen et al., 2011), and that the interactivity is important in creating interest (Stemler, 1997). Furthermore, feedback from participants in this research is consistent with findings of other studies showing that monitoring self-reports is an adherence enhancing strategy that prompts engagement in home-based exercise programmes (Myers & Midence, 1998; Rand & Wise, 1994).

This research has shown that the HAPA is a suitable model to use with people who have acute and chronic musculoskeletal injuries/disorders. Its suitability was shown by the significant correlations in the motivational and volitional stages of the HAPA despite the limited impact of action and coping plans. However, there were notable differences between the pilot and main studies in the correlations of the HAPA motivational variables. In the main study all four variables were significantly correlated with each other compared to the pilot study where the only significant relationship was between action self-efficacy and behavioural intentions. The strong correlations between action self-efficacy and behavioural intentions in both studies signifies the importance of action self-efficacy in forming behavioural intentions. The multiple regressions in the main study confirmed that self-efficacy was the most influential of the

motivational variables in predicting behavioural intentions. Indeed the pilot study provided further evidence of the importance of action self-efficacy and behavioural intentions on adherence by finding that participants who dropped out of the pilot had slightly lower scores on both variables compared to those who completed it. The findings of this thesis with regard to self-efficacy add further evidence to the important role it has on treatment behaviour. Likewise other studies have also identified this relationship as the most consistent and strongest of the correlations amongst the motivational variables (Schwarzer et al., 2007; Sniehotta, Scholz, & Schwarzer, 2005).

Correlations between the other variables in the motivational stage of the pilot study were not significant. These were between risk perception and outcome expectancies, outcome expectancies and action self-efficacy, and both risk perception and outcome expectancies with behavioural intentions. The variables in these relationships may have been influenced by personal experiences such as having had physiotherapy before which has changed the relationship and causal order between them. The variability of these relationships has occurred in other studies (see Conner & Norman, 2005; Luszczynska & Schwarzer, 2003). It is also likely that by the time participants attended their first physiotherapy appointment they had already moved into the volitional stage of the HAPA (Schwarzer, 2008a) so the motivational variables were no longer appropriate. The high maintenance self-efficacy and adherence scores in the volitional stage of the pilot and main studies suggest this may have been the case. Other factors that may have impacted on these relationships in the pilot study were the lack of power and the shorter study period.

Maintenance and recovery self-efficacy were either moderately or strongly correlated with behavioural intentions in both the pilot and main studies which aligns with findings from other investigations (Lippke et al., 2004a; Luszczynska & Schwarzer, 2003; Schwarzer et al., 2007; Sniehotta, Scholz, & Schwarzer, 2005). This adds to the already large body of knowledge including those of atheoretical research that have found self-efficacy strongly related to behavioural intentions and behaviour change (Bandura, 1977, 2004; S Milne et al., 2000; Schwarzer, 2011). Although self-efficacy is commonly regarded as being activity specific, it has been suggested that there may also be an underlying general self-efficacy construct that is being measured at the same time as action, maintenance and recovery self-efficacy are being assessed (Luszczynska et al., 2005; Sherer et al., 1982). For example, in this study a general

sense of self-efficacy could have contributed to the high scores on the three self-efficacy measures. In addition as many participants had been treated by physiotherapy previously they were familiar with the treatment requirements, and hence felt efficacious about undertaking the treatment. This is not a new confounding factor. Bassett and Prapavessis (2007) reasoned that as people sought physiotherapy again it could be viewed as an indication of consumer satisfaction with that form of treatment.

There was some evidence of a relationship between clinic-based adherence and functional outcomes. Significant negative correlations were found between the percentage of attendance and the DASH score in the pilot study, and the SIRAS score and both DASH and P4 scores in the main study. There was also a trend of other adherence-functional outcome correlations in the expected direction. Notably it was found in the pilot study that participants who did not attend all their appointments had poorer functional outcomes as assessed by the DASH. Appointments are important for continuity of treatment, especially in long term rehabilitation where physiotherapists are required to monitor and progress patient treatment programmes. These findings from both the pilot and the main studies indicate the importance of the relationship between physiotherapist and patient that develops during clinic-based treatments. They also suggest that the HAPA model could be extended to include functional outcomes but it is not conclusive and more research is required before this addition can be confirmed. The inconsistency amongst adherence-functional outcomes has been reported in other studies (Bassett & Prapavessis, 2011; Brewer et al., 2004; Gohner & Schlicht, 2006).

There are two factors that may have had an important influence on the adherence-functional outcome relationship and reduced the impact of adherence behaviours which have not been accounted for. Assuming that clinicians have made the correct diagnosis and are implementing appropriate management, then one of these factors is the dose-response association. In this study the most common exercise prescription given by physiotherapists was 10 repetitions for each exercise to be done three times per day irrespective of the disorder or its severity. Two studies have been identified that reported the dose prescribed for home-based exercise programmes. One study indicated a similar exercise dose was given to participants who were starting a new course of physiotherapy, irrespective of whether the injuries involved upper or lower limb or whether they were acute or chronic (Bassett & Petrie, 1999). The other study prescribed three sets of 10 repetitions in the first week increasing to 20 repetitions

by the third week for exercises given to strengthening muscles around the shoulder (Ludewig & Borstad, 2003). While these doses have been reported with no rationale given for the regimen, the prescription required to obtain optimal functional outcomes remains unknown. However it has been found that increasing exercise intensity does not necessarily result in improved functional outcomes (Brewer et al., 2004).

The second factor that may have had an important influence on the adherence-functional outcome relationship is age. Healing rates of connective tissues such as tendons and ligaments have been found to be slower with increasing age. For example Tashjian et al. (2010) found the repair of rotator cuff tendons of the shoulder was slower as age increased. A similar response to age was found following anterior cruciate ligament repair where participants aged 30 years and over who adhered to a home-based exercise programme experienced poorer outcomes than those of the same age group who did not adhere fully (Pizzari et al., 2005). Given that participants in the main study of this research were older with a mean age of 53.5 years the prescribed dose may not have been conducive to healing and the optimal return of function. Accommodating for increasing age by adjusting the dose was not apparent in this study or any of the studies reviewed for this thesis. Future research needs to investigate these two areas, namely the dose-response relationship and the healing rate of connective tissues with increasing age, to establish a better rationale for prescribing exercises which will lead to better functional outcomes and stronger adherence-functional outcome relationships.

The scores on all HAPA variables were high in both the pilot and main studies which were indicative of a ceiling effect. The Likert scales that were used to assess each of the psychometric variables may not have been sufficiently sensitive to detect a difference in study groups, especially the higher scoring items. This possibility was identified in the pilot study and consequently the 4-point Likert scale was changed to a 7-point Likert scale for the main study. However, increasing the size of the Likert scoring scale did not overcome possible ceiling effects in assessing the same HAPA variables in the main study. The lack of discriminative ability of the questionnaires could have been due to the wording associated with each of the scales. For example, the range of the scale was from *very strongly disagree* = 1 to *very strongly agree* = 7. The neutral anchor in the middle of the range was *neither agree nor disagree* = 4 which may have confused participants and been difficult to answer in an item such as “*I am confident that I could resume my home physiotherapy programme even if I felt I was*

short of time". It may have been preferable to use a numeric point rating scale from *do not agree at all* = 1 to *very strongly agree* = 7 where participants indicate how strongly they agree with the statement using ascending increments throughout the range. A numeric rating scale such as this has been found quick and easy for participants (Spadoni et al., 2004) and may allow a more accurate assessment.

Reducing the ceiling effect in health research involving short term studies may be difficult for two possible reasons. One, participants who have been treated by physiotherapy before understand the required behavioural demands and their seeking physiotherapy again suggests their confidence in being able to carry it out. Two, patients undertake physiotherapy because they want relief from their symptoms. The act of seeking treatment in itself indicates that they have already formed behavioural intentions and that they are motivated to adhere to the required behaviours in order to relieve symptoms. Thus it is likely that participants who enter studies in the first few weeks of their physiotherapy treatment when their symptoms are more acute (Sluijs et al., 1998) would have high scores on HAPA motivational variables including intentions to adhere to treatment. Highly motivated participants may have formed spontaneous action and coping plans as a means of achieving their recovery goals which could have enhanced their rehabilitation adherence (Carraro & Gaudreau, 2013). Consequently any additional experimentally induced planning may have had less impact which could have reduced the ability of the intervention to differentiate between the study groups in the volitional stage.

