Effect of the Rehabilitation Setting on Motivation and Clinical Outcomes Post Stroke – a Pilot Study

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A thesis submitted for the degree of Master of Health Sciences (Rehabilitation) at the University of Otago, Dunedin, New Zealand.

October 2012
Abstract

Background
Previous research suggests that the rehabilitation setting can influence both motivation for rehabilitation and adherence to the rehabilitation programme. These two factors are considered important determinants of rehabilitation outcomes. Community rehabilitation is delivered at home or in a clinic, with clinic-based rehabilitation being provided either individually or in a group. Although research has shown that group exercise programmes can positively influence mobility outcomes following stroke, no community-based study has directly compared group and individual rehabilitation programmes using a similar content, to determine the effect on motivation and mobility outcomes.

Purpose
The purpose of this non-experimental pilot study was to undertake the feasibility work for a future randomised controlled trial (RCT) that would investigate whether the rehabilitation setting influences motivation for rehabilitation and clinical outcomes in patients with stroke. The motivation levels of two groups of participants undergoing community-based rehabilitation following stroke (group clinic-based and individual home-based rehabilitation) were evaluated to provide information about the required sample size for a future RCT. In addition, walking ability and adherence to the rehabilitation programme were compared in the two rehabilitation settings.

Methods
Sixteen participants, with a primary diagnosis of stroke, and who were referred for rehabilitation to the Community Rehabilitation Team in Wellington, were recruited. Participants completed rehabilitation in either a group clinic-based or individual home-based setting for up to eight weeks. Two motivation questionnaires, the Apathy Evaluation Scale (AES) and the Intrinsic Motivation Inventory (IMI), were administered and the Six Minute Walk Test (6MWT) was measured. Participants completed an exercise adherence diary to measure adherence to the prescribed home exercise programme (HEP), and the treating physiotherapist documented adherence to the rehabilitation sessions.
Results
A total sample size of ninety-six participants is recommended for a future RCT, to detect a minimum difference of five points on the AES between settings. No statistically significant difference in motivation levels between the two settings was found; however, the point estimates of the IMI were consistent with higher motivation levels in the group clinic-based setting. There was no statistically significant difference in 6MWT distance between the two groups, although the point estimates favoured home-based participants. There was no evidence of a difference in the degree of adherence to the rehabilitation sessions between the two settings. However, the group clinic-based participants had a statistically significant higher level of adherence to the prescribed HEP.

Conclusion
This pilot study showed a trend towards higher motivation levels in participants who received rehabilitation in a group clinic-based setting; however, this did not translate to improved clinical outcomes. Further research, using more robust methods and a larger sample size, is warranted to explore whether the rehabilitation setting affects motivation for rehabilitation and clinical outcomes following stroke. In addition, this study has highlighted the need for a review of the content of the group clinic-based rehabilitation programme.
Acknowledgements

Thank you to my supervisors, Associate Professor Will Taylor and Professor Mark Weatherall, for helping trim my original idea down to a manageable size for a Masters project. Thank you also for all your feedback on my many drafts and for keeping me on track during this journey.

Thank you to the participants who took part in this research, as without you this study would not have been possible.

Thank you to my colleagues in the Community Rehabilitation Team for assisting with recruitment. A particular thanks to the physiotherapists – Rachel Crone, Emma Robinson and Vanessa Simpson – who helped assess and treat participants involved in this study.

Thank you to Chris McCully for reading my thesis and providing valuable feedback.

Thank you to Capital & Coast District Health Board for providing financial assistance through the Allied Health, Technical & Scientific Scholarship, which allowed me to take time off from work to finish writing my thesis.

Finally, thank you to my family and friends who have supported me in getting over the finish line.
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<td>5mWT</td>
<td>Five Metre Walk Test</td>
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<tr>
<td>6MWT</td>
<td>Six Minute Walk Test</td>
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<tr>
<td>ACC</td>
<td>Accident Compensation Corporation</td>
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<tr>
<td>ADL</td>
<td>Activities of Daily Living</td>
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<tr>
<td>AES</td>
<td>Apathy Evaluation Scale</td>
</tr>
<tr>
<td>AES-C</td>
<td>Clinician-rated version of the Apathy Evaluation Scale</td>
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<tr>
<td>AES-I</td>
<td>Informant-rated version of the Apathy Evaluation Scale</td>
</tr>
<tr>
<td>AES-S</td>
<td>Self-rated version of the Apathy Evaluation Scale</td>
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<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
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<tr>
<td>ARCOS</td>
<td>Auckland Regional Community Stroke</td>
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<td>ATS</td>
<td>American Thoracic Society</td>
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<tr>
<td>BI</td>
<td>Barthel Index</td>
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<tr>
<td>BREQ</td>
<td>Behavioural Regulation in Exercise Questionnaire</td>
</tr>
<tr>
<td>C&amp;CDHB</td>
<td>Capital and Coast District Health Board</td>
</tr>
<tr>
<td>CET</td>
<td>Cognitive Evaluation Theory</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>CR</td>
<td>Cardiac Rehabilitation</td>
</tr>
<tr>
<td>CREC</td>
<td>Central Regional Ethics Committee</td>
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<tr>
<td>CRT</td>
<td>Community Rehabilitation Team</td>
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<tr>
<td>DALY</td>
<td>Disability Adjusted Life Years</td>
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<tr>
<td>FAC</td>
<td>Functional Ambulation Classification</td>
</tr>
<tr>
<td>FAI</td>
<td>Frenchay Activity Index</td>
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<tr>
<td>FIM</td>
<td>Functional Independence Measure</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HEP</td>
<td>Home Exercise Programme</td>
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<tr>
<td>HR</td>
<td>Heart Rate</td>
</tr>
<tr>
<td>HRQoL</td>
<td>Health-related Quality of Life</td>
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<tr>
<td>ICC</td>
<td>Intraclass Correlation Coefficient</td>
</tr>
<tr>
<td>ICF</td>
<td>International Classification of Functioning, Disability and Health</td>
</tr>
<tr>
<td>ICIDH</td>
<td>International Classification of Impairment, Disability and Handicap</td>
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<tr>
<td>IMI</td>
<td>Intrinsic Motivation Inventory</td>
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<tr>
<td>Acronym</td>
<td>Term</td>
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<tr>
<td>IQR</td>
<td>Interquartile Range</td>
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<tr>
<td>K-S</td>
<td>Kolmogorov-Smirnov</td>
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<tr>
<td>MCID</td>
<td>Minimal Clinically Important Difference</td>
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<tr>
<td>MD</td>
<td>Mean Difference</td>
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<tr>
<td>MMSE</td>
<td>Mini Mental State Examination</td>
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<tr>
<td>OIT</td>
<td>Organismic Integration Theory</td>
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<tr>
<td>ORA</td>
<td>Older Adults, Rehabilitation and Allied Health</td>
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<tr>
<td>RCT</td>
<td>Randomised Controlled Trial</td>
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<tr>
<td>RPE</td>
<td>Rating of Perceived Exertion</td>
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<tr>
<td>SD</td>
<td>Standard Deviation</td>
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<tr>
<td>SDT</td>
<td>Self-Determination Theory</td>
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<tr>
<td>SMI</td>
<td>Self-Motivation Inventory</td>
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<tr>
<td>SpO₂</td>
<td>Oxygen Saturation</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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Chapter One: Background

1.1 Introduction
This chapter gives the background to this research project. Firstly, stroke is discussed to provide context to the research. In particular, stroke is defined and the effects of stroke are described, followed by a discussion of stroke in the New Zealand setting. Secondly, the clinical background of the researcher is outlined, as well as the motivation for the project. Thirdly, the research objectives are presented. Finally, an outline of the thesis structure is given.

1.2 Stroke

1.2.1 Definition and sequelae of stroke
The World Health Organisation (WHO) defines stroke as “rapidly developed clinical signs of focal (or global) disturbance of cerebral function lasting more than twenty-four hours (unless interrupted by surgery or death), with no apparent cause other than a vascular origin”. This definition includes subarachnoid haemorrhage, but excludes transient ischaemic attacks, and secondary stroke caused by trauma (WHO MONICA Project 1998-1999). Stroke, which is caused by a disruption in cerebral blood flow, can be classified as either ischaemic or haemorrhagic. Ischaemic stroke occurs when a cerebral artery is occluded and blood flow can not reach the brain. Haemorrhagic stroke is the result of blood leaking into the brain due to the rupture of an artery. Both mechanisms result in brain cells being deprived of oxygen and nutrients, leading to cell damage (Caplan 2009). The effect of this damage is dependent on the area of the brain that is involved, and may include changes in cognitive, emotional, sensory or motor functions (Kaufman & Becker 1986). The resulting impairments can range from minor to severe, can be temporary or permanent (Kaufman & Becker 1986) and lead to activity limitations and participation restrictions, with the level of these limitations usually being related to the degree of impairment (Gordon et al. 2004). A number of other factors can impact on the degree of activity limitations including intrinsic motivation, mood, cognition and exercise endurance (Gordon et al. 2004). Although some stroke survivors make a complete recovery, up to 50% have ongoing functional deficits (Bonita et al. 1997a; Gordon et al. 2004; Wiles et al. 2004). Where deficits remain six months or more post stroke, this is defined as chronic stroke (Harris et al. 2005; Ivey et al. 2008).
1.2.2 Stroke in New Zealand

Stroke is the third greatest cause of death in New Zealand (Ministry of Health 2010), with approximately 2,000 deaths each year being attributed to stroke (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010). Stroke affects approximately 6,000 New Zealanders annually (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010), and it was anticipated that by 2011 there would be about 45,000 people in New Zealand living with stroke (Tobias et al. 2007). Stroke is the leading cause of disability in older people in New Zealand (Ministry of Health 2003), and chronic disability is the major burden of stroke (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010).

A number of studies have evaluated the prevalence of stroke-related disability in New Zealand stroke survivors, using data from the Auckland Regional Community Stroke (ARCOS) study (Bonita et al. 1997a; Hackett et al. 2000; Tobias et al. 2007; Feigin et al. 2010). The ARCOS study is a population-based, stroke incidence study that has evaluated stroke survivors in Auckland over twelve month periods in 1981/82, 1991/92 and 2002/03 (Tobias et al. 2007). Bonita and colleagues (1997a) utilised data from the 1981/82 and 1991/92 ARCOS studies to estimate the prevalence of disability following stroke. The results suggested that approximately 50% of stroke survivors will make a complete recovery, 30% will make an incomplete recovery but will not necessarily require assistance with activities of daily living (ADL) and a further 20% will need assistance with at least one ADL. In contrast, when using data from the 1991/92 and 2002/03 ARCOS studies it was estimated that only 30% of stroke survivors will make a complete recovery within five years of stroke, 50% of survivors will have mild to moderate disability and 20% will have severe disability that requires daily assistance with ADL (Tobias et al. 2007). Hackett et al. (2000) assessed dependence with ADL in long-term stroke survivors. This study followed up stroke survivors who took part in the 1991/92 ARCOS study, and found that six years post stroke 42% of the survivors were dependent with ADL and 61% self-reported an incomplete recovery post stroke. In a more recent study, Feigin et al. (2010) assessed the five year outcomes of 418 stroke survivors and found similar results to Hackett and colleagues (2000). Their results showed that approximately 65% of the study participants self-reported an incomplete recovery post stroke and about 35% had some dependency with ADL, as measured by the Barthel Index (BI) (Feigin et al. 2010). The BI is a measure of a patient's independence with ADL (Loewen & Anderson 1988). With stroke incidence decreasing at a slower rate than stroke mortality and
with an ageing population there are likely to be more people living with the consequences of stroke. As a result, there may be an increased burden of stroke-related disability on the country (Tobias et al. 2007).

The lifetime costs of first-ever stroke in New Zealand have been estimated at $73,600 per person, and it is thought that the annual cost to New Zealand is approximately $450 million, with these costs expected to rise (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010). The burden of stroke can be calculated not only in terms of financial cost, but also by the years of healthy life lost because of stroke. This is measured in disability adjusted life years (DALYs), which represents years lost to disability plus years lost to premature mortality. One DALY is equivalent to the loss of one year of healthy life. Stroke ranks second and accounts for 5.4% of total DALYs in New Zealand, representing 30,115 years of healthy life lost (Ministry of Health 2001). The following sections will consider specific issues facing Māori and Pacific stroke survivors in New Zealand.

1.2.3 Māori and stroke

The Clinical Guidelines for Stroke Management (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010) report that there are significant disparities between Māori and non-Māori patients with stroke. Research has shown that there is a higher incidence of stroke in Māori than in New Zealand Europeans (Bonita et al. 1997b; Carter et al. 2006), and that Māori are younger at the time of first stroke (Bonita et al. 1997b). The mean age of first stroke in Māori is 61 years, compared to 65 years and 76 years in Pacific peoples and New Zealand Europeans, respectively (Carter et al. 2006), with approximately 71% of all strokes in Māori occurring in those aged under sixty-five (Bonita et al. 1997b). Māori have a higher incidence of modifiable stroke risk factors, including obesity, smoking, hypertension and diabetes mellitus, compared to non-Māori (Feigin et al. 2006; Robson & Harris 2007). Significant differences in the socioeconomic status of Māori and non-Māori have also been found, with over 55% of Māori patients with stroke being in the low socioeconomic group compared to approximately 27% of New Zealand Europeans (Feigin et al. 2006). The higher incidence of both stroke risk factors and low socioeconomic status may contribute to higher stroke incidence in Māori (Bonita et al. 1997b; Feigin et al. 2006).

Māori not only have a higher incidence of stroke than New Zealand Europeans, but may also have worse functional outcomes, however the evidence is conflicting (McNaughton et al.
McNaughton and colleagues (2002) assessed the community outcomes of patients with stroke at twelve months following hospital discharge in Wellington and found that Māori and Pacific peoples were more likely to be dependent compared to New Zealand Europeans. This study had a relatively small sample size (n=181), and the researchers recommended further investigation to support this finding. In a more recent study, Feigin and colleagues (2010) assessed the long term functional outcomes of 418 stroke survivors in Auckland. They found higher levels of cognitive impairment, language and visuoperceptual impairment and reduced economic self-sufficiency in non-Europeans compared to New Zealand Europeans five years after stroke. No other statistically significant differences in functional outcomes between ethnic groups were found in this study.

1.2.4 Pacific peoples and stroke

Significant disparities also exist between Pacific patients with stroke and New Zealand Europeans (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010). Pacific peoples, like Māori, have a higher incidence of stroke and are also younger at the time of first stroke compared to New Zealand Europeans, with 57.5% of all strokes in Pacific peoples occurring prior to the age of sixty-five (Bonita et al. 1997b). Pacific peoples also have higher rates of modifiable stroke risk factors (Feigin et al. 2006), which may contribute to the higher incidence of stroke (Bonita et al. 1997b; Feigin et al. 2006). While stroke event rates have been declining in New Zealand Europeans over the last twenty years, they have doubled for Pacific peoples, and remained high for Māori (Carter et al. 2006). Pacific peoples, like Māori, have a higher incidence of ischaemic stroke and primary intracerebral haemorrhage compared to New Zealand Europeans (Feigin et al. 2006). McNaughton and colleagues (2011) evaluated functional outcomes six months post stroke in 1127 patients with stroke. The results showed that Pacific and Asian people had lower levels of function, as measured by the Frenchay Activity Index (FAI); however, they were more likely to be living at home compared to New Zealand Europeans. The researchers suggested that cultural values in these populations may account for the lower scores on the FAI, indicating performance of few instrumental ADL, compared to New Zealand Europeans. This study also suggested that ethnicity does not independently affect stroke outcomes, rather that the differences seen may be caused by a number of interacting cultural factors.

In summary, stroke affects thousands of New Zealanders each year and as a result leaves many with chronic disability. In New Zealand, both Māori and Pacific peoples are over-
represented in stroke statistics, and evidence suggests that these populations also have poorer functional outcomes. Rehabilitation after stroke is important, and aims to maximise functional recovery and participation (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010). Rehabilitation is discussed in detail in Chapter Two, section 2.2. In the following section, the development of this research project is explored, including a description of the rehabilitation service, which is the recruitment venue for study participants and the inspiration for this project.