There are studies where ceiling effects may be less evident. Such investigations could involve preventative behaviours such as dental flossing (Schwarzer et al., 2007), breast self-examination (Luszczynska & Schwarzer, 2003) or exercise to prevent colon cancer (Graham et al., 2006). Participants in these studies are not experiencing symptoms and therefore they are less likely to be motivated to adhere to the required behaviours prior to an intervention. It is probable that this would result in lower scores on the HAPA variables at baseline and therefore effective interventions have the opportunity to enhance adherence behaviours that would differentiate study groups.

It is speculated that study periods of longer duration, such as those that extend for two months or more may not be influenced by ceiling effects to the same extent as shorter study periods. Evidence for this comes from maintenance self-efficacy that has

been found to decline over the course of rehabilitation (Morgan et al., 2010; O'Brien et al., 2013; Wesch et al., 2011). Therefore effective interventions should result in higher maintenance self-efficacy scores in the intervention group compared to the control group. Studies that extend over long periods such as six months or more may also benefit from booster sessions which have been shown to enhance maintenance self-efficacy (Rejeski et al., 2003) and long-term adherence (Huss et al., 1991; Pisters, Veenhof, de Bakker, et al., 2010).

Given that participants in the intervention and control group in the main study improved on functional outcomes over the duration of the study and had high self-efficacy scores and adherence behaviours, there was no disadvantage physically or psychologically to those who used the CBPE programme. This is consistent with findings of Bassett and Prapavessis (2007) where participants used a booklet to guide their home-based treatment programme. Hence in the future, patients who cannot attend frequent physiotherapy appointments could safely opt for a larger home-based rehabilitation component in conjunction with the CBPE programme, and action and coping planning. Intermittent face-to-face booster sessions could be used to monitor and progress treatments. This alternative treatment pathway may be suitable for individuals such as those living in rural areas and those with financial or time constraints, and also other patients who feel able to continue their treatment on their own. Conversely, it may also be that not all individuals like a larger home-based treatment component and would prefer to attend physiotherapy on a regular basis. Notwithstanding, the advantage of introducing a larger home-based treatment component to suitable patients is in the reduction of costs, not only to patients but also to the New Zealand Government funding body for injuries, the ACC.

In the volitional stage there was one significant difference found between the intervention and control groups of the main study. This was between the SIRAS scores which does suggest that action and coping planning and/or a combination of the CBPE programme with action and coping planning did impact on clinic-based adherence. Previous research has found that health behaviours can be increased by action and coping planning (Sneihotta et al., 2006a; Sneihotta, Scholz, Schwarzer, et al., 2005) and also through the use of CBPE programmes (Wetstone et al., 1985). However, the findings of this study were not conclusive as there were no significant differences in the other clinic-based adherence measure, namely the RAdMAT scores. Nevertheless it is

notable that higher scores were obtained in the intervention group on all adherence measures despite there being only one significant difference. A greater number of participants may be required to evaluate these adherence findings further.

Strong correlations between the SIRAS and RAdMAT questionnaires supports the use of the RAdMAT as a more comprehensive assessment of clinic-based adherence than the SIRAS even though they have a number of different features. Clinic-based adherence as assessed by the SIRAS is comprised of only three items which may be more useful for evaluating overall adherence quickly but is less likely to capture particular attitudes and behaviours. In contrast the 16 item RAdMAT provides an overall measure of clinic-based adherence as well as discriminating between three subscales that evaluated different factors influencing rehabilitation adherence (Granquist et al., 2010). As physiotherapy can extend over many weeks, the RAdMAT may be a valuable assessment to use as an interim measure of rehabilitation adherence especially for patients who have not progressed as expected or who have been identified as poor adherers. The subscales may identify behaviours that could guide physiotherapy management to enhance adherence over subsequent treatments. For example, a poor score on factor 3 (communication) may signal the need for the physiotherapist to spend more time communicating with the patient in order to develop a better patient-therapist rapport. This relationship has been found to be a key determinant of home-based exercise adherence for musculoskeletal conditions (Medina-Mirapeix et al., 2009).

Adherence measures such as the SIRAS and RAdMAT assessments could become a routine part of patient records. Previous investigations have found patients who have been poor adherers in the past are not likely to adhere during subsequent rehabilitation (Alewijns et al., 2003; Conner, Sandberg, & Norman, 2010; Medina-Mirapeix et al., 2009). Hence, adherence records would alert physiotherapists to poor adherers who could then instigate strategies to enhance adherence at the beginning of treatment programmes. Records of adherence rates could also be used for reporting back to referring bodies such as general practitioners and specialists which may reflect the patient's progress. Additional parties that may have an interest in adherence records could be funding bodies such as ACC which may require their evaluation prior to the allocation of funding.

In conclusion, the combination of the Cognitive Theory of Multimedia Learning with action and coping plans, and information that targeted the HAPA variables are likely to have contributed to the effectiveness of the CBPE programme. However it was not possible to identify the influence that each of the theoretical models had on the success of the CBPE programme and further research would be required to do so. Nevertheless participants across all age groups were satisfied with the CBPE programme and indicated that other similar programmes would be valuable adjuncts for future physiotherapy rehabilitation. As computer technology becomes even more accessible it could be that CBPE takes on a higher profile and plays a greater role in the overall management of physiotherapy for musculoskeletal injuries/disorders. The Cognitive Theory of Multimedia Learning and the extended HAPA model that helped explain the attitudes and beliefs contributing to adherence behaviours and functional outcomes of physiotherapy patients in this thesis would provide a suitable framework from which future CBPE programmes could be developed.

Strengths and Limitations

There were two methodological strengths to this research. The first was the multifaceted approach that was used to measure adherence. Validated questionnaires evaluated the different attitudes and beliefs required for patients to adhere to the different aspects of treatment required for clinic- and home-based rehabilitation (Brewer, 1999). The second was the sample of individuals used in both studies that was limited to patients with shoulder injuries/disorders. This relatively homogeneous sample minimized the discrepancies between injuries and the requirements of their rehabilitation programme which demanded similar behaviours to undertake treatment (Brewer, 1999). Restricting the pathology to the one region of the body enabled the same functional outcome assessments and adherence indicators to be used.

Six limitations occurred in this research. One, HAPA variable questionnaires focussed on the home-based components of rehabilitation and may not have been relevant to clinic-based treatment. This appears to have been reflected in the behavioural intentions-clinic-based adherence, and volitional self-efficacies-clinic-based adherence correlations. Two, home-based adherence was reported through self-report diaries which are known to be prone to response bias (Sluijs et al., 1998), although there are reports that have shown these measures are valid for physical exercise behaviour (B.

E. Ainsworth et al., 2000). There are no known objective measures that are appropriate or that could have been applied to specific shoulder exercises even though objective measures may have provided a more accurate account of home-based adherence (Brewer, 1998a). Three, the self-report diaries may have acted as a prompt to exercise which may have influenced the data (Meichenbaum & Turk, 1987; Taylor & May, 1996). Four, a history of previous physiotherapy experienced by most participants may have been one reason for the high scores on all HAPA variables, consistent with findings of Bassett and Prapavessis (2011). Five, some of the items in the questionnaires assessing HAPA variables may have been informative which prompted participants to consider aspects of their rehabilitation which may have influenced their adherence behaviours (Ogden, 2003). Six, despite participants being satisfied with the CBPE programme a difficulty arose for physiotherapists due to the array of shoulder exercises that are prescribed by them. For the pilot study it was decided after extensive consultation with physiotherapists, who were expert in shoulder management, to video 62 exercises for the CBPE programme. This was too large for physiotherapists to select from easily so consequently a reduction to 17 exercises was made for the main study. While this provided the most commonly prescribed exercises and was adequate, some physiotherapists felt they were limited in what they could prescribe. Determining an easy way for physiotherapists to select from a larger array of shoulder exercises needs to be considered.