1.3 Development of the research
At Capital and Coast District Health Board (C&CDHB) in Wellington, community rehabilitation is provided by the Wellington Community Older Adults, Rehabilitation and Allied Health (ORA) team. For the purpose of this research, the group of health professionals providing rehabilitation within this team were defined as a sub-team known as the community rehabilitation team (CRT). For the last five years, the researcher has worked as a physiotherapist within the CRT. This team provides interdisciplinary rehabilitation for patients with new and chronic stroke and offers both individual home-based and group clinic-based physiotherapy treatment, where 'standard' treatment is physiotherapy at home. The group intervention, a recent addition to the service, was introduced to attempt to reduce the waiting time for the start of physiotherapy. Patients who meet the inclusion criteria for the group are given the choice of receiving physiotherapy at home or in the clinic. Inclusion criteria for the group are:

- A diagnosis of stroke – new or chronic
- Able to walk ten metres with or without an aid
- Able to make their own way to the group
- Able to undertake semi-supervised exercise
- Tolerate sixty minutes of exercise
- Independent with toileting

The majority of patients with stroke who are referred to the CRT are initially seen by one or two team members for a screening assessment. The purpose of this assessment is to identify the patient’s problems and needs, and to determine a treatment plan with the patient, based on their goals. It is at this assessment where patients, who meet the group inclusion criteria, are offered the choice of where they receive their physiotherapy treatment.
The researcher was involved in setting up the group clinic-based intervention, and now oversees the weekly running of this group. Anecdotally, a number of patients with stroke who attended the group as part of their rehabilitation programme remarked that the group setting provided them with motivation to exercise. These accounts led the researcher to consider whether the rehabilitation setting could have an influence on patient motivation for rehabilitation and whether increased motivation could improve rehabilitation outcomes. The researcher was interested in establishing whether differences in motivation levels between the two rehabilitation settings exist, and in particular whether the group setting did in fact promote increased patient motivation compared to individual physiotherapy at home. However, given the scope of a Masters project and the timeframe available for completion, it was decided that initially a pilot study would be undertaken. This pilot study would carry out the feasibility work for a future randomised controlled trial (RCT) that would investigate whether the rehabilitation setting influences motivation for rehabilitation and outcomes. The primary aims of the RCT would be to determine if patients’ functional ability and participation can be improved by increasing their motivation levels, and whether it is the rehabilitation setting that influences motivation for rehabilitation.

The purpose of this non-experimental pilot study was to evaluate the difference in motivation between two groups, those taking part in group clinic-based and individual home-based rehabilitation programmes for stroke. The study evaluated patient motivation, and the impact this has on outcomes and adherence to the rehabilitation programme. The following section outlines the research objectives in more detail.

1.4 Research objectives
The primary objective of this pilot study was to determine the utility and characteristics [mean, standard deviation (SD), median, inter-quartile range (IQR), minimum (min) and maximum (max)] of two motivation questionnaires, the Apathy Evaluation Scale and the Intrinsic Motivation Inventory, in group clinic-based and individual home-based rehabilitation settings. The summary statistics for these questionnaires were used to calculate the required sample size for a randomised controlled trial (RCT) comparing these two rehabilitation settings as venues for community-based rehabilitation patients, using motivation scores as a primary outcome. Secondary objectives were as follows:

1. To compare the mean scores of the motivation questionnaires in the two rehabilitation settings
2. To evaluate the characteristics, including feasibility, of the Six Minute Walk Test, in both settings
3. To assess adherence to the rehabilitation programme, specifically:
   - To consider the feasibility of using an adherence diary to assess adherence to a home exercise programme
   - To assess the number of sessions of rehabilitation completed compared to the number prescribed.

The hypotheses for this study were:
1. That motivation levels will be higher in the group clinic-based rehabilitation setting
2. That higher motivation levels in the group clinic-based setting will be associated with improved clinical outcomes, as measured by the Six Minute Walk Test
3. That higher motivation levels will lead to better adherence to the rehabilitation programme.

1.5 Thesis Structure
Chapter Two examines and discusses the literature of the key concepts of this research: rehabilitation, motivation and adherence. In addition, justification for the choice of outcome measures used in this study is discussed. Chapter Three discusses the methods used in this pilot study, including the study design, ethical issues and data analysis. Chapter Four presents the results of this research in relation to each of the stated objectives. Chapter Five discusses the results, and compares them with the previous literature. The limitations of the research are also considered and implications for further research are discussed.
Chapter Two: Literature Review

2.1 Introduction

There is evidence to suggest that the rehabilitation setting can influence both motivation for rehabilitation (Hale et al. 2003; Hale 2004) and adherence to the rehabilitation programme (Dalal et al. 2010). This issue is important, as motivation is often considered the key to the rehabilitation process (Kaufman & Becker 1986; Becker & Kaufman 1995; Maclean et al. 2000), and it is thought that increased motivation leads to improved patient outcomes (Becker & Kaufman 1995; Maclean & Pound 2000; Maclean et al. 2002). Group exercise programmes may enhance motivation for rehabilitation by providing competition and peer support (Ada et al. 1999), and may also lead to increased adherence to the rehabilitation programme (Seguin & Nelson 2003). Although research has shown that group exercise programmes can positively influence mobility outcomes (Salbach et al. 2004; Wevers et al. 2009), a comprehensive literature search failed to find any research that specifically compares group clinic-based rehabilitation and individual home-based rehabilitation for patients with stroke.

In this literature review chapter, rehabilitation is discussed first. Different methods of delivering community-based rehabilitation are explored, with both group and individual rehabilitation as well as clinic- and home-based rehabilitation being considered. Secondly, motivation is defined and discussed in relation to self-determination theory, and the link between motivation and rehabilitation outcomes is examined. The influence of the rehabilitation setting on motivation is also described. Thirdly, the construct of adherence is considered, including factors that influence adherence, and the association between motivation and adherence. Finally, the outcome measures that were chosen to be used in this research are described. The psychometric properties of each measure are considered, and the rationale for selecting these measures is discussed.

2.2 Rehabilitation

2.2.1 Definition of rehabilitation

The WHO defines rehabilitation as a “problem-solving and educational process aimed at reducing the disability and handicap experienced by someone as a result of disease, always
within the limitations imposed both by available resources and the underlying disease” (Wade 1992). This definition is based on the International Classification of Impairment, Disability and Handicap (ICIDH) which was published by the WHO in 1980. The ICIDH was criticised for a lack of recognition of the role of the environment on health and disability, and for the use of negative terminology (Stucki et al. 2007). It has since been further developed and is now known as the International Classification of Functioning, Disability and Health (ICF) (World Health Organisation 2001). The ICF, a framework for measuring health and disability, classifies health by describing human functioning, and not only considers environmental factors, but also personal factors and how these can influence functioning and disability (Stucki 2005). The ICF also uses more neutral language, with “disability” having been replaced with “activity limitations” and “handicap” with “participation restrictions” (Wade & de Jong 2000; Stucki et al. 2007). An activity limitation is defined as difficulty undertaking a task, while a participation restriction is a problem an individual has with involvement in life situations (Stucki 2005).

Rehabilitation has also been described as a continuous process that involves: identifying a patient's problems and needs; relating the identified problems to impaired body functions and structures, personal factors and environmental factors; and managing the rehabilitation intervention, as shown in Figure 2.1 (Stucki et al. 2002). Rehabilitation services for patients with stroke are provided both in hospital and in the community (Wiles et al. 2002). The following sections will focus on community rehabilitation and will explore the different delivery methods of this type of rehabilitation service.
2.2.2 Community rehabilitation

Rehabilitation following stroke often needs to continue after discharge from hospital (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010) and nearly all stroke survivors returning to the community who still have disabilities will need rehabilitation in the community (Barnes 2003). Ongoing community rehabilitation is important, because although up to 70% of patients with stroke discharged from hospital are able to walk independently within their home environment, many of these patients are unable to walk functionally in the community (Mudge & Stott 2009). Community mobility is the ability to walk outside the home in complex environments (Lord et al. 2004; Lord & Rochester 2005), and up to 93% of stroke survivors consider independent community mobility to be important or essential (Liu et al. 2008). The attainment of independent community mobility often marks the end point of a patient's rehabilitation (Lord & Rochester 2005). The next two sections will examine methods of delivering community rehabilitation, and the effect this has on rehabilitation outcomes.

2.2.2a Clinic-based versus home-based community rehabilitation

Community rehabilitation is usually delivered in one of two settings: clinic-based or home-based. Clinic-based rehabilitation is provided in a community centre, hospital outpatient
department or day hospital (Hillier & Inglis-Jassiem 2010), with rehabilitation in a day hospital including both individual and group therapy (Roderick et al. 2001). Home-based rehabilitation is provided in the stroke survivor's home or residential facility (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010). Both home-based and clinic-based rehabilitation settings have advantages and disadvantages. The main advantage of day hospital (or group clinic-based) rehabilitation is the social interaction for the patients (Young & Forster 1991; English & Hillier 2010). This is important because social support may play an important role in successful rehabilitation outcomes (Guthrie & Harvey 1994). Hale (2004) described two qualitative studies which considered the patient's preference for the location of their rehabilitation, either at home or in an outpatient setting. She reported that patients appreciated the social contact and motivation that arises from the interaction with other patients in the outpatient setting.

The disadvantages of rehabilitation in the clinic setting include that the patient has to travel to receive their treatment, and that by providing treatment away from the home environment, therapy may focus more on activity limitations rather than participation restrictions (Young & Forster 1991). It may be better to provide physiotherapy in the home for patients with stroke (Young & Forster 1991), because in the clinic setting it is difficult to plan ongoing therapy without a clear understanding of the home environment (Baskett et al. 1999); however the disadvantage of home-based therapy is that patients are more isolated and may feel “house-bound” (Young & Forster 1991; Hale 2004).

Evidence suggests that the community rehabilitation setting may have an influence on adherence to the treatment programme; however, to date results are conflicting. A systematic review of home-based and clinic-based cardiac rehabilitation (CR) programmes found conflicting results across nine studies that assessed adherence rates (Dalal et al. 2010). Pooling of data was not possible in this systematic review because the definitions of adherence used, and the way in which it was measured, varied significantly between the nine studies. Two of the included studies found significantly higher adherence to the CR programme by patients undertaking rehabilitation at home compared to the clinic-based patients. In contrast, a further two studies found no significant difference between the two settings. Furthermore, none of the studies found adherence to be higher in the clinic-based group. In a study exploring reasons for non-adherence with home-based or clinic-based CR programmes differences were found between the two settings (Jones et al. 2007). For the
patients completing CR at home the main reason for non-adherence to the programme was a lack of motivation, while difficulty with accessing the clinic was cited as a reason for non-adherence in the clinic-based group. Overall however, reasons for non-adherence to both programmes tended to be multi-factorial and idiosyncratic.

A number of studies have investigated whether rehabilitation outcomes differ depending on the treatment setting and have reported conflicting results (Young & Forster 1991; Young & Forster 1992; Britton & Andersson 2000; Hillier & Inglis-Jassiem 2010). Young and Forster (1991; 1992) compared day hospital and home-based physiotherapy on outcomes following stroke. It is unclear whether day hospital treatment was in a group or individually. The results showed no significant differences in outcomes between groups after eight weeks of treatment. However, at six months there was a significant difference between groups on the BI in favour of the home-based group [p=0.01; median score: 15 (day hospital); 17 (home)]. Furthermore, significantly more patients in the home-based group were able to walk independently outdoors compared to the day hospital group (p=0.03; day hospital 23%; home 45% χ²=4.65). A New Zealand study (Baskett et al. 1999) compared outpatient or day hospital rehabilitation with home-based rehabilitation and found that although the home-based group had a significantly longer contact period with the therapist (p=0.03), no statistically significant differences were found in any of the outcomes measured. In addition, Britton and Andersson (2000) reviewed seven studies and found no significant difference between home- and clinic-based rehabilitation on depression, quality of life, social participation or ability with ADL.

More recently, Hillier and Inglis-Jassiem (2010) completed a systematic review assessing the effectiveness of community rehabilitation for stroke survivors in both home and clinic settings, where clinic-based rehabilitation included either outpatient therapy or treatment in a day hospital. None of the studies included in this systematic review specifically compared individual therapy to group therapy. The authors included eleven RCTs, with a total of 1711 adult stroke survivors living in the community, all within the first year post stroke. When considering the studies individually, four of the trials reported no differences between home- and clinic-based rehabilitation in any of the measures evaluated. The other seven trials found some benefits in favour of the home-based group. The authors combined data in a meta-analysis to compare the effect of home- and clinic-based rehabilitation on BI and modified BI scores. Results of the pooled data showed that home-based rehabilitation had a greater effect
on BI scores at six to eight weeks post intervention than clinic-based rehabilitation \( p=0.03; \) mean difference (MD)=1.00; 95% confidence interval (CI) 0.12 to 1.88]. Modified BI scores at three to six months post treatment were also statistically significant in favour of the home-based group \( p=0.01; \) MD=4.07; 95% CI 0.81 to 7.34), however, no statistically significant difference was found between groups at six months using the BI \( p=0.27; \) MD=0.65; 95% CI -0.50 to 1.81). The authors of this systematic review concluded that rehabilitation provided at home is superior to clinic-based rehabilitation, especially in the short term. As the effect over the longer term is less clear, they suggested that where possible rehabilitation services should provide both delivery methods and the stroke survivor should be given the choice of where they receive their rehabilitation. Comans et al. (2010) concur, in essence, with this recommendation. They compared clinic-based group and home-based individual rehabilitation programmes for older adults with a recent fall. In this study, patients received eight weeks of treatment, delivered once weekly either at home or in a clinic, and in addition received a home exercise programme (HEP) to complete in between therapy sessions. The results showed a significant reduction in the rate of falls and in the total number of patients who fell over the six month period following completion of the programme, in favour of the clinic-based group intervention. There were no significant differences between groups in the mobility or balance outcomes. The authors concluded that while clinic-based therapy provided better results in this patient population, both clinic-based and home-based services should be provided where possible, as transport to the clinic may be difficult for some patients.

2.2.2b Group exercise programmes

Clinic-based rehabilitation can be provided either in a group or individually. A particular benefit of group exercise classes is that patient motivation for recovery may be increased, and motivation to continue practising activities learnt in the class may also be increased (Carin-Levy et al. 2009; Jones et al. 2009). The group environment also provides social support (Eng et al. 2003; Jones et al. 2009), which is described as essential in maintaining patient motivation for rehabilitation (Maclean et al. 2002). A number of studies have assessed the effectiveness of group exercise programmes in improving mobility in community-dwelling patients with stroke (Eng et al. 2003; Yang et al. 2006; Wevers et al. 2009).

Firstly, Eng et al. (2003) assessed the effect of an eight week community-based exercise programme on mobility and balance outcomes in individuals with chronic stroke. The results
showed participants had a significant increase in gait speed, endurance and balance, and that these improvements were retained one month later. Secondly, Yang et al. (2006) completed a RCT comparing a task-oriented group exercise programme to no rehabilitation in chronic stroke survivors. The authors found that lower limb muscle strength improved significantly in the intervention group, while the control group had a decrease in muscle strength. Significant improvements in walking distance and speed were also found in the intervention group compared to the control group. Finally, Wevers et al. (2009) completed a systematic review to determine the effect of circuit class training on gait or gait-related activities in patients with stroke. Six studies were included in this review, with a total of 307 participants. Walking distance was assessed using the Six Minute Walk Test (6MWT) by five of the studies (n=241). Statistically significant improvements in favour of the intervention group were found (Summary effect size: 0.43, 95% CI 0.17 to 0.68), which represented a mean clinical improvement of forty-two and a half metres on the 6MWT. These studies have demonstrated that group exercise programmes can positively affect mobility outcomes in patients with stroke. In addition, the social support provided in the group setting may enhance patient motivation for the programme. As yet, no community-based study has directly compared group and individual rehabilitation programmes using a similar content, to determine the effect on motivation and mobility outcomes in patients with stroke. In the next section motivation is explored in more detail.