Recommendations for Future Research

There is still a need to investigate further the use of CBPE programmes to enhance adherence to physiotherapy rehabilitation especially as there is some evidence from this thesis to suggest that adherence is associated with functional outcomes. This was indicated by the percentage of attendance at clinic-based physiotherapy found in the pilot study and by the SIRAS scores showing adherence to clinic-based physiotherapy was correlated to functional outcomes in the main study. The true worth of CBPE that uses theory driven development with embedded adherence enhancing strategies and planning could be evaluated using the current CBPE programme as a template for other injuries/disorders such as osteoarthritis or chronic low back pain. To establish the contribution of the CBPE programme and the making of action and coping plans a four group experimental study design could be undertaken, with one group being allocated to

CBPE programme plus planning, CBPE programme alone, planning alone, and the control condition.

Computer based delivery of patient education provides a unique opportunity to build in objective measures into the software. For example, timers could gauge the amount of time that was spent on different aspects of the programme and where data needs to be entered by participants the date and time of entry could be recorded. Where diary recording is requested timers would indicate if information had been ‘hoarded’ and therefore whether it was open to inaccurate recall before being diarised. Computer programming could also (i) generate automated reminder notices when daily diary entries are not made on time and (ii) provide feedback to participants on their adherence rates automatically calculated from diaries entries. Information in these areas may impact on patient adherence. Feedback about weekly diary entries in the current study indicated that monitoring was important and did enhance adherence which has also been found in other studies (Moseley, 2006).

Another line of inquiry is the development and testing of CBPE programmes that run on mobile devices. With the proliferation of this hardware it is now feasible that home-based rehabilitation programmes could be accessed from any of these devices. It is also possible that programmes could be tailored to each participant so that only material and prescribed exercises for that individual were accessible on the website. As treatment is progressed exercise programmes could be updated to reflect these changes. Investigations are required to assess the value of providing this software to patients which is expensive to develop but likely to be cost-effective once produced.

The questionnaires that are used to evaluate rehabilitation adherence need to be reviewed to pre-empt the possibility of ceiling effects in future research. There are three areas that could be addressed. One, the questionnaires need to be reworded to reflect all components of treatment. Hence questionnaires that account for different beliefs and attitudes associated with clinic- and home-based adherence are required. This may mean the development of questionnaires with two subscales: one to account for the home-based component and the other the clinic-based component. Proof of their construct validity would need to be established by testing patients with a variety of injuries/disorders. Two, the response scales could be changed to a numeric rating with ascending increments throughout the scale such as *does not apply* = 1 to *completely*

applies = 7. This would eliminate the *neutral* response midscale which can be confusing. Three, participants who have been identified as poor adherers or who have a history of poor adherence should be recruited. Baseline scores of HAPA variables are less likely to be high so any effective intervention will differentiate groups. The major disadvantage of this third recommendation is that recruiting sufficient participants may extend the study period over a prolonged period of time.

There are two adherence enhancing strategies in this thesis that could be considered for modification in future studies. One, is the making of coping plans. Unlike action planning which provides situational cues for initiating a behaviour such as exercise rehabilitation, coping planning requires the correct anticipation of possible obstacles associated with undertaking the behaviour and therefore some prior experience (Sneihotta, Schwarzer, Scholz, & Schuz, 2005). Realistic and effective coping plans are more likely to be made after the rehabilitation period has begun when participants have had experience of possible obstacles that may be encountered. Two, is assessing how frequently participants reviewed their cue cards. Feedback would enable the relationship between this intervention component and adherence to be examined.

The main study of this thesis found the RAdMAT correlated well with the SIRAS but with the three subscales being able to identify different behaviours, it may be of more value than the SIRAS for poor adherers. However it needs to be tested in conjunction with the SIRAS within the context of physiotherapy for patients who have other injuries/disorders such as osteoarthritis or chronic low back pain. There are no other known studies that have used the RAdMAT in a physiotherapy setting so this will provide evidence of its construct validity.

The effect of booster sessions on long-term rehabilitation adherence warrants investigation as it is unclear what effect they have in maintaining adherence despite other health sectors finding they enhance adherence (Pisters et al., 2007). CBPE programmes provide a unique opportunity to offer booster sessions to patients following one off clinic-based evaluations and exercise prescriptions. Adherence to programmes can be monitored through self-report diary entries for designated time periods and automated reminders issued for missed entries. Future studies need to be undertaken to assess the value of CBPE programmes for chronic conditions such as osteoarthritis

where long term home-based unsupervised exercise programmes are being prescribed by physiotherapists.

Future research should consider integrating the HAPA model with Protection Motivation Theory (PMT: Rogers, 1975) as previous research has found that interventions designed to manipulate PMT variables with action and coping planning can lead to increased self-reported exercise behaviour (Gaston & Prapavessis, 2012; Zhang & Cooke, 2011). In a physiotherapy setting the combination of these models may be especially pertinent as patients have sustained the injury/disorder and are keen to have relief from their symptoms. Thus patients are most likely to be susceptible to manipulation of the threat appraisal (severity and vulnerability variables) which could strengthen their behavioural intentions. Following the formation of behavioural intentions the making of action and coping planning would help translate these intentions into action. Indeed Bassett and Prapavessis (2011) have demonstrated that the threat appraisal can be manipulated in participants with ankle sprains who are undertaking physiotherapy. Thus combining these two social cognitive models is a line of enquiry that has not been explored in physiotherapy and it is now timely to do so.

The adherence-functional outcome association needs to be established across a variety of musculoskeletal injuries/disorders. Although this research and other previous studies (Bassett & Prapavessis, 2011; Brewer et al., 2004; Gohner & Schlicht, 2006) have found significant relationships between some of the adherence-functional outcomes variables it is not conclusive. Further research is needed to confirm the existence of this relationship. Once confirmed the dose-response required to achieve optimal outcomes requires further investigation as this remains unknown in physiotherapy rehabilitation. It is likely that the relationship will vary depending on the injury/disorder and its severity, the age of the patient, the type of behaviours that are required to adhere to the physical and psychological demands of the rehabilitation and to the amount of adherence that is required. Further research is needed to establish these rehabilitation parameters and to be methodologically robust this research needs to recruit a homogeneous cohort of participants with respect to injury/disorder and rehabilitation programme (Brewer, 1999).

Clinical Implications

The findings from this research have implications for the practice of physiotherapy. First, the pilot and the main study point to action and coping planning in conjunction with CBPE with embedded strategies to enhance HAPA variables as being a possible way of improving patient adherence to rehabilitation and in particular the home-based component. The strong correlations between the volitional stage self-efficacies and home-based adherence indicate that this delivery may be especially useful for patients who do not feel confident in their ability to undertake the unsupervised home-based component of treatment. Feedback from participants in the study suggests that self-report diaries should be monitored by physiotherapists as this provides support and feedback which may enhance adherence.

Second, the CBPE programme may be an effective adjunct to treatment for: (i) all patients who have been prescribed a home-based component of physiotherapy treatment; (ii) those unable to attend regular scheduled physiotherapy appointments such as individuals living in rural areas, or those with financial, work or family commitments; and (iii) patients with low health literacy. Use of the programme by these patients would assist them in the correct performance of prescribed exercise and provide relevant education that could be viewed at their own pace and repeated as needed which would help understanding of their injury/disorder and adherence to treatment.

The RAdMAT questionnaire is a useful interim assessment measure for patients who are not progressing as expected. Results of the questionnaire may indicate whether slow progress is the result of inadequate adherence or point to the treatment procedures as not being effective. If poor adherence is the likely cause of slow progress then the three factor RAdMAT assessments may pinpoint the specific area that could be addressed to improve adherence, that is RAdMAT factor 1 (attitude/effort), RAdMAT factor 2 (attendance/participation) or RAdMAT factor 3 (communication). For example, a low score on factor 2 may prompt a conversation with patients about obstacles that are being encountered attending physiotherapy appointments such as transport difficulties or initiate an enquiry about the patient's understanding of the programme they have been given. Specific attention in these areas could increase adherence and proceed to better outcomes for the patient.