2.3 Motivation

2.3.1 Defining motivation
The WHO has defined motivation as “a global mental function, a conscious or unconscious drive, that produces the incentive to act” (World Health Organisation 2001). Motivation is a dynamic process (Colombo et al. 2007) that has also been described as “the forces that initiate, direct and sustain behaviour” (Vallerand & O'Connor 1989). It can be intrinsically or extrinsically driven (Ryan et al. 1997) and as motivation “produces”, it is of interest to people in a number of different roles, including health care providers (Ryan & Deci 2000a). The next sections will discuss the different types of motivation, the effect of stroke on motivation and the influence of motivation on rehabilitation outcomes.

2.3.2 Self-determination theory and motivation
Self-determination theory (SDT) is an “organismic theory of human motivation” (Deci &
Ryan 1985). It focuses on three innate psychological needs, competence, autonomy and relatedness, which are the basis for optimal functioning and when satisfied, lead to greater self-determined motivation (Ryan & Deci 2000a). SDT describes motivation along a continuum: intrinsic motivation, extrinsic motivation and amotivation (Ryan & Deci 2000a; Ryan & Deci 2000b). Intrinsic motivation has been defined as engaging in an activity for the inherent satisfaction of performing that activity, rather than to receive an external reward (Deci 1971; Deci 1975 p.23). It is thought to come from the need to feel competent and self-determined (Deci 1975 p.61; Deci & Ryan 1985 p.39), where self-determination is the capacity to make choices oneself without outside influence (Deci & Ryan 1985 p.38). In contrast, extrinsically motivated behaviours are performed for outcomes which are separate to the activity itself, and amotivation can be described as a lack of intention to act (Ryan & Deci 2000b). The classification of motivation, as described in SDT, is summarised in Figure 2.2 (Ryan & Deci 2000a; Ryan & Deci 2000b).

**Figure 2.2: Classification of Motivation** (Ryan & Deci 2000a; Ryan & Deci 2000b)

SDT is comprised of a number of mini-theories, including Cognitive Evaluation Theory (CET) and Organismic Integration Theory (OIT) (Deci & Ryan 1985). CET details the effect of external events, those that relate to the initiation or regulation of behaviour, on motivation (Deci & Ryan 1985; Ryan & Deci 2000a). According to this theory two important factors affect motivation: perceived locus of causality and perceived competence (Ryan 1982). The theory describes how the presence of an external reward or constraint can cause a change of
perceived locus of causality from internal to external, thus leading to a reduction in intrinsic motivation. Conversely, the absence of an external reward can increase intrinsic motivation by changing the perceived locus of causality from external to internal (Ryan 1982). CET also suggests that environmental events can enhance or diminish a person's perceived competence, therefore increasing or decreasing intrinsic motivation respectively (Ryan 1982). Furthermore, CET specifies that perceived competence alone will not enhance intrinsic motivation, rather that it needs to be accompanied by self-determination (Ryan & Deci 2000a). Deci and Ryan (1985) suggest that by providing people with choice, thus increasing their self-determination, intrinsic motivation can be increased. To summarise, factors can alter intrinsic motivation by changing perceived competence and locus of causality, but intrinsic motivation will only occur when activities hold an inherent interest for the individual. For other activities, behaviours will be extrinsically driven and OIT will apply (Ryan & Deci 2000b).

OIT describes four different types of extrinsic motivation along a continuum of internalisation (Deci & Ryan 1985; Ryan & Deci 2000b), or self-determination (Vallerand & O’Connor 1989; Vallerand & Bissonnette 1992). OIT also describes the factors that can facilitate or hinder the internalisation and integration of behaviours that are not inherently intrinsically motivating. Internalisation refers to the process of taking in a value, and integration is the process where an individual transforms that value into their own and it becomes self-determined (Deci et al. 1994; Ryan & Deci 2000b). The four types of extrinsic motivation, from lower to higher levels of self-determination are: external regulation, introjection, identification and integration (Vallerand & Bissonnette 1992). The first type of extrinsic motivation is external regulation, a form of non self-determined extrinsic motivation (Vallerand & O’Connor 1989). Behaviours that are externally regulated are usually performed to receive an external reward or to satisfy an external demand (Vallerand & O’Connor 1989; Ryan & Deci 2000a), and have an external perceived locus of causality (Ryan & Deci 2000b). The second form of extrinsic motivation is introjected regulation, which is also non-self-determined and has an external perceived locus of causality (Deci & Ryan 1985 p.137; Vallerand & Bissonnette 1992; Ryan & Deci 2000b). Introjection refers to the process where a person starts to internalise the reasons for their actions (Deci & Ryan 1985 p.135; Vallerand & Bissonnette 1992). Behaviour that is motivated by introjection is performed with the feeling of pressure, often to avoid guilt (Ryan & Deci 2000b). Next on the self-determination continuum is identified regulation, which refers to behaviour that the individual can identify with and is perceived as being important.
The perceived locus of causality for this type of extrinsic motivation is somewhat internal (Vallerand & Bissonnette 1992; Ryan & Deci 2000b). Finally, integrated regulation, the most self-determined form of extrinsic motivation, describes behaviour that is volitional and has some value to the individual (Ryan & Deci 2000b). This type of extrinsic motivation is similar to intrinsic motivation in that it is autonomous, unconflicted and has an internal perceived locus of causality. However, behaviour that is motivated by integrated regulation is performed as a means to an end and thus extrinsically driven (Vallerand & O'Connor 1989; Ryan & Deci 2000a; Ryan & Deci 2000b). The internalisation process can be facilitated by providing an environment that encourages self-determination, specifically through autonomy, competence and relatedness supports (Ryan & Deci 2000b). In addition, providing rationale for undertaking a behaviour, acknowledging conflicting feelings and offering choice have been demonstrated to help with internalisation (Deci et al. 1994). Research has found that some health care outcomes are improved with increased internalisation, including better adherence to long-term medications in patients with chronic conditions (Williams et al. 1998; Ryan & Deci 2000a). In summary, extrinsic motivation can vary greatly in the degree of autonomy, and autonomy is crucial for an individual to transform a value into their own, thus the value becomes integrated (Ryan & Deci 2000a).

A third construct of motivation, amotivation, has been described by Deci and Ryan (1985). Amotivation occurs when an individual does not see any link between their behaviour and outcomes (Vallerand & Bissonnette 1992). Amotivated behaviour lacks intention, and the individual experiences incompetence and a lack of control (Vallerand & O'Connor 1989; Vallerand & Bissonnette 1992; Ryan & Deci 2000b). With amotivation there is no sense of purpose, no expectation of rewards and eventually the activity being performed will stop (Vallerand & O'Connor 1989; Vallerand & Bissonnette 1992).

2.3.3 Motivation for rehabilitation

The concept of motivation is a common theme in rehabilitation literature (Hallams & Baker 2009), and is seen by many health professionals as being a key factor to the rehabilitation process (Kaufman & Becker 1986; Becker & Kaufman 1995; Maclean et al. 2000). Motivation for rehabilitation is often characterised by the need for success and to avoid failure (Geelen & Soons 1996). These authors describe three factors that can have an influence on patient motivation for rehabilitation. The first factor is the patient's perception of whether they are able to achieve a successful outcome with the rehabilitation programme. The second
factor relates to the patient's perceived value of achieving a good outcome with rehabilitation. Finally, the third factor concerns the perceived “cost”, both with achieving the desired outcome and with the process of rehabilitation itself. Costs may be physical, social or psychological. Based on these factors, a patient is deemed to be highly motivated for rehabilitation when they believe that they have a good chance of a successful rehabilitation outcome and place high value on this outcome without expecting to experience negative effects from undertaking the rehabilitation programme.

A number of other factors have also been suggested to influence motivation for rehabilitation (Guthrie & Harvey 1994). Firstly, the provision of information can increase motivation, as it enables the patient to have a clear understanding of the reasons for the condition occurring and the behaviours that will allow the best management of this condition. Secondly, allowing the patient to have opportunities for “real choice” in daily activities, such as when, where and how various treatments are undertaken, will increase self-determination. Choice also allows for internalisation of control, with control shifting from the health professionals to the patient. Finally, as not many rehabilitation interventions are fun in themselves, behaviours to undertake them are not intrinsically motivated. It is therefore important that health professionals provide an explanation for the purpose of the rehabilitation task and give positive feedback to the patient when they are completing the task to enhance motivation for the rehabilitation programme (Guthrie & Harvey 1994). Furthermore, motivation can be difficult to achieve when an immediate benefit is unlikely, and with exercise-based treatments this is usually the case (Friedrich et al. 1998).

Health professionals have identified a number of qualities in patients with stroke which they believe indicate that a patient is highly motivated. These qualities include: an eagerness to participate in rehabilitation, a willingness to put in the required effort during therapy sessions, maintaining a positive attitude about recovery and no need for excessive encouragement (Kaufman & Becker 1986; Thompson et al. 1989). Research also suggests that patients who feel a stigma associated with stroke, or who have a dependent attitude towards illness, are more likely to have lower motivation levels towards rehabilitation and make less progress (Thompson et al. 1989).

2.3.3a Motivation in stroke survivors
Apathy, which has been defined for clinical purposes as a “lack of motivation that is not
attributable to diminished level of consciousness, cognitive impairment, or emotional distress” (Marin et al. 1991), is estimated to occur in 20-25% of stroke survivors (Jorge et al. 2010). A number of studies have assessed the association between stroke lesion location and apathy and reported conflicting results (Thompson et al. 1989; Marin et al. 1993; Starkstein et al. 1993; Andersson et al. 1999). Andersson and colleagues (1999) assessed seventy-two patients with acquired brain injury (including thirty patients with stroke), and found those with sub-cortical damage and right hemisphere damage were significantly more apathetic than patients with left hemisphere lesions. Their results were similar to those by Marin et al. (1993), who used the Apathy Evaluation Scale (AES) to measure apathy. In contrast, Thompson et al. (1989) found a trend towards left hemisphere stroke being predictive of lower patient motivation compared to right hemisphere stroke. Finally, in a study of eighty patients with stroke, no association between apathy and the cerebral hemisphere affected by stroke was found (Starkstein et al. 1993). It is unclear from these results whether there is an association between the stroke-affected hemisphere and apathy.

Post stroke apathy is thought to be related to increased age, difficulty with ADL, decreased cognitive functioning and decreased verbal fluency (Brodaty et al. 2005; Jorge et al. 2010), and has been associated with adverse outcomes (van Reekum et al. 2005). Starkstein et al. (1993) found that in a sample of eighty patients with stroke, those with apathy had more severe cognitive impairments, and more difficulties with ADL compared to those without apathy. These results are supported by a number of more recent, larger studies (Brodaty et al. 2005; Hama et al. 2007; Mayo et al. 2009). Brodaty and colleagues (2005) assessed 135 patients with stroke who were three to six months post stroke and found that those with apathy had lower scores on the Mini Mental State Examination (MMSE), a measure of cognitive function, and were less independent with ADL. In addition, Hama et al. (2007) evaluated 237 patients with stroke and found a significant negative correlation between apathy and improvements on the Functional Independence Measure (FIM), a measure of functional status. Furthermore, Mayo et al. (2009) examined the effect of apathy on outcomes in 408 patients with stroke over the first twelve months post stroke. The results showed that those patients with apathy had worse cognitive functioning, as measured on the MMSE, and more difficulties with ADL than those without apathy. In addition, apathy was found to have a strong negative association with physical functioning and social participation, and therefore had a significant impact on recovery post stroke. The results of these studies suggest that apathy in patients with stroke can negatively affect rehabilitation outcomes.
2.3.4 Motivation and rehabilitation outcomes

An important hypothesis, commonly believed by health professionals, is that increased motivation leads to improved patient outcomes (Becker & Kaufman 1995; Maclean & Pound 2000; Maclean et al. 2002). Indeed, a number of studies have found motivation to be a predictor of outcomes (Sharma et al. 1996; Grahn et al. 2000). In a study assessing outcomes in patients with chronic musculoskeletal disorders, motivation was found to be a predictor of changes in health-related quality of life (HRQoL) and working ability, irrespective of whether specialised multi-disciplinary rehabilitation or standard care was received (Grahn et al. 2000). Highly motivated patients were more able to improve their HRQoL and ability to work than the less motivated patients. In addition, Sharma et al. (1996) found that psychosocial factors, including motivation, were positively associated with the functional outcome following total knee joint replacement and accounted for 19% of the variance in outcome. Furthermore, motivation, as measured by the AES, has been found to be a significant predictor of functional outcomes in older people undergoing inpatient rehabilitation (Resnick et al. 1998). Motivation accounted for 31% of the variance in functional status at discharge. In this study, participation in rehabilitation was also measured and the results suggested that those patients who were motivated, based on AES scores, were also willing to participate in rehabilitation.

For older people undergoing stroke rehabilitation, health professionals deem motivation as the single most important determinant of functional outcomes (Becker & Kaufman 1995). This is an important statement to explore because three quarters of all patients with stroke are aged sixty-five or older (Bonita et al. 1997a). Old age is often associated with a decrease in physical and cognitive functioning and altered social roles and interactions. These changes may lead to feelings of incompetence and reduced self-determination, which are known to affect motivation (Vallerand & O'Connor 1989). Changes in physical and cognitive ability are known consequences of stroke (Kaufman & Becker 1986), and as a result of these deficits, social contact often decreases and changes in valued roles may also occur (Pound et al. 1998). These changes may result in older patients with stroke having decreased self-determination, thus impacting negatively on their motivation for rehabilitation and the outcomes achieved during rehabilitation. Vallerand and O'Connor (1989) found that by providing older people with choice or control, their self-determination can be enhanced leading to positive effects on their well-being.

To summarise, health professionals deem motivation to be an important factor in a successful
rehabilitation programme, and research has shown that motivation is a predictor of outcomes. There are many factors that can influence motivation for rehabilitation, and in fact a lack of motivation, or apathy, is a known symptom of stroke. In section 2.4.4 the association between motivation and adherence to the rehabilitation programme is considered.

2.4 Adherence

2.4.1 Defining adherence
Patient adherence has been defined as the degree to which a patient follows the instructions given by a health professional about a prescribed treatment (Haynes et al. 2008). In contrast, the World Health Organisation (2003) defines adherence as “the extent to which a person's behaviour corresponds with agreed recommendations from a health care provider”. The difference between these two definitions is the implied involvement of the patient in the treatment process in the WHO definition. The terms adherence and compliance are often used interchangeably in the literature (Myers & Midence 1998; Brawley & Culos-Reed 2000), however the WHO (2003) recommends that a distinction is made between them and that adherence is used in preference to compliance. The term adherence considers the patient as an active and voluntary participant in their treatment, while compliance implies that the patient is a passive recipient of instructions from a health professional (Bassett 2003; World Health Organisation 2003).

Two distinct forms of adherence have been described: short-term adherence and long-term adherence (Ice 1985; Sluijs & Knibbe 1991). Short-term adherence, also described as “supervised” adherence, occurs within the treatment period and an important component of this form of adherence may be contact with the health professional (Sluijs & Knibbe 1991). A feeling of obligation or loyalty to the therapist may enhance adherence to prescribed exercises over the short-term (Campbell et al. 2001). In contrast, long-term, or “unsupervised” adherence has been defined as that which occurs after the treatment period, and is considered more difficult to achieve (Sluijs & Knibbe 1991). Mayo (1978) described a number of different forms of non-adherent behaviour, including completing none of the treatment prescribed, or only part of it. She also reported that doing more than recommended, or adding something to the programme which was not prescribed is considered a form of non-adherence. The remainder of this section will discuss factors that affect adherence, and will consider adherence with physiotherapy programmes and the influence of motivation on
adherence.

2.4.2 Factors that affect adherence
Sluijs et al. (1993) reported that there are over 200 factors listed in the literature that can affect adherence. These factors can be categorised in four ways: characteristics that relate to the patient, characteristics of the condition, characteristics of the treatment regimen and characteristics of the provider of that treatment (Sluijs et al. 1993; Brawley & Culos-Reed 2000). The following four sections will explore these characteristics and their influence on adherence to treatment programmes.

2.4.2a Characteristics of the patient
A number of patient attributes have been studied to determine whether they have an influence on adherence, including socio-demographic characteristics, the attitude of the patient towards their condition or treatment, and motivation (Mayo 1978; Sluijs et al. 1993; Bassett 2003). Evidence on whether socio-demographic characteristics affect adherence is conflicting. Jurkiewicz and colleagues (2011) completed a pilot study to assess adherence by patients with stroke to a resistance- and aerobic-based HEP both during and after a course of supervised exercise. They found no difference in adherence levels to the HEP between males and females, however found a trend towards greater adherence to the aerobic exercises in younger patients who had completed the supervised component of the treatment programme. In the group who were still undertaking supervised exercise, there was no correlation between age and adherence. In contrast, Sluijs and colleagues (1993) found a trend towards increased adherence with older age, and found that highly educated females, aged under forty-five years were the least adherent to the prescribed HEP. Despite these conflicting results, several authors report that the majority of studies investigating links between socio-demographic variables and adherence have found no association between them (Mayo 1978; Myers & Midence 1998 p.12).

Patient beliefs about the seriousness of the condition and efficacy of treatment can influence adherence (Mayo 1978). Geelen and Soons (1996) make an important point on this topic: “even a perfect rehabilitation programme can fail, when the patient does not believe in its potential or in his own potential to complete it”. Some research suggests that patients who have an internal locus of control, – a belief that their health depends on their own behaviour and that they have some control over outcomes (Deci & Ryan 1985; Sluijs et al. 1993), – have
higher levels of adherence than those with an external locus of control (Sluijs et al. 1993). Conversely, Dishman (1982) and Chen et al. (1999) reported no association between locus of control and patient adherence. In fact, Chen and colleagues (1999) reported an inverse relationship between internal locus of control and adherence to an exercise programme. They suggested that the reason for this could be because patients may not feel in control of their health, however, will follow recommendations from their therapist as they see this as the best way to recover. This would then account for the association between external locus of control and adherence. Sluijs and colleagues (1993) assessed short-term adherence to exercise regimens prescribed during physiotherapy intervention and found that those patients who did not believe that exercising would assist in their recovery, were less likely to adhere to the prescribed exercises than those who believed the exercises would help. They also found that patients who were non-adherent to the treatment regimen reported more problems in completing the exercise programme than those who were adherent. The most frequently reported problems were a lack of time or motivation to exercise and forgetting to exercise. Social support has been linked to higher levels of adherence to a rehabilitation programme (Bassett 2003; Leong et al. 2004) and self-motivation has also been positively associated with adherence (Bassett 2003). The influence of motivation on adherence is discussed in detail in section 2.4.4.

2.4.2b Characteristics of the condition
Where a condition causes a number of activity limitations and participation restrictions, and the patient perceives the condition to be serious, adherence tends to be higher (Haynes 1979; Bassett 2003). However, adherence to treatment regimens tends to be lower for chronic conditions compared to acute illnesses (Sluijs et al. 1993; van Dulmen et al. 2007). One reason for this is that the expected recovery from an acute illness may motivate the patient to adhere to the prescribed exercise programme (Sluijs et al. 1993), whereas a chronic condition, such as stroke, requires long term self-management with a HEP and patients often have difficulty incorporating this into their daily routine (Bassett 2003).

2.4.2c Characteristics of the treatment regimen
Adherence is likely to be lower when treatment regimens are complex, need to be undertaken over a long period of time, or require an alteration in lifestyle (Haynes 1979 p.59; Becker 1985; Bassett 2003). Becker (1985) suggests a number of ways in which treatment regimens can be made less complex, thus enhancing adherence. These include emphasising the critical
elements of the regimen, in essence prioritising treatment; providing a graded treatment programme that can be implemented in stages; and tailoring the treatment to fit with the patient's daily routine to help to reduce inconvenience and forgetfulness of undertaking the treatment. Furthermore, Sluijs (1991) recommended that physiotherapists provide patients with a graded exercise programme to facilitate the patient's management of this programme. Other factors relating to the treatment regimen can also affect adherence, including the timing of appointments and the clinic environment (Bassett 2003). Adherence to scheduled appointments is likely to be lower if the appointment time is considered to be inconvenient or if it is made too far in advance. Where the clinic environment is felt to have a comfortable atmosphere, adherence to appointments is likely to be higher (Bassett 2003). Furthermore, Ryan et al. (2008) argue that treatment environments that promote autonomy, and support confidence are likely to increase adherence.

2.4.2d Characteristics of the treatment provider

Physiotherapists can assist with enhancing adherence to the treatment programme by personalising treatment, providing feedback and assessing progress to meet individual needs (Rhodes & Fiala 2009). Patient adherence has been found to be significantly related to positive feedback given to patients by their physiotherapist (Sluijs et al. 1993; Rhodes & Fiala 2009). In particular, patients who felt that the therapist was satisfied with the way they were exercising tended to be more adherent to the exercise regimen compared to those who were unsure whether the therapist was pleased with their performance. It is however unclear whether adherence to the programme lead to positive feedback, or if the positive feedback lead to adherence (Sluijs et al. 1993).

Communication between therapist and patient is considered to be crucial in developing a good rapport with the patient, and this is important because patients who report a positive relationship with their physiotherapist tend to have higher adherence rates to the treatment programme (Sluijs et al. 1993; Bassett 2003). Although physiotherapists can positively influence adherence, they can also have a negative effect on it. Patient education is an important component of most physiotherapy treatment programmes (Sluijs 1991); however, providing too much information or unclear instructions may lead to unintentional non-adherence due to the patient forgetting the information given (Sluijs 1991; Sluijs et al. 1993). Adherence to a prescribed treatment may be enhanced when information is provided to the patient in stages throughout the entire course of physiotherapy (Sluijs 1991). Physiotherapists
frequently modify or change exercises during a course of treatment, therefore to enhance adherence it is imperative that the physiotherapist educates the patient on the importance of the exercises and what is required at each session (Bassett 2003).

2.4.3 Adherence with physiotherapy and exercise programmes
Physiotherapy plays an important role in rehabilitation post stroke as the most common impairments are motor deficits (Wiles et al. 2002), and the most common activity limitation is walking, with up to 80% of patients losing this ability in the beginning (Wevers et al. 2009). The aim of physiotherapy is to optimise motor performance in functional activities (Carr & Shepherd 2003). Adherence to physiotherapy programmes is an important concept to consider, as much of the treatment given by physiotherapists involves the patient completing prescribed exercises at home (Mayo 1978; Sluijs & Knibbe 1991). A HEP is often given to the patient during a course of physiotherapy, to complete in between treatment sessions (Bassett 2003), and also prior to discharge with the aim of maintaining the level of function achieved during the treatment programme (Forkan et al. 2006). The outcome of some physiotherapy treatments is thought to be affected by the degree of adherence to the treatment programme (Sluijs et al. 1993; Rhodes & Fiala 2009).

Adherence to exercise programmes is generally low, with one third to two thirds of patients being non-adherent to prescribed exercises (Sluijs et al. 1993). Adherence rates are thought to decrease over time, with the greatest decrease being at the time of discharge from physiotherapy (Sluijs & Knibbe 1991). At this time, the degree to which the patient's motivation to continue a prescribed exercise programme is intrinsically driven, may be a key factor in determining whether they will continue with the prescribed programme (Russell & Bray 2009). The benefits of exercise which are achieved during a course of physiotherapy are often not maintained after discharge, and this may be due to poor adherence to the prescribed HEP (Forkan et al. 2006). Physiotherapists have estimated that 64% of their patients are adherent with the exercises prescribed over the short term, but that only 23% continue with the exercises following completion of physiotherapy treatment (Sluijs & Knibbe 1991; Sluijs et al. 1993). This level of non-adherence is concerning because some exercise programmes are only effective when performed daily over the long term, thus patients need to continue with the prescribed treatment even after symptoms have disappeared and physiotherapy treatment is complete (Sluijs 1991). Adherence to prescribed exercise programmes is important for patients with stroke both during rehabilitation and after completion of the
formal rehabilitation programme, however, it is often found to be poor. Suggested reasons for this include that the rehabilitation programme is boring or difficult to perform (Balaam et al. 2011), and in addition to these reasons patients with stroke often cite motivation as a limiting factor for completing prescribed exercise programmes (Damush et al. 2007; Jurkiewicz et al. 2011).

Exercise is one of the ways to manage risk factors for recurrent stroke; therefore, promotion of long-term exercise adherence is important (Damush et al. 2007). Following the completion of formal rehabilitation, patients' activity levels often decrease, which can lead to cardiovascular deconditioning, disuse atrophy, a loss of the functional gains made during rehabilitation (Shaughnessy et al. 2006), and an increased risk of falls and recurrent stroke (Gordon et al. 2004). Undertaking regular aerobic and resistance exercise post stroke is thought to have a positive effect on neurological disability, risk factors for recurrent stroke and quality of life (Jurkiewicz et al. 2011), however research has found that less than one third of patients with stroke regularly exercise (Shaughnessy et al. 2006).

A number of barriers have been found to be associated with decreased adherence to exercise following discharge from physiotherapy in the older adult population. These include a lack of social support, a fear of falling, a lack of time and a change in health status (Forkan et al. 2006). In a study assessing adherence to risk factor modification strategies following stroke, a number of reasons for non-adherence to regular exercise were found (Choi-Kwon et al. 2005). In patients with stroke aged under forty-five years approximately 44% cited a lack of time as the main reason for not exercising regularly, followed by physical problems (26.5%) and an inability to see the benefits of exercising (25%). In contrast, about 80% of patients aged over forty-five years reported that physical problems were the main reason for non-adherence to a regular exercise programme. Furthermore, Damush and colleagues (2007) completed a qualitative study to assess both perceived barriers and facilitators to exercise in stroke survivors. Three barriers to exercise were revealed in this study. Firstly, stroke survivors reported that physical problems, including visual deficits and difficulties with walking, were a limiting factor to undertaking exercise. The common theme established was that because of the physical deficits, participants were fearful of the consequences of exercising, thus did not undertake physical activity. Secondly, a lack of motivation to exercise was reported, with twelve out of the thirteen participants in the study endorsing this as a barrier. A lack of energy post stroke also hindered exercise participation. Finally,
environmental factors were found to be a barrier to exercise after stroke. These factors included a perception by stroke survivors that there were no places for them to exercise, and related to this was the idea that exercise is something that is performed in a formal manner at a facility. Physical activity that is incorporated into daily routines was not seen as exercise by the study participants. A lack of transport was also reported as an environmental barrier to exercise.

2.4.4 Motivation and adherence

High adherence to a rehabilitation programme is seen by health professionals as an indicator of patient motivation for rehabilitation. Motivation is a dynamic process and levels of motivation may change over time, therefore adherence to a rehabilitation programme may also change (Colombo et al. 2007). Maclean and colleagues (2002) reported that nearly half of the health professionals surveyed described motivated patients as those who were adherent with rehabilitation, and conversely those that rejected rehabilitation were seen as having low motivation. However in contrast, one of the therapists interviewed indicated that adherence alone was not sufficient to consider a patient motivated. Rather, this therapist reported that some patients were “intrinsically motivated”, and these patients not only adhered to rehabilitation, but also had “a desire to recover for themselves”.

Self-motivation, defined as “a generalized, non-specific tendency to persist in habitual behaviour regardless of extrinsic reinforcement”, has been described as an important determinant of exercise adherence (Dishman 1982) and has been shown to predict perseverance in a variety of settings (Dishman & Ickes 1981). Perseverance, or persistence, has been described as a “critical problem” in rehabilitation programmes which require long-term adherence (Dishman & Ickes 1981). Dishman (1982) suggests that self-motivation may be able to be influenced by external sources, such that someone with low self-motivation for exercise may be able to increase their self-motivation through external reinforcements.

In the health care setting, a number of studies have investigated whether there is an association between motivation and adherence to treatment programmes. In sports injury rehabilitation, self-motivation has been found to be a significant predictor of HEP adherence (Brewer et al. 2000) and autonomous motivation, those types that are self-determined (Ryan et al. 2008), has been found to be strongly associated with medication adherence (Williams et al. 1998). Russell and Bray (2009) suggested that an individual who completes exercises for
health benefits, despite perhaps finding the exercises boring, demonstrates behaviour that is driven by identified extrinsic motivation. As discussed previously, this type of extrinsic motivation is self-determined. In a study of patients transitioning from a supervised CR programme to an independent home-based programme, the degree of self-determined motivation at the point of discharge from the supervised programme was positively associated with the amount of independent exercise being completed at three and six weeks after discharge (Russell & Bray 2009).

To summarise, there are many factors that may have an effect on adherence to the rehabilitation programme, and research has shown that adherence to exercise-based programmes is often poor. Motivation, specifically those forms which are self-determined, has been found to be positively associated with adherence.

2.5 Outcome measurement

This section considers how to measure the constructs of motivation, adherence and community mobility. The outcome measure chosen to measure each concept is described and the psychometric properties are detailed. The justification for choosing each outcome measure is also discussed.

2.5.1 Measuring motivation

Health professionals place an emphasis on motivation in the rehabilitation process (Kaufman & Becker 1986; Becker & Kaufman 1995; Maclean et al. 2000) so the ability to measure this construct is important. There are a number of motivation questionnaires used in healthcare settings, including the Self-Motivation Inventory (SMI), the Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2), the Apathy Evaluation Scale (AES) and the Intrinsic Motivation Inventory (IMI) (Resnick et al. 1998; Brewer et al. 2000; Colombo et al. 2007; Russell & Bray 2009; Sampson et al. 2012).

The SMI is a valid and reliable forty-item scale, measuring the construct of self-motivation (Dishman & Ickes 1981). However, it was found that for older adults the wording of the questionnaire was difficult to understand and furthermore, it places a strong emphasis on work, which for many older adults is no longer relevant (Resnick 1995; Resnick et al. 1998). As three quarters of patients with stroke are aged sixty-five or older (Bonita et al. 1997a), the SMI was not chosen to be used in this research.
The BREQ-2 is a modified version of the BREQ, which was developed to measure motivation towards exercise. The BREQ-2 assesses the constructs of amotivation, extrinsic motivation (external regulation, introjection and identification) and intrinsic motivation (Markland & Tobin 2004). While the BREQ-2 measures aspects of motivation that are relevant to this research, a literature search found only a limited number of studies which have used this measure in the healthcare setting.

The AES and IMI were chosen to measure motivation in this study. These questionnaires are described in detail in the next two sections, together with justification of this choice.

2.5.1a Apathy Evaluation Scale (AES)

The AES was developed to measure apathy in adults (Marin et al. 1991). From an original set of several hundred items, a preliminary scale containing seventy items was developed and evaluated with forty participants who had a diagnosis of major depression or dementia. Following the initial evaluation, fourteen items were removed and the remaining fifty-six items were further evaluated with 123 participants. These participants included individuals who had a diagnosis of major depression, dementia and right or left hemisphere stroke. A group of well elderly people were also included in the evaluation (Marin et al. 1991). This led to the development of the eighteen-item AES, which contains items covering three aspects of goal-directed behaviour: cognitive, such as an interest in learning new things or having new experiences; behavioural, such as productivity or effort; and emotional (Marin et al. 1991; Resnick et al. 1998).