Conclusions

Within the context of this research where patients were undertaking physiotherapy treatment for a shoulder injury/disorder six conclusions can be drawn. One, CBPE programmes developed using the Cognitive Theory of Multimedia Learning can be an effective adjunct to physiotherapy treatment and can produce high levels of patient satisfaction. Two, the HAPA model can provide the conceptual framework for enhancing rehabilitation adherence in a physiotherapy setting. Three, CBPE and action and coping planning can lead to improved adherence to clinic-based adherence as assessed by the SIRAS questionnaire. In this study it was surprising that this was the only group difference but it may have been due to a ceiling effect. Four, participants generally feel efficacious about their ability to adhere to both home- and clinic-based rehabilitation in the first 8 weeks of treatment which may in part be due to previous physiotherapy experiences. Five, the overarching influence of the three specific self-efficacies is indicated by the high self-efficacy scores and the moderate to strong correlations they form with behavioural intentions and the home-based self-report diary. Of particular note were the relationships of (i) action and maintenance self-efficacies with behavioural intentions and (ii) behavioural intentions with home-based diary sessions. Six, although not all adherence behaviours were significantly related to functional outcomes there is sufficient evidence to continue to investigate this relationship with a view of extending the HAPA model to include functional outcomes. With the electronic age in full flight, and the ability of the internet to access most households, the potential to use CBPE to enhance treatment adherence and possibly functional outcomes must be fully explored.

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Appendix 1: Literature Search Strategy

Literature investigating patient education and its effect on adherence to exercise rehabilitation was retrieved for this thesis.

Inclusion Criteria

The criteria used to determine which studies relating to patient education and adherence rehabilitation would be reviewed were (i) investigations based on social cognitive theory (ii) investigations examining adherence to exercise rehabilitation and (iii) those studies investigating the measurement of adherence. The criteria used for determining the studies that would be used for the delivery of patient education pertained to (i) methods of delivery with emphasis on computer based programmes and (ii) educational theory using multimedia. There were no limits placed on the methodology used to investigate these bodies of knowledge.

Exclusion Criteria

Studies associated with adherence behaviours in health-related areas other than rehabilitation adherence such as smoking cessation and medication adherence were excluded. Any research or review articles were rejected if they were not published in English or if the study was not published in peer reviewed Journals and edited book chapters.

Databases and Resources Searched

Relevant studies were identified using the following electronic databases: AMED, CINAHL, MEDLINE, PUBMED, PSYCINFO, SPORTDISCUSS, PEDro, ProQuest 5000, Health and Psychosocial Instruments and SCOPUS. The search was limited to those studies that involved human subjects prior to October 2014. Article titles and abstracts were screened for relevance and the bibliographies of key articles were reviewed manually to find other relevant articles that may have been overlooked using the electronic searches. These were entered into the SCOPUS Citation Tracker. There was no limitation regarding the date the studies were published, other than the date limitations of each selected database. Throughout the duration of undertaking this thesis articles were retrieved through auto alerts and repeatedly searching the data bases.

Search Terms Used

Literature searches were undertaken using the key words listed in Table 1.

Table 15.
Key Search Words Used

Key Words		
physiotherapy	rehabilitation	therapeutic exercise
physical therapy	adherence	compliance
physical activity	behaviour change	social cognitive models
self-efficacy	action planning	coping planning
patient education	multimedia	implementation intentions
computers	shoulder	

Appendix 2: Computer Based Patient Education Websites

Website 1. Intervention group

Website 2. Attention control group










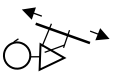


Appendix 3: Exercise Mastercard for Pilot Study

PHYSIOTHERAPY EXERCISE PROGRAMME FOR SHOULDERS

	Early		Mid		Late
1	ER Side Lying	23	ERIR Standing with Towel	40	ER Standing with Theraband
2	ER Sitting	24	ER Side with Weight	41	ER Standing with Theraband2
3	ER Sitting 90° unsupported	25	Ext Prone Lying	42	ER Standing with Theraband 3
4	ER Sitting 90° supported	26	Ext Prone Lying Row with Weight 1	43	Ext Standing with Theraband
5	ER Standing with Pole	27	Ext Stoop Standing Row with Weight 2	44	Ext Standing Woodchop
6	ER Supine Lying with Pole	28	Flex Kneeling UL	45	Flex Standing Lawnmower
7	Ext Prone Lying Row	29	Flex Kneeling UL & LL	46	Flex & Ext Supine Lying with Ball
8	Flex Abd Sitting Clock	30	Horizontal Abd Prone with Weight	47	Flex & Ext Standing Wall Ball
9	Flex Abd Lying with Pole	31	IR Standing Bear Hug	48	IR 90° Standing with Theraband
10	Flex Sitting Pulley	32	Protraction Standing with Cable	49	IR Standing Post Theraband
11	Flex Side Lying	33	Push Up Plus Kneeling	50	IR Standing with Theraband
12	Flex Standing Spider	34	Push Up Plus Standing Table	51	IR Standing Weighted Catch
13	Flex Standing with Pole	35	Scaption Standing	52	Plank Prone Lying 1
14	Horizontal Abd Prone Lying	36	Stretch into Corner Standing	53	Plank Prone Lying 2
15	IR Standing Belly Press	37	Stretch ER Supine Lying with Weight	54	Plank Side Lying 1
16	Pendular Standing	38	Stretch IR Side Lying	55	Plank Side Lying 2
17	Posterior Scapular Tilt Sitting	39	Stretch IR Standing	56	Plank Side Lying 3
18	Protraction Supine Lying			57	Push Up Clap
19	Push Up Plus Wall Standing			58	Push Up Plus Prone Lying with Ball
20	Stretch ER Supine Lying			59	Stretch into Corner Standing
21	Stretch IR Side Lying			60	Stretch ER Supine Lying with Weight
22	Stretch Posterior Capsule Standing			61	Stretch IR Side Lying
				62	Stretch IR Standing

Appendix 4: Exercise Mastercard for Main Study

SHOULDER EXERCISES

	Early		Middle		Late		Stretches
1	Pendular 	5	ER – 0° 	9	ER/IR with towel 	14	For ERs
2	Clock sitting at table 	6	ER – 90° supported 	10 11	ER with theraband 	15	For IRs
3	Spider up the wall 	7	Flexion with pole 	12	IR with theraband 	16	Post capsule
4	Assisted ERIR 	8	IR – belly press 	13	IR (90°) with theraband 	17	Ant capsule

Appendix 5: Demographics Characteristics Questionnaire

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

Age in years:	Gender: Male/Female
Ethnic Group: New Zealand European/Pakeha New Zealand Maori Pacific Islander Other, please specify	Employed If yes, Occupation Unemployed Student Retired
Date of onset of shoulder injury/disorder:	
Gradual onset/sudden onset	
Did the injury occur during a sporting activity?	Yes/No
Have you had physiotherapy treatment before?	Yes/No
If 'yes', was physiotherapy treatment successful	Yes/No
Reason for choosing this physiotherapy clinic:	
Have you had a shoulder injury/disorder before?	Yes/No
If you have had a shoulder injury before:	
• How many times has it occurred?	.....
• Was it treated by physiotherapy?	Yes/No
• Was physiotherapy treatment successful?	Yes/No
Circle how many hours you would use a computer per week?	< 1, 1-5, 5- 10, >10
Write down your highest qualification:	

Appendix 6: Risk Perception Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

Completely false	Sometimes false	Sometimes true	Completely true
1	2	3	4

If I don't do my home physiotherapy programme:

1. it will be harder for me to move my arm	
2. it will be harder for me to care for myself	
3. it will be harder for me to continue with my normal daily life	
4. it will be harder for me to participate in my leisure/recreational activities	

Appendix 7: Treatment Outcome Expectancies Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

Completely false	Sometimes false	Sometimes true	Completely true
1	2	3	4

If I follow my home physiotherapy programme as recommended

1. I will get better quicker	
2. it will improve my ability to cope with my normal daily life	
3. I will be able to cope better with any daily hassles	
4. I will have less pain in my shoulder	
5. I will be able to move my shoulder better	
6. my shoulder will be stronger	