There are three different versions of the AES: clinician-rated (AES-C), informant-rated (AES-I) and self-rated (AES-S). Items are the same for each version, and are scored on a four-point Likert scale. Scores range from eighteen to seventy-two. Higher scores indicate a greater degree of apathy, or lower motivation (Marin et al. 1991; Andersson et al. 1999; Glenn 2005). The response for each item is derived from the patient's “thoughts, feelings and actions” over the previous four weeks (Marin et al. 1993). There is a lack of agreement about the score required to distinguish between apathetic and non-apathetic patients. Andersson and colleagues (1999) and Sagen et al. (2010) used a score of thirty-four or higher as a criterion for apathy, whereas Marin et al. (1993) and Njomboro and Deb (2012) used a score of thirty-eight or greater. For the purpose of this study, the mid-point of these studies, thirty-six points, was chosen as the cut-off score to identify participants with a lack of motivation.
The AES is a reliable and valid measure of apathy. The internal consistency is good for all three versions of the scale (AES-S: $\alpha=0.86$; AES-I: $\alpha=0.94$; AES-C: $\alpha=0.90$), as is the test-retest reliability (AES-S: $r=0.76$; AES-I: $r=0.94$; AES-C: $r=0.88$) (Marin et al. 1991). In addition, the inter-rater reliability of the AES-C was established, with an intraclass correlation coefficient (ICC) of 0.94 (Marin et al. 1991). The ability of the AES to discriminate apathy from depression was assessed using the Hamilton Rating Scale for Depression and the Zung Depression Rating Scale. Results for the three versions varied (AES-S: $r=0.42$; AES-I: $r=0.65$; AES-C: $r=0.39$) and suggest that the AES-S and AES-C are able to discriminate between apathy and depression, while the AES-I may not (Marin et al. 1991). The authors also tested the convergent validity by assessing the inter-correlations between the three versions of the scale. Scores on the AES-C correlated with scores on the AES-S ($r=0.72$) and the AES-I ($r=0.62$), and the correlation between the AES-S and the AES-I was 0.43. These results were statistically significant ($p<0.001$).

Although the validity of the AES-S is reported as less robust than that of the other two versions (Njomboro & Deb 2012), the AES-S was chosen for use in this research for two reasons. Firstly, there was no guarantee that all the participants would have an 'informant', a family member, friend or carer, who could complete the AES-I and secondly, it is recommended that to use the AES-C, clinicians are trained in its administration (“Guidelines for Apathy Evaluation Scale”). For this pilot study, it was not feasible to train the physiotherapists who would administer it.

2.5.1b Intrinsic Motivation Inventory (IMI)

The IMI, which has a theoretical foundation in SDT, was designed to assess a participant's subjective experience of a particular activity in laboratory experiments (University of Rochester 1996-2008). Since its development, a number of studies have used the IMI to assess motivation in a variety of different settings, including healthcare (McAuley et al. 1989; Colombo et al. 2007; Palmeira et al. 2007; Sampson et al. 2012). The IMI has a total of forty-five items, within seven sub-scales: interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, perceived choice and relatedness. Items are scored on a seven-point Likert scale, where one indicates the statement is “not at all true” and seven corresponds to a statement that is “very true”. The scores of all items are added together to give a total IMI score, which provides an overall level of motivation (Sampson et al. 2012). In addition, the scores of items within each sub-scale are added together to give a score for
that sub-scale (Colombo et al. 2007; Choi et al. 2011). The IMI is a flexible outcome measure, as only items relevant to the issues being explored need to be used, and the items can be modified slightly to fit a specific activity (University of Rochester 1996-2008). The interest/enjoyment sub-scale of the IMI is the only one that actually measures the construct of intrinsic motivation, therefore this sub-scale is considered a self-report measure of intrinsic motivation (University of Rochester 1996-2008; Colombo et al. 2007). Perceived choice items are thought to positively predict intrinsic motivation (Colombo et al. 2007), while the value/usefulness sub-scale looks at the internalisation of an activity which an individual considers useful, but may not be inherently interesting (Deci et al. 1994; University of Rochester 1996-2008). Higher total IMI scores indicate higher levels of motivation (Choi et al. 2010).

Previous studies have used the IMI to assess motivation for rehabilitation in patients with stroke (Colombo et al. 2007; Choi et al. 2011; Sampson et al. 2012). Colombo and colleagues (2007) administered a seventeen-item version of the IMI to nine patients with chronic stroke who had completed three weeks of upper limb, robot-assisted therapy. The authors reported high scores on the interest/enjoyment, effort/importance and value/usefulness sub-scales, and suggested that this indicated that the patients found the treatment “very interesting”, were highly motivated for treatment and were satisfied with the results they achieved. More recently, Sampson et al. (2012) used a thirty-two-item version of the IMI to assess the motivation of five patients with stroke (one sub-acute and four chronic) undertaking upper limb rehabilitation with a novel, bilateral upper limb trainer with interactive computer games. They used a percentage rating of the total IMI score to determine motivation for the treatment and found that the intervention provided high levels of motivation to exercise.

The IMI is a reliable and valid measure of motivation. Previous research has assessed the internal consistency of different versions of the IMI (McAuley et al. 1989; Tsigilis & Theodosiou 2003; Palmeira et al. 2007). McAuley et al. (1989) used an eighteen-item version in a competitive sports setting. The items in this IMI were from four of the sub-scales, and each sub-scale was found to have adequate internal consistency: interest/enjoyment ($\alpha=0.78$), perceived competence ($\alpha=0.80$), effort ($\alpha=0.84$) and pressure/tension ($\alpha=0.68$). The authors reported an overall alpha coefficient of 0.85 for this version of the IMI, demonstrating good internal consistency. In addition, Palmeira et al. (2007) and Tsigilis and Theodosiou (2003) both reported an overall alpha coefficient of 0.90 for a sixteen-item IMI and fourteen-item
version, respectively. A number of studies have assessed the construct validity of IMI (McAuley et al. 1989; Whitehead & Corbin 1991; Deci et al. 1994). Both McAuley and colleagues (1989) and Whitehead and Corbin (1991) used types of factor analysis to demonstrate that a sixteen-item version had construct validity. In addition, Deci et al. (1994) demonstrated the construct validity of a twenty-five item version, with factor loadings of greater than 0.6.

The IMI, a post-intervention questionnaire, was chosen as the second motivation questionnaire for this study, because it has a strong theoretical base, and the wording can be modified for the particular constructs being assessed. Furthermore, the IMI has recently been used in a number of studies assessing the motivation of patients with stroke undertaking rehabilitation (Colombo et al. 2007; Choi et al. 2011; Sampson et al. 2012).

2.5.2 Measuring adherence

Measuring adherence is challenging as there is a lack of a “gold standard” (Mihalko et al. 2004; Jordan et al. 2010). A number of methods to measure adherence to exercise programmes are described in the literature (Mayo 1978; Bassett 2003; Jordan et al. 2010). These include self reporting by the patient, attendance at treatment sessions and objective measures of physical activity, such as a pedometer.

A self report method, such as an exercise diary, interview or questionnaire, is commonly used to measure adherence (Bassett 2003; Jordan et al. 2010), and physiotherapists generally have to rely on this method (Mayo 1978). An exercise diary is used to record the number of exercises completed and the percentage of the prescribed HEP that the patient has completed is calculated from this (Bassett 2003). When using interviews or questionnaires it is recommended that open-ended questions are used (Jordan et al. 2010) and that questions are phrased in such a way that the patient does not feel guilty if they have not completed, or only partially completed, their HEP (Mayo 1978). The advantage of a self report method is that they are simple and inexpensive to use, however there are conflicting views over the accuracy of these (DiMatteo 2004; Mihalko et al. 2004). Mihalko and colleagues (2004) described self report methods as being subject to recall bias and suggested that they tend to overestimate adherence, especially if the patient is trying to please the therapist (Mayo 1978). Conversely, DiMatteo (2004) argued that self-report methods do not overestimate adherence, despite being
limited by memory. Mihalko et al. (2004) also recommended that adherence is measured as a continuous variable, rather than in a dichotomous manner, such as adherent or non-adherent.

As no single measure of adherence is better than another, it may be better to use two or more methods, as combining them will likely increase the accuracy of the data (Jordan et al. 2010). In this study, two methods were chosen to measure adherence: an exercise adherence diary and attendance at physiotherapy appointments. These were chosen for their simplicity, ease of administration, and that neither would take long to complete, thus having minimal impact on participant or therapist time. Chen et al. (1999) categorised participants in their study as having low (0-33%), moderate (34-66%), or high (67-100%) adherence to the prescribed HEP. To calculate the adherence rate, the number of repetitions completed was divided by the number of repetitions prescribed, and multiplied by 100 to get a percentage. Sjösten et al. (2007) used the same categories to measure participant adherence to prescribed group exercise sessions. These categories were used in the present study to define adherence to the rehabilitation programme.

2.5.3 Measuring community mobility
There were two reasons for selecting community mobility as the construct to measure the outcome of the rehabilitation programme. Firstly, many patients with stroke deem independence with community mobility as crucial (Liu et al. 2008), and secondly, the researcher regarded it as clinically important to consider whether the group clinic-based intervention could lead to improvements in community mobility, without specifically practicing this task. A number of outcome measures are currently used by clinicians to measure constructs that represent community mobility. These include gait speed, functional mobility scales, and endurance (Lord & Rochester 2005). Gait speed is commonly measured with the ten metre walk test, which is simple to administer and has sound psychometric properties (Lord & Rochester 2005; Donovan et al. 2008). However, Dean et al. (2001) and Fulk and colleagues (2010) suggested that gait speed may overestimate community mobility ability in patients with stroke. The Functional Ambulation Classification (FAC) is an example of a functional mobility scale, and measures the amount of physical assistance an individual requires to mobilise (Holden et al. 1984). The scale has six categories from zero, where an individual does not have functional mobility, to five, which indicates a “patient can ambulate independently on non-level and level surfaces, stairs, and inclines” (Holden et al. 1984). Hill et al. (1997) reported that “to achieve true community ambulation” a score of five on the FAC
was required, in addition to several other criteria relating to FIM score, gait speed and endurance. The 6MWT, a measure of exercise endurance, was recommended by Donovan et al. (2008) over other outcome measures when used in a clinic environment, as it provides a better reflection of community mobility. The 6MWT was chosen to measure community mobility in this study because of its sound psychometric properties, and in addition, it is an outcome measure which was already commonly used by the physiotherapists who would complete the assessments of participants involved in this study.

The 6MWT was originally developed to use with individuals who had cardiorespiratory and cardiovascular conditions (Liu et al. 2008). It has since been used to assess patients with a variety of conditions, including stroke (Duncan et al. 1998; Perera et al. 2006; Donovan et al. 2008). To complete the 6MWT, patients are instructed to walk as far as they can in six minutes and are advised that they may rest, if needed (Flansbjer et al. 2005). The 6MWT measures the distance walked in six minutes, and scores this as a continuous variable. Walking speed can also be calculated (Kosack & Smith 2005). The American Thoracic Society (ATS) stipulates that the 6MWT should be “performed indoors, along a long, flat, straight, enclosed corridor with a hard surface” and that a thirty metre track must be used (American Thoracic Society 2002). However, a number of studies have used shorter distances (Salbach et al. 2004; Yang et al. 2006; Liu et al. 2008), and have assessed 6MWT distance in settings outside of the clinic environment (Donovan et al. 2008; Wevers et al. 2011). Donovan et al. (2008) measured the 6MWT in a suburban street and in a shopping mall, as well as in the clinic setting, while Wevers and colleagues (2011) completed the assessment outdoors in the patients’ neighbourhood.

An important consideration with any outcome measure is the minimal clinically important difference (MCID), which is described as “the lower boundary of change that has been defined, in some way, to be important” (Beaton et al. 2002). A number of studies have assessed the MCID for the 6MWT and reported differing results (Flansbjer et al. 2005; Perera et al. 2006). Perera et al. (2006) assessed 692 individuals, including 100 patients aged fifty or older with stroke, to determine the magnitude of a small meaningful change and a substantial meaningful change on the 6MWT. Their results suggested that a small meaningful change is twenty metres, and a substantial meaningful change is fifty metres. This is similar to Fulk and colleagues (2008) who report that the MCID for the 6MWT is 54.1m, and van de Port et al. (2012) who used 50m or more as a clinically meaningful change. In contrast, Flansbjer and
colleagues (2005) assessed fifty patients with chronic stroke with mild to moderate hemiplegia, and suggested that “a real (clinical) change” on the 6MWT is indicated by a relative change of 13%. The ATS recommends that the change on the 6MWT is expressed as an absolute value rather than a percentage (American Thoracic Society 2002). Therefore, in this study the values from Perera’s et al. (2006) study were used to detect clinically important changes on the 6MWT.

The 6MWT is a valid and reliable measure. It was found to have excellent test-retest reliability when assessing patients with both acute and chronic stroke, with the ICC ranging from 0.97 to 0.99 (Eng et al. 2004; Flansbjer et al. 2005; Fulk et al. 2008). The intra-rater and inter-rater reliability of the 6MWT was established by Kosack and Smith (2005). These authors assessed eighteen patients with acute stroke and reported an intra-rater ICC of 0.74 and an inter-rater ICC of 0.78. They also reported excellent correlations between the 6MWT and two-minute ($r=0.997; p<0.0001$) and twelve-minute versions ($r=0.994; p<0.0001$) of this test, thus establishing construct validity. This form of validity was further demonstrated by two studies which compared the 6MWT and the Berg Balance Scale (Eng et al. 2002; Patterson et al. 2007). Both studies found a strong correlation between these two measures ($r=0.784; p<0.01$ and $r=0.69; p<0.001$ respectively). A number of studies have demonstrated the criterion validity, both concurrent and predictive, of the 6MWT. Tang et al. (2006) measured the 6MWT and five metre walk test (5mWT) in thirty-six patients with acute stroke. They found a strong correlation between the 6MWT and preferred and fast walking speeds over five metres ($r=0.79; p<0.001$ and $r=0.82; p<0.001$ respectively). This result was confirmed in another study, where the correlation between the 6MWT and the 5mWT was 0.89 (Fulk et al. 2008). The 6MWT was also found to be able to predict community mobility ability, as measured by the average number of steps taken per day ($r=0.68; p=0.001$) (Fulk et al. 2010).

**2.6 Conclusion**

The evidence examined in this chapter suggests that there are a number of factors that can influence the outcome of rehabilitation, including motivation for the rehabilitation programme and adherence to the programme. A lack of motivation is a known consequence of stroke in up to 25% of patients, and this may have implications for adherence to the prescribed rehabilitation interventions, and lower adherence may result in poorer functional outcomes. Both motivation and adherence may be affected by the rehabilitation setting, thus it is
important to consider whether one setting is superior to the other. While there is evidence to suggest that both home-based and clinic-based rehabilitation lead to improvements in functional outcomes, there is yet to be any research that specifically examines the effect of group clinic-based and individual home-based programmes on mobility outcomes in patients with stroke undergoing community rehabilitation. This research aims to begin to address this gap in the literature, and contribute to a growing body of knowledge on the influences of the environment on outcomes for patients with stroke receiving rehabilitation.
Chapter Three: Methods

3.1 Introduction
This chapter presents the design of this research project, the ethical considerations and the data analysis.

3.2 Study design
This section presents the design of this pilot study. The primary objective was to determine the sample size required for a future RCT to have adequate statistical power to compare two rehabilitation settings as venues for community-based rehabilitation patients. The participants, justification for the sample size, recruitment strategy, assessment procedures, and physiotherapy intervention are described. Figure 3.1 summarises the flow of participants through the study.

Figure 3.1: Participant Flow through the Study
3.2.1 Participants
Participants were recruited from the Wellington Community ORA team and required rehabilitation from the CRT. Participants were newly referred to the service and were not receiving community-based physiotherapy input prior to recruitment. Specific inclusion and exclusion criteria for participants were:

**Inclusion criteria:**
- A primary diagnosis of stroke – new or chronic
- Require physiotherapy input
- Able to walk independently (can use a mobility aid and/or orthosis)
- Able to follow instructions for testing procedures

**Exclusion criteria:**
- Any medical condition that is a contraindication to physiotherapy intervention

To determine if a potential participant had any medical conditions that would contraindicate physiotherapy input, such as unstable angina or uncontrolled arrhythmias (Best et al. 2010), patient medical notes were reviewed. If any concerns were identified, clarification regarding the appropriateness of physiotherapy input at that time was sought from the patient’s consultant or GP.

The WHO definition of stroke was used in this study (see Chapter One, section 1.2.1); therefore any patients covered by the Accident Compensation Corporation (ACC) for stroke secondary to trauma or treatment injury were also excluded.

3.2.2 Sample size
There were two factors determining the sample size for this study. The first was that it was necessary to have sufficient data to estimate the variance of the AES and IMI. For the purpose of precision of estimates of variance, fifteen to twenty degrees of freedom in a one way analysis of variance (ANOVA) gives reasonable precision. The second factor was being able to recruit enough participants in the time-frame of the Masters project, given the limitations of the number of potential participants in the clinical setting. A review of the number of patients with stroke who received physiotherapy from the CRT in 2008 and 2009 found that there were a total of fifty-five and sixty-six patients respectively. Based on these patient numbers, the planned recruitment timeframe and the required data to estimate the
variance of the AES and IMI, a sample size of between fifteen and twenty participants was planned.

### 3.2.3 Recruitment

During the initial screening assessment, CRT health professionals identified potential participants for this study. These identified individuals were offered a 'recruitment pack', which included an invitation letter (Appendix One), information sheet (Appendix Two), and consent form (Appendix Three). Where potential participants did not have a screening assessment, a CRT health professional phoned the individual to offer them a 'recruitment pack'. Potential participants who accepted the 'recruitment pack' were asked to provide verbal consent for the researcher to contact them by phone to discuss the study further, and to answer any questions. During the phone call, the researcher offered a face-to-face visit to discuss the study further. Written informed consent was obtained from all participants who agreed to take part, prior to their initial physiotherapy appointment. In addition, for those participants who wished for their General Practitioner (GP) to be informed that they were enrolled in this study, a letter was sent to their GP (Appendix Four). Potential participants who chose not to take part in this study were still offered a choice of where they wanted to receive their physiotherapy input, as is usual practice within the CRT.

### 3.2.4 Assessment procedures

Assessments were undertaken by one of the four physiotherapists working in the CRT. Participants who chose to receive individual home-based therapy had their assessments completed at home, while those who chose to attend the group were offered the choice of being assessed at home or in the clinic, as is usual practice. Table 3.1 presents the schedule of assessments. At baseline (week one) participant demographics (Appendix Five) were collected, the AES-S (Appendix Six) was administered and the 6MWT (Appendix Seven) was measured. Prior to commencing the 6MWT, the participant's heart rate (HR) and oxygen saturation (SpO$_2$) was measured, using the PalmSAT 2500 pulse oximeter (Nonin Medical, Inc.). HR and SpO$_2$ were re-measured at the end of the six minutes, and during the test for those participants who stopped to rest. In addition, the Borg Rating of Perceived Exertion (RPE) scale was used before and after completing the 6MWT, and during any rest periods. The track length for the 6MWT varied between participants, due to the amount of space that was available at the participants' homes, however was the same at assessment and
reassessment for each participant. In addition to the AES-S and 6MWT, other appropriate outcome measures that would usually be used during assessment, as judged by the treating physiotherapist, were undertaken at baseline but were not used as part of this research.

### Table 3.1: Schedule of assessments

<table>
<thead>
<tr>
<th>Week</th>
<th>AES</th>
<th>6MWT</th>
<th>IMI</th>
<th>Exercise adherence diary</th>
<th>Adherence to rehab session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeks 2 and 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeks 4 and 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeks 6 and 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeks 8 and 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 10</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Participants in both groups were given an exercise adherence diary (Appendix Eight) to complete for the first two weeks and the last two weeks of their intervention. It was decided not to give the participants the exercise adherence diary for the entire intervention period for two reasons. Firstly, it was important to minimise the impact of taking part in the study on the participants’ time. While filling out the exercise diary was not anticipated to take long, it has been suggested that it is an extra burden for patients, and that the impact of this should not be underestimated (Prasad & Cerny 2002). In addition, the burden may be greater when data are collected over a long period of time (Speck & Looney 2006). Secondly, in designing this study the researcher attempted to keep the assessment and treatment procedures as close to usual practice as possible, and the use of an exercise adherence diary is not routinely used in the CRT. Where a participant was unable to independently fill in the adherence diary (for example because of upper limb impairments), they were able to receive help from a family member or carer. The adherence diary was used to measure adherence to the prescribed HEP, both in terms of the number of repetitions of each exercise and the number of days per week that the participant completed them. Adherence to the rehabilitation programme was also measured, by documenting the number of physiotherapy sessions that the participants attended (Appendix Nine).

The AES-S was re-administered and the 6MWT was re-measured after eight weeks of
treatment or on completion of treatment, whichever occurred first. The IMI (Appendix Ten) was also administered at reassessment. In this study, a twenty-five item version of the IMI was used, assessing the interest/enjoyment, perceived choice and value/usefulness sub-scales. The wording of each statement was adapted slightly, to reflect the activities being assessed in this study: the rehabilitation programme and mobility. For example, question four originally read: “I believe that doing this activity is useful for improved concentration”. It was changed to: “I believe that doing the rehabilitation programme is useful for improving my walking”. In addition to the original twenty-five items, a twenty-sixth was added at the request of the Central Regional Ethics Committee (CREC). The twenty-sixth item asked home-based participants to rate the following statement: “I would have preferred rehabilitation in a group setting but I am unable to attend for reasons such as cost, or a lack of available transport to the group”.

### 3.2.5 Intervention

Participants received their usual physiotherapy treatment via either individual therapy at home or clinic-based group therapy. All participants were given the choice of in which setting they received their rehabilitation. The group, supervised by a physiotherapist and a rehabilitation assistant, had a maximum of six participants per class to allow a staff to participant ratio of one to three (English et al. 2007). Participants attended the class weekly for eight weeks and completed individualised exercises based around six stations: mobility, balance, lower limb strengthening, upper limb strengthening and motor control, cardiovascular fitness and functional retraining. The class lasted for up to ninety minutes, allowing time for participants to rest in between exercises. When a public holiday fell on the day the class was due to be run, an additional class was not provided.

Exercises at the clinic focussed on impairments and activity limitations. The mobility station included exercises such as forwards and backwards walking, sidestepping, tandem walking and walking over and around obstacles. The balance station included exercises designed to improve both static and dynamic balance. Lower limb strengthening exercises used gravity or weights, depending on the participant's ability, to strengthen weak muscles. Participants with weak trunk musculature also completed core stability exercises at the lower limb station. The upper limb station involved strengthening of weak muscles, using gravity, weights or a latex exercise band. In addition, where indicated, participants practiced motor control exercises, such as the grasp and release of objects of varying sizes. Cardiovascular fitness was
undertaken using an exercycle (Tunturi E30 from Tunturi Oy Ltd, Finland) or arm ergometer (Magnetic Resistive Exerciser from Durable Medical Equipment), or by completing exercises such as fast marching. The last station, functional retraining, involved participants completing activities such as 'sit to stand' and stair walking. Exercise sets and repetitions were increased over the eight weeks on an individualised basis, usually up to a maximum of three sets of ten repetitions. For the strengthening exercises, participants began with the maximum number of repetitions (up to ten) that they were just able to complete, with good form, before needing a break due to muscle fatigue. When participants were able to complete ten repetitions easily, an additional set was added, up to a maximum of three sets. For participants who were unable to complete ten repetitions, they began with the maximum number they were able to (while maintaining good form). The number of repetitions was then increased when they were completing the prescribed number easily (Carr & Shepherd 2003; Glynn & Fiddler 2009). The intensity of the cardiovascular fitness exercises were adjusted by increasing the resistance on the exercycle and arm ergometer or by increasing the length of time participants spent on these exercises. The Borg RPE scale was used to modify the intensity of the cardiovascular fitness exercises, with the aim to have the participants exercising between 11 (“fairly light”) to 13 (“somewhat hard”) on the fifteen-point Borg RPE scale. This level of intensity has been described as appropriate for patients with neurological conditions (Umphred 2007).

The physiotherapy treatment for home-based patients was determined by the treating physiotherapist and included exercises similar to those described for the group treatment. However, in addition to impairment- and activity limitation-based exercises, participation restrictions, such as accessing the community by public transport, were also addressed, where indicated. Participants in this study who received home-based individual physiotherapy, received up to eight weeks of treatment, usually administered once weekly. Treatment at home is up to one hour long. Participants who had achieved their goals (and no longer required physiotherapy treatment) prior to completion of eight weeks of treatment, were reassessed at that point and no further intervention was provided. Participants who required further physiotherapy intervention following their reassessment at week ten, continued to receive treatment; however their involvement in this study was complete. Both individual and group treatments included a home programme of exercises, which is usual practice.
3.2.6 Blinding and randomisation

Within the CRT all four physiotherapists treat patients with stroke in order to minimise waiting times for treatment. In this study, the assessment and reassessment of the 6MWT was completed by the treating physiotherapist. It was not possible to blind a therapist for the purpose of measuring the 6MWT for all study participants. Had a therapist been blinded, this would have meant that they were not able to treat any of the patients who were enrolled in this study, thus likely having an impact on patient waiting times for physiotherapy treatment. In addition, in order to maintain usual physiotherapy practice during this pilot study, where patients have the choice of where they receive their physiotherapy treatment, randomisation was not used, and so this study has a cohort rather than a randomised design.

3.3 Ethics

3.3.1 Ethical issues

A number of ethical issues were identified and considered during the development of this study. Firstly, a potential conflict was identified for the researcher, who also works as a clinician for the CRT and therefore carries out screening assessments, where potential participants would be identified and approached to take part in this study. To eliminate this potential conflict, it was decided that the initial approach to patients would not be made by the researcher, rather other CRT health professionals would undertake this. In addition, the information sheet highlighted the fact that the researcher may treat study participants in her role as a CRT physiotherapist, however that this role was entirely separate to the study.

Secondly, it was imperative that the confidentiality of collected data was protected, and this was managed in a number of ways. Once enrolled in the study, participants were only identified by a unique identifier. Their name was only recorded on the informed consent sheet and on a master list of participants with their unique identifier, which was kept separate from all other stored data. Raw outcome measure data were stored in a locked cabinet in the CRT office, and only the researcher had a key to this cabinet. No material that could identify any individual was used during the writing up of this research.

Thirdly, the safety of both the study participants and CRT health professionals was considered. When undertaking exercises to improve mobility and balance there is a risk of falls, however, to minimise this risk participants were supervised during both individual and
group physiotherapy sessions. It was anticipated that some of the participants may have other cardiovascular conditions, such as angina. This condition may be triggered by exercise, however all CRT physiotherapists are trained in administering cardiopulmonary resuscitation. For home visits, the C&CDHB “Safety of employees working off C&CDHB premises” policy was utilised. This policy requires staff to sign out (with patient name and location, as well as expected time back) when doing off-site visits. A cell phone is carried when off-site, which would allow an ambulance to be called in a medical emergency, and for staff to be contacted if they have not returned from a visit. For group physiotherapy (on-site at the gym in the Ewart Building, Wellington Hospital) a cell phone is carried by the physiotherapist, as there is no phone in the gym. This is used in case of an emergency. There is a defibrillator and oxygen available on-site for use in a medical emergency and the CRT physiotherapists are trained in the use of these. It was not anticipated that there were likely to be frequent adverse outcomes during this study, as both the treatments being investigated are currently accepted practice and being provided by the CRT. However, the provision was made that if there were a large number of participants who suffered a serious adverse event (Appendix Eleven) in the group exercise cohort, then consideration would be given to terminating the study, and providing all participants with individual home-based physiotherapy.

Fourthly, consideration was given to the impact this study would have on service provision within the Wellington Community ORA team, and specifically within the CRT. As participants received their usual assessment and treatment during this study, it was deemed that the research was unlikely to have an impact on waiting times for patients to receive physiotherapy. Physiotherapists who assessed and treated participants in this study were asked to document adherence to the rehabilitation programme. This documentation was designed to only take a few minutes to complete, therefore it was expected to impact only very minimally on the physiotherapist's time, and was not anticipated to have an impact on service provision. Furthermore, this study was designed to have very minimal impact on any of the other health professionals within the CRT, as approaching potential participants to take part in this study was anticipated to only take a few minutes.

Finally, during the development of this study, it was decided that no payments would be made to any of the participants involved in the research, including those who travelled to the hospital for the clinic-based group therapy. Participants who attended this class were responsible for their own transport needs, as this is the 'usual practice' expectation to take part
in the group. CRT staff who assisted with recruitment into the study did not receive any payment or reward for this.

3.3.2 Ethics approval
This study was approved by the CREC (Approval number: CEN/11/03/015, Appendix Twelve). In addition, a letter of support was received from the Whānau Care Centre at C&CDHB (Appendix Thirteen), and endorsements were received from the Ngai Tahu Research Consultation Committee (Appendix Fourteen) and the Research Advisory Group – Māori (Appendix Fifteen).

3.4 Data analysis
Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 20. Missing data were dealt with by using the “exclude cases pairwise” option. This excludes participants with an incomplete data set only in analyses where data is missing. In all other analyses the data from that participant is included. Preliminary analyses preceded formal data analysis to examine data distribution, including whether continuous data were approximately normally distributed. When strong evidence of non-normality was found, data transformations were considered and also whether a non-parametric method of analysis might be more suitable. Formal tests of normal distribution of the key outcome variables, the AES, IMI and 6MWT, were by the Kolmogorov-Smirnov (K-S) statistic. The paired difference in AES and 6MWT scores were also examined for a normal distribution.

Simple data summaries (mean, SD, median, IQR, minimum and maximum) and plots were used to describe the distribution of important variables, the AES, IMI and 6MWT, by groups of participants. The estimates of variance for the AES and IMI were used to calculate the required sample size for a future RCT. The twenty-sixth item of the IMI, added at the request of the CREC, was analysed separately from the other twenty-five items, as it does not assess a construct of motivation. The mean score of item twenty-six was calculated, to consider whether participants who received individual therapy at home would have preferred to receive clinic-based group therapy.

One-way ANOVA was used to compare AES and 6MWT scores between the two groups at each time point. As an exploratory analysis, paired t-tests were used to assess within group differences for the AES and 6MWT comparing baseline and reassessment values. To further
explore the relationship between the two motivation questionnaires, scatter plots and simple linear regressions were used. Both the baseline and reassessment AES were compared with the IMI, using Pearson product-moment correlation coefficient. Linear regression was performed to calculate the coefficient of determination ($r^2$), to assess the percentage of total variation of IMI scores that could be explained by the AES scores. Correlation and linear analyses were also performed to determine the relationship between the AES and the IMI subscales. In addition, the correlation between the perceived choice and interest/enjoyment subscales was analysed. This was completed, as it is recommended that in order to be confident in the assessment of intrinsic motivation, perceived choice should be significantly correlated with interest/enjoyment (University of Rochester 1996-2008).

Finally, Poisson regression analysis was performed to compare rate ratios for adherence to the rehabilitation programme between the two groups. An offset was used for the number of sessions prescribed.
Chapter Four: Results

4.1 Introduction
This chapter presents the results from the statistical analyses in relation to the primary and secondary research objectives. The recruitment rate is described and the participant characteristics are presented. Summary statistics and plots of the key outcome variables, the AES, IMI and 6MWT, are reported and the results from the adherence data are described. Estimates of variance are presented for the AES and IMI, and are used in a sample size calculation to determine the required sample size for a future RCT. Results from t-tests and ANOVA are shown for the key outcome measures, as well as correlation and linear regression analyses assessing the relationship between the AES and IMI. Finally, Poisson regression analyses illustrate adherence to the rehabilitation programme.

4.2 Participants

4.2.1 Recruitment rate
Between May 2011 and the end of February 2012, twenty-two patients with stroke receiving rehabilitation from the CRT met all inclusion criteria for this study and were offered a ‘recruitment pack’. All twenty-two patients accepted the pack, and provided verbal consent for phone follow up by the researcher. Of these patients 16/22 (72.7%) gave written consent to take part in the research.