Appendix 8: Behavioural Intentions Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

Completely false	Sometimes false	Sometimes true	Completely true
1	2	3	4

I intend to

1. do my home exercise programme as recommended by my physiotherapist.	
2. rest my upper limb as recommended by my physiotherapist	
3. take the advice given by my physiotherapist	
4. avoid doing any activities that may reinjure my shoulder	

Appendix 9: Action Self-Efficacy Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

Completely false	Sometimes false	Sometimes true	Completely true
1	2	3	4

I am confident I can do my home physiotherapy programme

1. the number of times recommended each day	
2. the number of repetitions required for each exercise at each session	
3. and follow the advice of my physiotherapist	

Appendix 10: Maintenance Self-Efficacy Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

Completely false	Sometimes false	Sometimes true	Completely true
1	2	3	4

I was confident I would be able to perform my home programme daily over the 8 weeks even if

1. I did not see any positive changes immediately	
2. I felt I was short of time	
3. I was tempted to do something else	
4. I had to force myself to do the exercises	
5. I was tired	
6. my daily routine changed e.g. went on holiday, was away for the week-end	
7. there were other reasons	

Appendix 11: Recovery Self-Efficacy Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

Completely false	Sometimes false	Sometimes true	Completely true
1	2	3	4

I was confident I could perform my home programme daily over the eight weeks even if

1. I did not see any positive changes immediately	
2. I felt I was short of time	
3. I was tempted to do something else	
4. I had to force myself to do the exercises	
5. I was tired	
6. my daily routine changed e.g. went on holiday, was away for the week-end	
7. there were other reasons	

Appendix 12: Sports Injury Rehabilitation Adherence Scale (SIRAS)

To be completed by the physiotherapist at the end of each of the participant's treatment session. For each of the following circle the number that best indicates the patient's behaviour:

-
1. The intensity with which the patient completed the rehabilitation exercises during today's appointment

minimum effort 1 2 3 4 5 maximum effort

2. During today's appointment, how frequently did the patient follow your instructions and advice?

never 1 2 3 4 5 always

3. How receptive was this patient to changes in the rehabilitation programme during today's appointment?

very unreceptive 1 2 3 4 5 very receptive

Appendix 13: Daily Diary Report Sheet for Pilot Study

Did you complete the exercises required?

pick up date

	Number of sessions for each day	Number of repetitions for each exercise
Exercise 1	N/A	N/A
Exercise 2	N/A	N/A
Exercise 3	N/A	N/A
Exercise 4	N/A	N/A
Exercise 5	N/A	N/A

Click the box once for 'yes' and twice for 'no'

submit

Appendix 14: Disabilities of Arm, Shoulder, and Hand (DASH) Questionnaire

		NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1.	Open tight or new jar.	1	2	3	4	5
2.	Write.	1	2	3	4	5
3.	Turn a key.	1	2	3	4	5
4.	Prepare a meal.	1	2	3	4	5
5.	Push open a heavy door.	1	2	3	4	5
6.	Place an object on a shelf above your head.	1	2	3	4	5
7.	Do heavy household chores e.g. wash wall, wash floors.	1	2	3	4	5
8.	Garden or do yard work.	1	2	3	4	5
9.	Make a bed.	1	2	3	4	5
10	Carry a shopping bag or briefcase.	1	2	3	4	5
11	Carry a heavy object (over 10lbs).	1	2	3	4	5
12	Change a light bulb overhead.	1	2	3	4	5
13	Wash or blow dry your hair.	1	2	3	4	5
14	Wash your back.	1	2	3	4	5
15	Put on a pullover sweater.	1	2	3	4	5
16	Use a knife to cut food.	1	2	3	4	5
17	Recreational activities which require little effort e.g. cardplaying, knitting.	1	2	3	4	5
18	Recreational activities in which you take some force or impact through your arm, shoulder or hand e.g. golf, hammering, tennis.	1	2	3	4	5
19	Recreational activities in which you move your arm freely e.g. playing Frisbee, badminton.	1	2	3	4	5
20	Manage transportation needs (getting from one place to another)	1	2	3	4	5
21	Sexual activities	1	2	3	4	5

Appendix 15: P4 Pain Scale

Rate your level of shoulder pain (P4).

	No Pain										Pain as bad as it can be	
In the morning over the past 2 days?	0	1	2	3	4	5	6	7	8	9	10	
In the afternoon over the past 2 days?	0	1	2	3	4	5	6	7	8	9	10	
In the evening over the past 2 days?	0	1	2	3	4	5	6	7	8	9	10	
With activity over the past 2 days?	0	1	2	3	4	5	6	7	8	9	10	

Appendix 16: Knowledge Quiz for Pilot Study

1. The bones that come together at the shoulder joint are the
 - a. humerus and scapula (shoulder blade).
 - b. humerus and clavicle (collar bone).
 - c. humerus, scapula (shoulder blade), and clavicle (collar bone)
 - d. don't know.

2. The bones that form the greater shoulder region are the
 - e. humerus and scapula (shoulder blade).
 - f. humerus and clavicle (collar bone).
 - g. humerus, scapula (shoulder blade), and clavicle (collar bone)
 - h. don't know.

3. The rotator cuff muscles
 - a. help hold the bones of the shoulder joint together.
 - b. help move the shoulder.
 - c. are small muscles around the shoulder.
 - d. all of the above.

4. When placing your hand above your head
 - a. only the shoulder joint moves.
 - b. the scapula (shoulder blade) and the shoulder joint must move.
 - c. all the joints of the shoulder complex must move.
 - d. don't know.

5. Shoulder injuries or disorders
 - a. affect older people only.
 - b. may affect any age group.
 - c. affect young people only.
 - d. result only from trauma or accidents.

6. Trick movements that help lift your arm above your head are
 - a. bending the elbow.
 - b. rotating the shoulder joint.
 - c. turning your head.
 - d. sideways movement of the trunk.

7. The best way to put a jersey on when your shoulder is painful is to put your
 - a. jersey over your head first, then put your bad arm in the sleeve, then your good arm.
 - b. jersey over your head first, then put your good arm in the sleeve, then your bad arm.
 - c. good arm in the sleeve first, then your bad arm, then your jersey over your head.
 - d. bad arm into the sleeve first, then your good arm, then your jersey over your head.

8. When you have a sore shoulder, the best way to get something off a shelf above your head is to
 - a. stand on a stool.
 - b. use a broom handle.
 - c. push through the pain when you lift your arm up.
 - d. don't know.

9. Cues to exercise
 - a. remind me to do my exercises.
 - b. help me strengthen my shoulder.
 - c. should be put in an 'out of the way' place.
 - d. don't know.

10. If you get severe pain in your shoulder when you do some exercises you should
 - a. only do the exercises that don't hurt.
 - b. push through the pain and do the exercises anyway.
 - c. take a tablet to relieve the pain even if you have taken pain relief recently.
 - d. stop and get in touch with your physiotherapist.

Appendix 17: Patient Satisfaction with Computer Based Patient Education Scale

To indicate what you think about your interaction with the CBPE programme, use the scale below to show the extent to which you agree with each of the 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. After using the CBPE programme, I now know much more about my injury/disorder.	
2. The CBPE programme gave me all the information I wanted to know about my injury/disorder.	
3. The CBPE programme informed me about the nature of my injury/disorder in words that were easy to understand.	
4. I am really certain how to follow the information on the CBPE programme.	
5. The CBPE programme has relieved my worries about my injury/disorder.	
6. After using the CBPE programme I felt confident that I was accurately performing the exercises the physiotherapist had given me.	
7. After using the CBPE programme I felt motivated to perform the exercises the physiotherapist had given me.	

Appendix 18: Physiotherapist/Receptionist Feedback for Pilot Study

This form is only completed when people express a desire to contribute information about the implementation of the research.

Write the feedback under the categories on the sheet.

Thank you for the information. It will be of value for undertaking a larger study planned to test the CBPE programme with people who have shoulder injuries.

1. Acceptability and impact of the CBPE programme:

2. Exercises offered on the CBPE programme

3. Way in which the study was conducted:

4. Other information about the study:

Appendix 19: Action Plans Form

Action planning is a way of achieving your goals. First you need to set your goals and these should be specific, measurable and achievable. For example *by the end of the four week exercise programme my shoulder will be able to move better.*

My goal is to be able to:

.....

.....

The next thing we would like you to do is to plan the steps needed to achieve this goal. Think about the next four weeks, in terms of when and where you plan to do the exercises, and how you will manage to do them. Please write down your plan in the following table. The more precise, concrete and personally you formulate the plans the more they can help you. Memorize your plans carefully and keep them in a visible place. Visualise your planned actions and make a firm commitment to act as planned.

Exercise sessions

When do you plan to do the exercises? Give the time of the day and the days of the week.	
Where are you going to do the exercises?	
Are you going to exercise with anyone?	

Appendix 20: Coping Plans Form

Nothing ever goes completely according to plan. Things will always get in the way. Coping planning is identifying in advance, some of the obstacles that could get in the way of the achievement of your goal and planning how these obstacles could be overcome. For example, *I will overcome the problem of thinking that I do not have enough time to do the exercises by scheduling it at times that fit in with my other daily routines.*

Think about which obstacles or barriers might interfere with the home physiotherapy programme, and how you could overcome these obstacles. The more precise, concrete and personally you formulate the plans the more they will help you. Memorize your plans carefully and keep them in a visible place. Visualise the situations in which the obstacles might occur and how your planned actions will overcome them. Make a firm commitment to act as planned.

Obstacles to doing the exercise programme	I will overcome these obstacles by:

Appendix 21: Ethical Approval for Pilot Study



Northern Y Regional Ethics Committee

Ministry of Health
3rd Floor, BNZ Building
354 Victoria Street
PO Box 1031
Hamilton
Phone (07) 858 7021
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Email: northern_y_ethicscommittee@moh.govt.nz

16 March 2010

Ms Heather Clark
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School of Rehabilitation & Occupation Studies
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PB 92 006 Auckland 1142

Dear Heather

Ethics ref: NTY/09/12/116 (please quote this reference in all correspondence)
Study title: The effect of a computer-based patient education programme on rehabilitation adherence and shoulder function when used as an adjunct to physiotherapy in patients with shoulder injuries: a pilot study.
Investigators: Ms Heather Clark, Dr Sandra F. Bassett, Dr Andrew Higgins
Localities: Physio Rehab Clinic, Glen Gallagher Clinic

The above study has been given ethical approval by the Northern Y Regional Ethics Committee.

Approved Documents

-Information Sheet and Consent Form version 2 dated 11/01/2010.
-Questionnaires and rating scales.

Certification

The Committee is satisfied that this study is not being conducted principally for the benefit of the manufacturer or distributor of the medicine or item in respect of which the trial is being carried out.

Accreditation

The Committee involved in the approval of this study is accredited by the Health Research Council and is constituted and operates in accordance with the Operational Standard for Ethics Committees, April 2006.

Progress Reports

The study is approved until **3 December 2012**. The Committee will review the approved application annually and notify the Principal Investigator if it withdraws approval. It is the Principal Investigator's responsibility to forward a progress report covering all sites prior to ethical review of the project in **16 March 2010**. The report form is available on <http://www.ethicscommittees.health.govt.nz>. Please note that failure to provide a progress report may result in the withdrawal of ethical approval. A final report is also required at the conclusion of the study.

Requirements for SAE Reporting

The Principal Investigator will inform the Committee as soon as possible of the following:

- Any related study in another country that has stopped due to serious or unexpected adverse events
- withdrawal from the market for any reason
- all serious adverse events occurring during the study in New Zealand which result in the investigator breaking the blinding code at the time of the SAE or which result in hospitalisation or death.
- all serious adverse events occurring during the study worldwide which are considered related to the study medicine. Where there is a data safety monitoring board in place, serious adverse events occurring outside New Zealand may be reported quarterly.

All SAE reports must be signed by the Principal Investigator and include a comment on whether he/she considers there are any ethical issues relating to this study continuing due to this adverse event. It is assumed by signing the report, the Principal Investigator has undertaken to ensure that all New Zealand investigators are made aware of the event.

Amendments

All amendments to the study must be advised to the Committee prior to their implementation, except in the case where immediate implementation is required for reasons of safety. In such cases the Committee must be notified as soon as possible of the change.

Please quote the above ethics committee reference number in all correspondence.

The Principal Investigator is responsible for advising any other study sites of approvals and all other correspondence with the Ethics Committee.

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider within whose facility the research is to be carried out. Where applicable, authority for this must be obtained separately from the appropriate manager within the organisation.

We wish you well with your study.

Yours sincerely

Amrita Kuruvilla
Administrator
Northern Y Ethics Committee
Email: amrita_kuruvilla@moh.govt.nz



MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To: Sandra Bassett
 From: **Madeline Banda** Executive Secretary, AUTEC
 Date: 20 May 2010
 Subject: Ethics Application Number 10/59 **The effect of a computer-based patient education programme on rehabilitation adherence and shoulder function when used as an adjunct to physiotherapy in patients with shoulder injuries.**

Dear Sandra

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 12 April 2010 and that the Chair of AUTEC and I have approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 14 June 2010.

Your ethics application is approved for a period of three years until 20 May 2013.

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>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 20 May 2013;
- 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>. This report is to be submitted either when the approval expires on 20 May 2013 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. Also, if your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply within that jurisdiction.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at ethics@aut.ac.nz or by telephone on 921 9999 at extension 8860.

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

Yours sincerely

A handwritten signature in black ink, appearing to read 'M. Banda', with a stylized flourish at the end.

Madeline Banda
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Heather Clark heather.clark@aut.ac.nz, Andrew Higgins

Appendix 22: Participant Information Sheet for Pilot Study



Participant Information Sheet for the Research - the development and evaluation of a computer-based patient education programme as an adjunct to physiotherapy rehabilitation: a pilot study

Researchers: Heather Clark (Principal Researcher) and Dr. Sandra Bassett (Senior Lecturer, School of Physiotherapy, AUT University, Auckland). Telephone 921 9999, ext 7066

You are invited to take part in this pilot study, but before you accept the invitation would you please read the following outline of the study, the reasons for it, and your role in it. You can make a decision about whether you take part now or before your next physiotherapy clinic appointment. Your participation in the pilot study is entirely voluntary (your choice). You do not have to take part in it, and if you choose not to, this will not affect any future health care or treatment. If you do agree to take part you are free to withdraw from it 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 whanau support to help you understand the risks and/or benefits of this pilot study and any explanations you may require. The pilot study has received ethical approval from the Ministry of Health (Northern Region) Ethics Committee.

What is the purpose of this pilot study?

The purpose of this pilot study is to test the effectiveness of a computer-based patient education programme and questionnaires to be used in a larger study of adherence to a physiotherapy rehabilitation programme for shoulder disorders/injuries.

How were you selected to be asked to be part of the pilot study?

Your name has been given to us by the physiotherapist who is treating you for your shoulder injury.

Who can take part in the pilot study?

People who have a shoulder disorder/injury and are about to start a course of physiotherapy for this problem. They must be 16 years or older to participate. It is also necessary to be able to read and understand written English. Twenty people will be required for this pilot study.

What happens in this pilot study?

This study will be conducted over the first four weeks of your course of physiotherapy for your shoulder injury/disorder. Your participation in the pilot study will begin at your second physiotherapy appointment, and will not interfere with your normal course of physiotherapy.

Normal Physiotherapy

At your first treatment session your shoulder was assessed by your physiotherapist and on the basis of those findings an appropriate treatment programme was prescribed. This treatment will consist of home and clinic based physiotherapy which includes shoulder exercises and advice regarding shoulder activities.

Research Activities

At the second treatment session those people who volunteer to take part will meet with the researcher and sign a consent form for their participation in the pilot study. They will then answer some questionnaires about themselves and their shoulder injury/disorder. One questionnaire requests demographic information such as age, gender, occupation, and whether you have had any physiotherapy on your shoulder before. There are eight other short questionnaires that measure what you know about the shoulder, the support you are receiving from other people and how you feel about your injury/disorder. With the researcher, you will then be asked to write down some ideas about where and when you are going to do your home-exercise programme and how often you are going to do it.