4.2.2 Participant characteristics
Sixteen participants completed the initial assessment at week one, all of whom were assessed at home. Complete data sets were obtained from 13/16 (81.3%) participants. Of the three participants where data were missing, two were from the clinic-based setting and had one outcome measure missing each (one participant chose not to complete the IMI and re-measurement of the 6MWT in the other was contra-indicated due to the exacerbation of another medical condition). In the home-based setting, one participant had all reassessment data and HEP adherence data missing. This participant declined further physiotherapy input after one treatment session; therefore reassessment outcome measures could not be completed. No serious adverse events were recorded during the study. The mean (SD) age of the study participants was 68.6 (9.2) years. The mean (SD) time post stroke was 542.9
(1774.9) days, with the time ranging from 12 days to 7184 days. Three of the 16 (18.75%) participants had their stroke more than six months previously, and were classified as having chronic stroke. Other participant characteristics are shown in Table 4.1.

Table 4.1: Participant characteristics by rehabilitation setting

<table>
<thead>
<tr>
<th>Participant characteristic</th>
<th>Home (n=10)</th>
<th>Clinic (n=6)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6/9</td>
<td>3/9</td>
<td>9/16 (56.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>4/7</td>
<td>3/7</td>
<td>7/16 (43.8%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ European</td>
<td>7/12</td>
<td>5/12</td>
<td>12/16 (75.0%)</td>
</tr>
<tr>
<td>Other European §</td>
<td>2/2</td>
<td>0/2</td>
<td>2/16 (12.5%)</td>
</tr>
<tr>
<td>Indian</td>
<td>1/2</td>
<td>1/2</td>
<td>2/16 (12.5%)</td>
</tr>
<tr>
<td>Side of hemiplegia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>1/4</td>
<td>3/4</td>
<td>4/16 (25.0%)</td>
</tr>
<tr>
<td>Left</td>
<td>9/12</td>
<td>3/12</td>
<td>12/16 (75.0%)</td>
</tr>
</tbody>
</table>

§ Other European – further defined as Greek (1) and Australian (1).

4.3 Preliminary analysis

The distributions of key outcome variables (AES, 6MWT and IMI) were examined before performing t-test, ANOVA, correlation and regression analyses. Inspection of frequency histograms (see Figures 4.1, 4.2, 4.4 and 4.5 and 4.8) suggests a normal distribution for the AES at baseline (AES1), the AES and 6MWT at reassessment (AES2 and 6MWT2) and the IMI. The 6MWT data at baseline (6MWT1) appears to be clustered to the left of the histogram, at the lower values (see Figure 4.4). The Kolmogorov-Smirnov (K-S) test of normality is statistically significant for 6MWT1 (p=0.04), providing weak evidence of non-normality. K-S results for all other outcome variables were not statistically significant, and therefore consistent with normal distributions. The K-S statistic for the paired difference in 6MWT scores (6MWTdiff: 6MWT2 minus 6MWT1) is non-significant, consistent with a normal distribution of these data. This result, and the K-S statistic for the paired difference in AES scores (AESdiff: AES2 minus AES1) are presented in Table 4.2. As there was no important evidence of a non-normal data distribution, the planned parametric tests are used
for comparisons in later analyses. Plots of the residuals of the ANOVA and regression analyses were inspected and met the assumptions of linearity and homoscedasticity.

Table 4.2: Kolmogorov-Smirnov test of normality for the paired difference in AES scores and 6MWT distances

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Kolmogorov-Smirnov</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
</tr>
<tr>
<td>AESdiff</td>
<td>0.149</td>
</tr>
<tr>
<td>6MWTdiff</td>
<td>0.199</td>
</tr>
</tbody>
</table>

4.4 Summary statistics
This section presents the summary statistics from the key outcome measures: AES, 6MWT and IMI; as well as a description of the results from the adherence data.

4.4.1 Apathy Evaluation Scale (AES)
For the AES, all items, except 6, 10 and 11, are reverse coded. The possible range of scores for this questionnaire is 18 to 72, with higher scores indicating a greater degree of apathy, or lower motivation (Marin et al. 1991). The criterion for apathy was set at ≥36 points. Figure 4.1 shows the frequency distribution of AES scores before treatment (AES1), and Figure 4.2 presents the same information after treatment (AES2).
Figure 4.1: Frequency histogram with superimposed normal distribution curve for AES1 scores

Figure 4.2: Frequency histogram with superimposed normal distribution curve for AES2 scores
The mean (SD) AES1 score was 31.2 (5.3), and AES2 score was 31.3 (8.7). The summary statistics of the AES are presented in Table 4.3. This shows that the mean AES scores did not reach the criterion for apathy. Figure 4.3 presents AES scores for each participant before and after treatment, separated by rehabilitation setting. The reference line shows the cut-off score (36 points) to discriminate between participants with and without apathy. The Figure shows that at baseline three participants in the home-based group had AES scores indicating apathy. On reassessment, this had increased to five of the participants. In contrast, none of the clinic-based participants scored higher than 34 points (see also Table 4.3), and therefore were not considered apathetic.

Table 4.3: Summary statistics of the AES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
<th>Min to Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AES1 (N=16)</td>
<td>31.2 (5.3)</td>
<td>30.5 (7.0)</td>
<td>24 to 41</td>
</tr>
<tr>
<td>AES2 (N=15)</td>
<td>31.3 (8.7)</td>
<td>30.0 (15.0)</td>
<td>18 to 48</td>
</tr>
<tr>
<td>AESdiff (N=15)</td>
<td>-0.3 (6.0)</td>
<td>-1.0 (9.0)</td>
<td>-10 to 12</td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AES1 (N= 10)</td>
<td>32.0 (6.4)</td>
<td>30.0 (13.0)</td>
<td>24 to 41</td>
</tr>
<tr>
<td>AES2 (N=9)</td>
<td>32.9 (10.3)</td>
<td>38.0 (18.0)</td>
<td>18 to 48</td>
</tr>
<tr>
<td>AESdiff (N=9)</td>
<td>0.3 (7.0)</td>
<td>-2.0 (11.0)</td>
<td>-10 to 12</td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AES1 (N=6)</td>
<td>30.0 (2.7)</td>
<td>30.5 (5.0)</td>
<td>27 to 34</td>
</tr>
<tr>
<td>AES2 (N=6)</td>
<td>28.8 (5.2)</td>
<td>29.0 (9.0)</td>
<td>20 to 34</td>
</tr>
<tr>
<td>AESdiff (N=6)</td>
<td>-1.2 (4.5)</td>
<td>-5.0 (9.5)</td>
<td>-7 to 4</td>
</tr>
</tbody>
</table>
4.4.2 Six Minute Walk Test (6MWT)

Figures 4.4 and 4.5 show the frequency distribution of 6MWT distances before (6MWT1) and after treatment (6MWT2), respectively. The mean (SD) distance walked before treatment was 199.3m (104.2), and after treatment was 212.5m (96.2). Table 4.4 presents the summary statistics of the 6MWT.
Figure 4.4: Frequency histogram with superimposed normal distribution curve for 6MWT1 distances

Figure 4.5: Frequency histogram with superimposed normal distribution curve for 6MWT2 distances
### Table 4.4: Summary statistics of the 6MWT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
<th>Min to Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6MWT1 (N=16)</td>
<td>199.3 (104.2)</td>
<td>230.2 (176.6)</td>
<td>62.4 to 399.0</td>
</tr>
<tr>
<td>6MWT2 (N=14)</td>
<td>212.5 (96.1)</td>
<td>236.8 (157.9)</td>
<td>59.0 to 393.6</td>
</tr>
<tr>
<td>6MWTdiff (N=14)</td>
<td>14.1 (60.2)</td>
<td>-7.5 (93.3)</td>
<td>-91.0 to 116.5</td>
</tr>
<tr>
<td><strong>Home</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6MWT1 (N=10)</td>
<td>146.4 (88.7)</td>
<td>112.0 (143.2)</td>
<td>62.4 to 333.0</td>
</tr>
<tr>
<td>6MWT2 (N=9)</td>
<td>188.4 (95.9)</td>
<td>203.0 (188.6)</td>
<td>59.0 to 310.0</td>
</tr>
<tr>
<td>6MWTdiff (N=9)</td>
<td>37.9 (58.9)</td>
<td>44.9 (120.5)</td>
<td>-32.0 to 116.5</td>
</tr>
<tr>
<td><strong>Clinic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6MWT1 (N=6)</td>
<td>287.4 (59.0)</td>
<td>267.4 (76.0)</td>
<td>234.0 to 399.0</td>
</tr>
<tr>
<td>6MWT2 (N=5)</td>
<td>255.9 (89.3)</td>
<td>247.9 (129.8)</td>
<td>143.0 to 393.6</td>
</tr>
<tr>
<td>6MWTdiff (N=5)</td>
<td>-28.7 (35.6)</td>
<td>-12.0 (50.6)</td>
<td>-91.0 to -5.4</td>
</tr>
</tbody>
</table>

Figure 4.6 shows the distance walked pre- and post-treatment for each participant. This shows that 6/9 (66.7%) of the home-based participants who completed the 6MWT at both time points, walked further on reassessment. In contrast, none of the clinic-based participants improved their distance between assessment and reassessment.

Figure 4.7 presents the change in 6MWT distance over time by treatment location for each participant. Reference lines represent small (20m) and substantial (50m) clinically significant changes in distance (Perera et al. 2006). This plot shows that none of the clinic-based participants improved their walking distance after treatment. One participant had a substantial decrease in walking distance (-91.0m), and one had a small decrease (-25.3m). The other three clinic-based participants had changes that did not reach clinical significance. In contrast, 4/9 (44.4%) of the home-based participants had a substantial improvement in walking distance, and 2/9 (22.2%) had a small increase. The other three home-based participants had a small decrease in walking distance between assessment and reassessment.
Figure 4.6: Bar-plot of distance walked on 6MWT before and after treatment by rehabilitation setting

Figure 4.7: Bar-plot of the difference in 6MWT distance over time by rehabilitation setting
4.4.3 Intrinsic Motivation Inventory (IMI)

Items 8, 12, 14, 18, 20 and 24 were reverse coded prior to descriptive statistics being explored. The possible range of scores for the total IMI is 25 to 175, and those for the subscales are 8 to 56 for interest/enjoyment and perceived choice, and 9 to 63 for value/usefulness. Figure 4.8 shows the frequency distribution of total IMI scores and Table 4.5 presents the summary statistics for the total IMI and for each of the subscales.

![Image of Frequency Histogram with Normal Distribution Curve for IMI Scores](image)

**Figure 4.8: Frequency histogram with superimposed normal distribution curve for IMI scores**

Scores for the twenty-sixth item of the IMI (“I would have preferred rehabilitation in a group setting but I am unable to attend for reasons such as cost, or a lack of available transport to the group”) were available for nine of the ten home-based participants. The mean (SD) score was 2.4 (2.6). Figure 4.9 presents the frequency distribution of responses for question twenty-six. This shows that 6/9 (66.7%) home-based participants rated the statement “not at all true” (a score of 1), indicating that they would not have preferred rehabilitation in the group setting, and were therefore satisfied with receiving rehabilitation at home. Two of the participants rated the statement for question twenty-six as “very true” (a score of 7), meaning that they would have preferred to have had their rehabilitation in the group clinic-based setting.
Table 4.5: Summary statistics of the IMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
<th>Min to Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All participants (N=14)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMI total</td>
<td>148.8 (21.6)</td>
<td>154.0 (34.0)</td>
<td>100 to 172</td>
</tr>
<tr>
<td>IMI interest/enjoyment</td>
<td>44.9 (8.0)</td>
<td>44.0 (16.0)</td>
<td>32 to 56</td>
</tr>
<tr>
<td>IMI value/usefulness</td>
<td>58.9 (6.2)</td>
<td>62.5 (7.0)</td>
<td>45 to 63</td>
</tr>
<tr>
<td>IMI perceived choice</td>
<td>45.0 (11.6)</td>
<td>48.5 (22.0)</td>
<td>20 to 56</td>
</tr>
<tr>
<td><strong>Home (N=9)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMI total</td>
<td>140.8 (23.1)</td>
<td>137.0 (37.0)</td>
<td>100 to 172</td>
</tr>
<tr>
<td>IMI interest/enjoyment</td>
<td>42.0 (8.1)</td>
<td>41.0 (13.0)</td>
<td>32 to 56</td>
</tr>
<tr>
<td>IMI value/usefulness</td>
<td>58.2 (7.0)</td>
<td>62.0 (11.0)</td>
<td>45 to 63</td>
</tr>
<tr>
<td>IMI perceived choice</td>
<td>40.6 (12.3)</td>
<td>44.0 (21.0)</td>
<td>20 to 56</td>
</tr>
<tr>
<td><strong>Clinic (N=5)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMI total</td>
<td>163.2 (6.6)</td>
<td>163.0 (12.0)</td>
<td>154 to 172</td>
</tr>
<tr>
<td>IMI interest/enjoyment</td>
<td>50.0 (5.1)</td>
<td>50.0 (10.0)</td>
<td>44 to 56</td>
</tr>
<tr>
<td>IMI value/usefulness</td>
<td>60.2 (4.8)</td>
<td>63.0 (7.0)</td>
<td>52 to 63</td>
</tr>
<tr>
<td>IMI perceived choice</td>
<td>53.0 (3.8)</td>
<td>55.0 (6.0)</td>
<td>47 to 56</td>
</tr>
</tbody>
</table>

Figure 4.9: Frequency histogram for responses on question twenty-six of the IMI
4.4.4 Adherence to the rehabilitation programme

4.4.4a Adherence to the rehabilitation sessions

The mean number of treatments prescribed by the physiotherapists over the study period was 6.5, and the mean number of treatments attended by the participants was 5.6. The mean percentage of treatments attended for all participants was 86.2%. Seven of the 10 (70%) home-based participants and 1/6 (16.7%) clinic-based participants had fewer than eight treatment sessions prescribed. Table 4.6 presents the summary statistics of participant adherence to the rehabilitation sessions.

### Table 4.6: Summary statistics of adherence to the rehabilitation sessions

<table>
<thead>
<tr>
<th></th>
<th>Mean number of treatments attended</th>
<th>Mean number of treatments prescribed</th>
<th>Mean Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All participants</strong> (N=16)</td>
<td>5.6</td>
<td>6.5</td>
<td>86.2%</td>
</tr>
<tr>
<td><strong>Home</strong> (N=10)</td>
<td>5.0</td>
<td>5.7</td>
<td>87.7%</td>
</tr>
<tr>
<td><strong>Clinic</strong> (N=6)</td>
<td>6.7</td>
<td>7.8</td>
<td>85.9%</td>
</tr>
</tbody>
</table>

Participants were categorised as having low, moderate, or high adherence, based on the percentage of treatment sessions they attended. Table 4.7 presents these results. Low adherence was classified as attending between 0% to 33% of rehabilitation sessions, moderate adherence between 34% to 66%, and high adherence as 67% or greater (Chen et al. 1999; Sjösten et al. 2007). Table 4.7 shows that the majority of participants (n=14; 87.5%) had high adherence to the rehabilitation sessions, irrespective of in which setting they received their rehabilitation.

### Table 4.7: Participants’ adherence to the rehabilitation sessions by adherence category

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low (0-33%)</th>
<th>Moderate (34-66%)</th>
<th>High (67-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rehabilitation sessions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All participants (N=16)</td>
<td>1/16 (6.3%)</td>
<td>1/16 (6.3%)</td>
<td>14/16 (87.5%)</td>
</tr>
<tr>
<td>Home (N=10)</td>
<td>1/10 (10%)</td>
<td>0/10 (0%)</td>
<td>9/10 (90%)</td>
</tr>
<tr>
<td>Clinic (N=6)</td>
<td>0/6 (0%)</td>
<td>1/6 (16.7%)</td>
<td>5/6 (83.3%)</td>
</tr>
</tbody>
</table>
Figure 4.10 shows the percentage of the prescribed treatment sessions participants attended by rehabilitation setting. The reference lines (34% and 67%) show the lower bounds of the moderate and high adherence categories. The Figure shows that 5/10 (50%) home-based participants attended all treatment sessions prescribed, and 9/10 (90%) were classified as having high adherence. In the clinic-based setting, 2/6 (33.3%) participants attended all of the prescribed treatment sessions, and 5/6 (83.3%) were classified as having high adherence.