After you have completed the questionnaires the researcher will show you how to use the shoulder CBPE programme which you will be able to access on your home computer. The programme will consist of a variety of information including film clips showing the exercises your physiotherapist has already given you, how the shoulder works, and quizzes about the shoulder and exercise programmes. In addition you will be shown how to use the chat room on the internet so you can have contact with other people who have similar problems with their shoulder as you. They may be able to give you support or tell you how they manage to do some everyday activities that are difficult because of pain or poor shoulder movement. Only those involved in the pilot study will be able to participate so you will be given a password by the researcher to can enter the chat room.

At the end of each of the 4 weeks you will be requested to submit a diary that you will have filled in on your computer programme about what exercises you did over the week and when you did them. An automated reminder will be sent to you if the weekly diary is not received. At the end of the 4 week period you will be asked to re-answer the initial questionnaires as well as answer a few questions about how you felt about the computer programme and the research project in general.

Once all the information has been collected, the questionnaire responses will be analysed to establish the effectiveness of the computer programme, the questionnaires and the chat room. This analysis may lead to changes in the information in the computer programme, the questionnaires and the chat room set-up in preparation for a larger study that will test the effectiveness of the DVD and chat room. The report will be written and given to the physiotherapists whose patients will take part in the pilot study. Participants are entitled to the report, or alternatively the outcomes of the pilot study can be discussed with the researcher. There may however be a delay between the participation in the pilot study and receiving information about it.

What are the discomforts and risks?

There are no physical or psychological discomforts or risks associated with this pilot study.

What are the benefits?

The information you could be given may improve your knowledge and understanding of shoulder injuries. Your participation in this pilot study will ensure the information and questionnaires to be used in the larger study of adherence to shoulder injury rehabilitation will be effective.

How is my privacy protected?

No material which could personally identify you will be used in any reports of this pilot study. For the analysis of the questionnaires, each participant will be given a confidential coding so as their information can be linked. After the analysis, the questionnaires will be kept locked in a filing cabinet in the Department of Physiotherapy, AUT University for ten years. They will then 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 pilot study. The only cost to you is your time to read the information and answer the questionnaires.

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

If you have any questions or concerns about your rights as a participant in this pilot 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

What compensation is available for injury or negligence?

In the unlikely event of you sustaining any injury during the time of your participation in this pilot study, you may be covered by ACC under the Injury

Prevention Rehabilitation and Compensation Act 2001. ACC cover is not automatic and your case will need to be assessed by ACC according to the provisions of the Injury Prevention Rehabilitation and Compensation Act 2001. If your claim is accepted by ACC, you still might not get any compensation. This depends upon a number of factors such as whether you are an earner or non-earner. ACC usually provides only partial reimbursement of costs and expenses and there may be no lump sum compensation payable. There is no cover for mental injury unless it is a result of physical injury. If you have ACC cover, generally this will affect your right to sue the investigators.

If you have any questions about ACC, contact your nearest ACC office or the investigator.

You are also advised to check whether participation in this pilot study would affect any indemnity cover you have or are considering, such as medical insurance, life insurance and superannuation.

Who can give me more information about this pilot study?

If you need more information you may contact Heather Clark, who is the principal researcher and will be undertaking the research with the participants. Heather can be contacted at 09 921 9999 ext 7066. Alternatively, the physiotherapist who will be treating you can give you information about the pilot study.

Thank-you for taking the time to read this information sheet and for the interest you have shown in the pilot study. Should you wish to take part please inform either Heather Clark, Sandra Bassett or the physiotherapy clinic staff.

This study has received approval from the Auckland Regional Ethics Committee, ethics reference number NTY/09/12/116.

Heather Clark (Principal Researcher and Ph.D student, School of Physiotherapy, AUT University).

November 2009

Appendix 23: Consent Form for Pilot Study

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



Title of Project: Development and evaluation of a computer-based patient education programme as an adjunct to physiotherapy rehabilitation for shoulder injuries: a pilot study

English	I wish to have an interpreter	Yes	No
Māori	E hiahia ana ahau ki tetahi kaiwhaka Māori/kaiwhaka pakeha korero	Ae	Kao
Cook Island Māori	Ka inangaro au i tetahi tangata uri reo	Ae	Kare
Fijian	Au gadreva me dua e vakadewa vosa vei au	Io	Sega
Niuean	Fia manako au ke fakaaoga e taha tagata fakahokohoko kupu	E	Nakai
Sāmoan	Ou te mana'o ia i ai se fa'amatala upu	loe	Leai
Tokelaun	Ko au e fofou ki he tino ke fakaliliu te gagana Peletania ki na gagana o na motu o te Pahefika	loe	Leai
Tongan	Oku ou fiema'u ha fakatonulea	Io	Ikai

I have:

- Read and understood the participant information sheet dated November 2009, for volunteers taking part in the pilot study to evaluate a computer-based patient education programme as an adjunct to physiotherapy rehabilitation for shoulder injuries.
- Had the opportunity to discuss this pilot study with the researcher and I am satisfied with the answers that I have been given.
- Had the opportunity to use whānau support or a friend to help me ask questions and understand the study.

I understand:

- That taking part in this pilot study is voluntary (my choice), and that I may withdraw from the pilot study at any time and this will in no way affect my future health care.
- That my participation in this pilot study is confidential and that no material which could identify me will be used in any reports on this pilot study.
- The compensation provisions for this pilot study.

Also I:

- Have had time to consider whether to take part, and know to contact the researchers should I have any further questions.
- Know who to contact if I have any side effects from the pilot study.
- Know that if I wish, I can receive a copy of the results of the pilot study, but I do realise that there may be a delay between my participation in the pilot study and publication of the results.
- I wish to receive a copy of a short report about the outcomes of this pilot study YES/NO

I(full name)

hereby consent to take part in this pilot study.

Date:

Signature:

Full names of researchers:

Ms Heather Clark, Dr Sandra Frances Bassett, Dr Andrew Higgins

Contact phone number for researchers:

(09) 9219999 ext. 7066

Project explained by:

Project role:

Signature:

Date:

Appendix 24: Risk Perception Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

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

If I don't do my home physiotherapy programme:

5. it will be harder for me to move my arm	
6. it will be harder for me to care for myself	
7. it will be harder for me to continue with my normal daily life	
8. it will be harder for me to participate in my leisure/recreational activities	

Appendix 25: Treatment Outcome Expectancies Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

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

If I follow my home physiotherapy programme as recommended

7. I will get better quicker	
8. it will improve my ability to cope with my normal daily life	
9. I will be able to cope better with any daily hassles	
10. I will have less pain in my shoulder	
11. I will be able to move my shoulder better	
12. my shoulder will be stronger	

Appendix 26: Behavioural Intentions Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

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

I intend to

5. do my home exercise programme as recommended by my physiotherapist.	
6. rest my upper limb as recommended by my physiotherapist	
7. take the advice given by my physiotherapist	
8. avoid doing any activities that may reinjure my shoulder	

Appendix 27: Action Self-Efficacy Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

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 do my home physiotherapy programme

4. the number of times recommended each day	
5. the number of repetitions required for each exercise at each session	
6. and follow the advice of my physiotherapist	

Appendix 28: Maintenance Self-Efficacy Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

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

I was confident I would be able to perform my home programme daily over the 8 weeks even if

8. I did not see any positive changes immediately	
9. I felt I was short of time	
10. I was tempted to do something else	
11. I had to force myself to do the exercises	
12. I was tired	
13. my daily routine changed e.g. went on holiday, was away for the week-end	
14. there were other reasons	

Appendix 29: Recovery Self-Efficacy Questionnaire

Using the scale shown below, respond to the statement by writing the number in the box by each statement that best fits how you feel about the statement.

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

I was confident I could perform my home programme daily over the eight weeks even if

8. I did not see any positive changes immediately	
9. I felt I was short of time	
10. I was tempted to do something else	
11. I had to force myself to do the exercises	
12. I was tired	
13. my daily routine changed e.g. went on holiday, was away for the week-end	
14. there were other reasons	

Appendix 30: Rehabilitation Adherence Measure for Athletic Training (RAdMAT) Questionnaire

Participant:

Date:

Rehabilitation Adherence Measure for Athletic Training (RAdMAT)

To be completed by the physiotherapist at the end of eight weeks of the participant's treatment sessions. For each of the following circle the number that best indicates the patient's behaviour:

Never true	Sometimes true	Usually true	Always true
1	2	3	4

1	Attends scheduled rehabilitation sessions	
2	Arrives at rehabilitation on time	
3	Follows the physiotherapist's instructions during rehabilitation sessions	
4	Follows the prescribed rehabilitation plan	
5	Completes all tasks assigned by the physiotherapist	
6	Asks questions about his/her rehabilitation	
7	Communicates with the physiotherapist if there is a problem with the exercises	
8	Provides the physiotherapist feedback about the rehabilitation program	
9	Has a positive attitude during rehabilitation sessions	
10	Has a positive attitude toward the rehabilitation process	
11	Gives 100% effort in rehabilitation sessions	
12	Is self-motivated in rehabilitation sessions	
13	Is an active participant in the rehabilitation process	
14	Stays focused while doing rehabilitation exercises	
15	Is motivated to complete rehabilitation	
16	Shows interest in the rehabilitation process	

Appendix 31: Knowledge Quiz for Main Study

1. The bones that come together at the shoulder to form the shoulder complex are the
 - a. humerus and scapula (shoulder blade).
 - b. humerus and clavicle (collar bone).
 - c. humerus, scapula (shoulder blade), and clavicle (collar bone)
 - d. don't know.

2. The rotator cuff muscles
 - a. help hold the bones of the shoulder joint together.
 - b. help move the shoulder.
 - c. are small muscles around the shoulder.
 - d. all of the above.

3. When placing your hand above your head
 - a. only the shoulder joint moves.
 - b. the scapula (shoulder blade) and the shoulder joint must move.
 - c. all the joints of the shoulder complex must move.
 - d. don't know.

4. Shoulder injuries or disorders may affect the
 - a. muscles around the shoulder.
 - b. tendons around the shoulder.
 - c. ligaments around the shoulder.
 - d. any of the above.

5. Shoulder injuries or disorders
 - a. affect older people only.
 - b. may affect any age group.
 - c. affect young people only.
 - d. result only from trauma or accidents.

6. Treatment for shoulder injuries often involves
 - a. doing exercises at home.
 - b. taking pain relief.
 - c. resting your arm.
 - d. all of the above.

7. The best way to put a jersey on when your shoulder is painful is to put your
 - a. jersey over your head first, then put your bad arm in the sleeve, then your good arm.
 - b. jersey over your head first, then put your good arm in the sleeve, then your bad arm.
 - c. good arm in the sleeve first, then your bad arm, then your jersey over your head.
 - d. bad arm into the sleeve first, then your good arm, then your jersey over your head.

8. Cues to exercise
 - a. remind me to do my exercises.
 - b. help me strengthen my shoulder.
 - c. should be put in an 'out of the way' place.
 - d. don't know.

9. Making action plans
 - a. is a good way to get out of doing my exercises.
 - b. helps me get back on track if I forget to do my exercises.
 - c. provides the incentive to do my exercises.
 - d. keeps me on track to do my exercises.

10. If you are working on the computer the best way to support your shoulder is to
 - a. put the keyboard on your lap.
 - b. type with your fingertips and hold your hands and forearms above the keyboard.
 - c. adjust the chair height so your forearms are unable to rest on the desk.
 - d. rest your forearms on the desk.

Appendix 32: Participant Feedback from Intervention Group

This form is only completed by people who want to give feedback about the implementation of the research.

1. Was the diary easy to complete? Yes No

2. Acceptability and impact of the CBPE programme.

3. Navigation through the CBPE programme:

4. If you were given the option to do more of your physiotherapy at home with the aid of an online programme like the one you have been using, would you expect the number of appointments with your physiotherapist to be reduced?

Yes
No

5. Ideally, how would you like to have your physiotherapy delivered?
 - a. Physiotherapy visits only
 - b. Physiotherapy plus and an online programme
 - c. Online programme only
 - d. Online programme with less visits to the physiotherapy clinic

6. Did you obtain any additional information about your shoulder other than from your physiotherapist or from the online programme e.g. doctor, internet. If so list these below.

7. Any other information or comment about the study.

Thank you for your time and feedback.

Appendix 33: Participant Feedback from Attention Control Group

This form is only completed by people who want to give feedback about the implementation of the research.

1. Was the diary easy to complete? Yes No

2. What other information could have been included on the website that may have helped you with your physiotherapy.

3. Did you obtain any additional information about your shoulder other than from your physiotherapist e.g. doctor, internet. If so list these below.

4. Any other information or comment about the study.

Thank you for your time and feedback.

Appendix 34: Ethical Approval for Main Study



Northern Y Regional Ethics Committee
c/- Ministry of Health
130 Grantham Street
PO Box 1031
Hamilton
Phone: 0800 4 ETHICS
Email: hdec@mh.govt.nz

15 August 2012

Ms Heather Clark
Auckland University of Technology
Dept Physiotherapy
School of Rehabilitation & Occupation Studies
Faculty of Health & Environment, AUT
PB 92 006 Auckland 1142

Dear Ms Clark

Re: Ethics ref: **NTY/12/06/056** (please quote in all correspondence)
Study title: The effect of a computer-based patient education programme on rehabilitation adherence and shoulder function when used as an adjunct to physiotherapy in patients with shoulder injuries
Investigators: Ms Heather Clark, Dr Sandra Bassett, Dr Andrew Higgins
Sites: Carrington Road Physio, Birkenhead Physiotherapy Centre, Golf Works Ltd.

This study was given ethical approval by the Northern Y Regional Ethics Committee on 15 August 2012.

Approved Documents

- Locality assessment for Carrington Road Physio
- Locality assessment for Birkenhead Physiotherapy Centre
- Locality assessment for Golf Works Ltd
- Participant Information Sheet, Version 2, dated 12 July 2012

This approval is valid until 30 January 2015, provided that Annual Progress Reports are submitted (see below).

Access to ACC

For the purposes of section 32 of the Accident Compensation Act 2001, the Committee is satisfied that this study is not being conducted principally for the benefit of the manufacturer or distributor of the medicine or item in respect of which the trial is being carried out. Participants injured as a result of treatment received in this trial will therefore be eligible to be considered for compensation in respect of those injuries under the ACC scheme.

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

All SAE reports must be signed by the Principal Investigator and include a comment on whether he/she considers there are any ethical issues relating to this study continuing due to this adverse event. It is assumed by signing the report, the Principal Investigator has undertaken to ensure that all New Zealand investigators are made aware of the event.

Amendments

All amendments to the study must be advised to the Committee prior to their implementation, except in the case where immediate implementation is required for reasons of safety. In such cases the Committee must be notified as soon as possible of the change.

Please quote the above ethics committee reference number in all correspondence.

The Principal Investigator is responsible for advising any other study sites of approvals and all other correspondence with the Ethics Committee.

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider within whose facility the research is to be carried out. Where applicable, authority for this must be obtained separately from the appropriate manager within the organisation.

We wish you well with your study.

Yours sincerely

Amrita Kuruvilla
Administrator
Northern Y Ethics Committee
Email: amrita_kuruvilla@moh.govt.nz



M E M O R A N D U M

Auckland University of Technology Ethics Committee (AUTEC)

To: Sandra Bassett
 From: Rosemary Godbold, Executive Secretary, AUTEC
 Date: 11 September 2012
 Subject: **Ethics Application Number 12/244 The effect of a computer-based patient education programme on rehabilitation adherence and shoulder function when used as an adjunct to physiotherapy in patients with shoulder injuries.**

Dear Sandra

I am pleased to advise that on 10 September 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 by AUTEC at its meeting on 24 September 2012.

Your ethics application is approved for a period of three years until 10 September 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 10 September 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 10 September 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 AUTEK 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: Heather Clark heather.clark@aut.ac.nz