![Bar-plot of the percentage of prescribed rehabilitation sessions attended by rehabilitation setting](image)

**Figure 4.10: Bar-plot of the percentage of prescribed rehabilitation sessions attended by rehabilitation setting**

### 4.4.4b Adherence to the HEP

The mean number of days prescribed by the physiotherapists for the HEP to be completed was 16.3, and the mean number of days that participants completed was 14.7. The mean number of exercise repetitions prescribed was 877.8, and participants completed 866.5. Tables 4.8 and 4.9 present the summary statistics of HEP adherence. Table 4.8 shows that participants completed their HEP on a mean of 90.2% of days prescribed, and Table 4.9 shows that they completed 98.7% of the prescribed repetitions. Clinic-based participants on average completed their HEP more often than prescribed and completed more repetitions than prescribed. Figure 4.11 presents a plot showing participant adherence to the prescribed HEP by rehabilitation setting. In the home-based group, one participant returned an exercise diary without having filled it in. It was not possible to determine with certainty whether the
participant had not completed the exercises, or had just not filled in the exercise diary.

Table 4.8: Summary statistics of HEP adherence - days

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean days completed</th>
<th>Mean days prescribed</th>
<th>Mean percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants (N=15)</td>
<td>14.7</td>
<td>16.3</td>
<td>90.2%</td>
</tr>
<tr>
<td>Home (N=9)</td>
<td>14.3</td>
<td>18.3</td>
<td>78.1%</td>
</tr>
<tr>
<td>Clinic (N=6)</td>
<td>15.2</td>
<td>13.3</td>
<td>114.3%</td>
</tr>
</tbody>
</table>

Table 4.9: Summary statistics of HEP adherence - repetitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean reps completed</th>
<th>Mean reps prescribed</th>
<th>Mean percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants (N=15)</td>
<td>866.5</td>
<td>877.8</td>
<td>98.7%</td>
</tr>
<tr>
<td>Home (N=9)</td>
<td>715.6</td>
<td>862.8</td>
<td>82.9%</td>
</tr>
<tr>
<td>Clinic (N=6)</td>
<td>1092.8</td>
<td>900.3</td>
<td>121.4%</td>
</tr>
</tbody>
</table>

Figure 4.11: Bar-plot of the percentage of the HEP completed by rehabilitation setting
Participants were classified as having low, moderate or high adherence to the prescribed HEP, based on the percentage of the HEP that they completed. Table 4.10 presents participants’ adherence to the HEP by adherence category. This shows that the majority of participants had high adherence for both the number of days they completed their HEP (n=11; 73.3%) and for the number of repetitions they completed (n=10; 66.7%).

Table 4.10: Participants’ adherence to the HEP by adherence category

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low (0-33%)</th>
<th>Moderate (34-66%)</th>
<th>High (67-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All participants</strong> (N=15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEP days</td>
<td>2/15 (13.3%)</td>
<td>2/15 (13.3%)</td>
<td>11/15 (73.3%)</td>
</tr>
<tr>
<td>HEP repetitions</td>
<td>4/15 (26.7%)</td>
<td>1/15 (6.7%)</td>
<td>10/15 (66.7%)</td>
</tr>
<tr>
<td><strong>Home</strong> (N=9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEP days</td>
<td>2/9 (22.2%)</td>
<td>1/9 (11.1%)</td>
<td>6/9 (66.7%)</td>
</tr>
<tr>
<td>HEP repetitions</td>
<td>3/9 (33.3%)</td>
<td>1/9 (11.1%)</td>
<td>5/9 (55.6%)</td>
</tr>
<tr>
<td><strong>Clinic</strong> (N=6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEP days</td>
<td>0/6 (0%)</td>
<td>1/6 (16.7%)</td>
<td>5/6 (83.3%)</td>
</tr>
<tr>
<td>HEP repetitions</td>
<td>1/6 (16.7%)</td>
<td>0/6 (0%)</td>
<td>5/6 (83.3%)</td>
</tr>
</tbody>
</table>

4.5 Primary objective: Sample size calculation for an RCT

Firstly, this section presents the sample size formula used to calculate the required sample size for an RCT. It describes the components of the formula, and the values used for each component. Next, this section discusses the justification for the value of the differences on the AES and the IMI to be detected, and it finishes by presenting the results of the sample size calculation, using the summary statistics of the AES2 and the IMI interest/enjoyment sub-scale. The AES2 was chosen over the AES1, as in a future RCT the inferential tests would use the final AES values rather than the initial values. The IMI interest/enjoyment sub-scale was chosen, as this is the only part of the IMI that specifically measures the construct of motivation.
4.5.1 Sample size formula
A two-sample normal approximation formula was used to determine how large the total sample (2N) would need to be for a future RCT. Equation 4.1 shows the sample size formula used (Friedman et al. 2010), where \( \alpha \) is the level of significance, 1-\( \beta \) is the power, \( \sigma^2 \) is the variance, and \( \delta \) is the difference to be detected.

**Equation 4.1: Two-sample normal approximation formula** (Friedman et al. 2010)

\[
2N = \frac{4(Z_{1-\alpha/2} + Z_{1-\beta})^2 \sigma^2}{\delta^2}
\]

For a 5% significance level and 80% power, the values of \( Z_{1-\alpha/2} \) and \( Z_{1-\beta} \) are 1.96 and 0.84, respectively. For 90% power, \( Z_{1-\beta} \) is 1.28.

4.5.2 Justification for the differences on the AES and the IMI to be detected
Research has yet to determine the MCID for the AES, however several studies investigating apathy in different patient populations have reported changes in AES scores that have been described as clinically important (Padala et al. 2007; Lenze et al. 2009). Lenze and colleagues (2009) evaluated apathy in 126 patients following surgical repair of a hip fracture. The authors categorised participants by high or low AES scores, and by whether their scores changed over time. Participants who had improvements in AES scores over time had a mean change of -8.2 points, corresponding to a 19% decline in apathy scores. This percentage decline is consistent with the lowest percentage change (18.3%) that Padala et al. (2007) reported in their case reports. This corresponded to an eleven-point change, and the authors reported that this change was significant. To detect a minimum difference of 18% from the lowest mean AES score obtained in the current study (28.8 points in the clinic-based group), the absolute difference needs to be five points. This was used as the smallest difference to be detected in the subsequent sample size calculation.

As for the AES, there is no MCID reported in the literature for the IMI. Xie and colleagues (2011) used the interest/enjoyment sub-scale, a self-report measure of intrinsic motivation, in their study to detect motivation levels in students. They defined high and low levels of motivation, using a score of five or more for high levels of motivation and three or less for low motivation on a Likert scale of seven points. It seems clinically important to be able to
differentiate between patients with high and low levels of motivation. Results for the interest/enjoyment sub-scale in the current study are presented out of fifty-six (eight questions on a seven-point Likert scale). Therefore, to differentiate between low and high levels of motivation, scores of twenty-four and forty points will be used, respectively, with a minimum difference of sixteen points to be detected. This corresponds to a difference of two points on a seven-point Likert scale.

### 4.5.3 Sample size requirements for an RCT

For the AES, differences of five to nine points were used in the equation, and for the IMI differences of sixteen and twenty-four points were used. Equation 4.2 presents an example of a sample size calculation using a significance level of 0.05, power of 0.8, variance of the AES2 (75.69) and a difference of 5 points. This gives a total sample size requirement of 96 participants, thus 48 participants per rehabilitation setting.

**Equation 4.2: Example of sample size calculation using the variance of the AES2**

\[
2N = \frac{4(1.96 + 0.84)^2 \times 75.69}{5^2}
\]

Table 4.11 presents the results of the remaining sample size calculations for the AES2 and the IMI interest/enjoyment sub-scale. The variance of the IMI interest/enjoyment is 64.

**Table 4.11: Total sample size requirements for future RCT by outcome variable**

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Power 0.8</th>
<th>Power 0.9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AES2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference=5</td>
<td>2N=96</td>
<td>2N=128</td>
</tr>
<tr>
<td>Difference=6</td>
<td>2N=66</td>
<td>2N=88</td>
</tr>
<tr>
<td>Difference=7</td>
<td>2N=48</td>
<td>2N=66</td>
</tr>
<tr>
<td>Difference=8</td>
<td>2N=38</td>
<td>2N=50</td>
</tr>
<tr>
<td>Difference=9</td>
<td>2N=30</td>
<td>2N=40</td>
</tr>
<tr>
<td><strong>IMI interest/enjoyment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference=16</td>
<td>2N=8</td>
<td>2N=12</td>
</tr>
<tr>
<td>Difference=24</td>
<td>2N=4</td>
<td>2N=6</td>
</tr>
</tbody>
</table>
Figure 4.12 shows a line graph depicting the total sample size required, as a function of the difference, using the variance of the AES2.

![Figure 4.12: Line graph showing the total sample size required using the AES2](image)

4.6 Secondary objectives

This section presents the results for the secondary objectives.

4.6.1 Secondary objective 1: To compare the mean scores of the AES and the IMI in the two rehabilitation settings

A paired comparison of the difference in the AES scores between baseline and reassessment (AESdiff) for all participants gave an estimated value of -0.3 (95% CI -3.6 to 3.0); p=0.87. This shows that there was no statistically significant difference in AES scores between baseline and reassessment across all participants. The paired t-test was repeated to evaluate within group differences for home-based and clinic-based participants. These analyses gave an estimated value of 0.3 (95% CI -5.0 to 5.6); p=0.89 for home-based participants, and -1.2 (95% CI -5.9 to 3.6); p=0.56 for clinic-based participants. The results show that there was no statistically significant difference in AES scores over time in either rehabilitation setting.

One-way ANOVA, with treatment location as the predictor variable, was carried out for the AES1, AES2 and AESdiff. Table 4.12 presents the results of these analyses. This shows that there was no statistically significant difference between groups in AES scores at either
baseline or reassessment. In addition, no statistically significant difference was found in the AESdiff scores between the two rehabilitation settings.

Table 4.12: One-way ANOVA results for the AES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Difference (home minus clinic)</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES1</td>
<td>2.0</td>
<td>-4.0 to 8.0</td>
<td>0.49</td>
</tr>
<tr>
<td>AES2</td>
<td>4.1</td>
<td>-5.9 to 14.0</td>
<td>0.39</td>
</tr>
<tr>
<td>AESdiff</td>
<td>1.5</td>
<td>-5.5 to 8.5</td>
<td>0.65</td>
</tr>
</tbody>
</table>

The ANOVA test was repeated for the IMI and for each of the IMI sub-scales. Table 4.13 presents these results, and shows no statistically significant differences between rehabilitation settings.

Table 4.13: One-way ANOVA results for the IMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Difference (home minus clinic)</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMI total</td>
<td>-22.4</td>
<td>-45.8 to 0.9</td>
<td>0.06</td>
</tr>
<tr>
<td>IMI interest/enjoyment</td>
<td>-8.0</td>
<td>-16.8 to 0.8</td>
<td>0.07</td>
</tr>
<tr>
<td>IMI value/usefulness</td>
<td>-2.0</td>
<td>-9.7 to 5.7</td>
<td>0.59</td>
</tr>
<tr>
<td>IMI perceived choice</td>
<td>-12.4</td>
<td>-24.9 to 0.0</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The relationship between the AES and IMI was examined using Pearson product-moment correlation coefficient, and a negative correlation was found. For the AES1, the correlation coefficient was $r=-0.49; p=0.08$, and for the AES2 it was $r=-0.62; p=0.02$. Figure 4.13 presents a scatter plot showing the correlation between the AES1 and the IMI, and Figure 4.14 presents the same information for the AES2 and the IMI. These plots show that a higher score on the AES is associated with a lower score on the IMI. Simple linear regression analysis reveals that AES1 scores account for 24% of the variance in IMI scores ($r^2=0.24$), while AES2 scores explain 39% of the variance in IMI scores ($r^2=0.39$).
The relationship between the AES and the sub-scales of the IMI were also explored. A negative correlation between the AES and each sub-scale was found, as presented in Table 4.14.
Table 4.14: Correlation between the AES and IMI sub-scales

<table>
<thead>
<tr>
<th></th>
<th>Interest/enjoyment</th>
<th>Value/usefulness</th>
<th>Perceived choice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AES1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson correlation</td>
<td>-0.20</td>
<td>-0.58*</td>
<td>-0.46</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.50</td>
<td>0.03</td>
<td>0.10</td>
</tr>
<tr>
<td>N</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td><strong>AES2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson correlation</td>
<td>-0.44</td>
<td>-0.60*</td>
<td>-0.54*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.12</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>N</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

*Significant at alpha=0.05

Simple linear regression analyses found that AES1 scores account for only 4% of the variance in interest/enjoyment scores \(r^2=0.04\), but 34% in value/usefulness scores \(r^2=0.34\) and 21% in perceived choice scores \(r^2=0.21\). The regression analyses were repeated using the AES2, and found that AES2 scores account for 19% of the variance in interest/enjoyment scores \(r^2=0.19\), 36% in value/usefulness scores \(r^2=0.36\) and 29% in the perceived choice scores \(r^2=0.29\). The correlation between perceived choice and interest/enjoyment was also analysed. Perceived choice was strongly correlated with interest/enjoyment \((r=0.73; p=0.003)\), and was statistically significant at alpha=0.01. Simple linear regression analysis found that perceived choice scores accounted for 53% of the variance in interest/enjoyment scores \(r^2=0.53\).

4.6.2 Secondary objective 2: To evaluate the characteristics of the 6MWT in both settings

A paired comparison of the difference in 6MWT distance between baseline and reassessment \(6\text{MWTdiff}\) gave an estimated value of 14.1m (95% CI -20.6 to 48.9); \(p=0.40\). This shows that there was no statistically significant difference in 6MWT distance between baseline and reassessment for all participants. Paired t-tests were repeated to assess for within group differences on the 6MWT. For the home-based participants the estimated value was 37.9m (95% CI -7.3 to 83.2); \(p=0.09\), and for the clinic-based participants it was -28.6m (95% CI -72.9 to 15.6); \(p=0.15\). An outlier was found in the clinic-based group (see Figure 4.15), and with this removed the estimated value was -13.1m (95% CI -26.7 to 0.6); \(p=0.06\). These
results show that neither group had a statistically significant change in their 6MWT distances over the course of the rehabilitation period. However, the point estimate for the home-based participants was consistent with an effect in this group, albeit with a wide confidence interval. The estimated change for the clinic-based participants with the outlier removed approaches statistical significance; however, the confidence limits do not include the clinically important value of 50m.

![Figure 4.15: Box plot of 6MWTdiff distances by treatment location](image)

Table 4.4 (see page 51) presents the summary statistics of the 6MWT and shows a large difference in baseline (6MWT1) walking distances between home-based and clinic-based participants. To determine whether this difference is statistically significant a one-way ANOVA was carried out. The results showed a mean difference of 140.9m (95% CI 53.0 to 228.9); p<0.001, in favour of the clinic-based group. An outlier was found in the clinic-based group (see Figure 4.16), and with this removed the mean difference was 118.6m (95% CI 29.8 to 207.5); p=0.01. These results suggest that at baseline the clinic-based participants were able to walk significantly further, both statistically and clinically, compared to the home-based participants; however, the confidence intervals for both analyses are wide.
To determine whether a difference existed in 6MWTdiff distances between rehabilitation settings, a one-way ANOVA, with treatment location as a predictor variable, was used. This suggested there was a difference in 6MWTdiff scores. Table 4.15 presents the results of the univariate ANOVA, which shows that the mean difference between groups was 66.6m. Table 4.4, which shows summary statistics of the 6MWT, reveals that the 66.6m difference is in favour of the home-based group. As described above, an outlier was found in the clinic-based group (see Figure 4.15). One-way ANOVA was repeated with the outlier removed, and this suggested there was no statistically significant difference between groups; however, the difference between groups is clinically important. Table 4.15 also presents the results of the ANOVA with the outlier removed. It is important to note that the confidence intervals for both analyses are wide, and include the clinically important value of 50m.

### Table 4.15: One-way ANOVA results for the 6MWTdiff

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Difference (home minus clinic)</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6MWTdiff</td>
<td>66.6m</td>
<td>3.0 to 130.2</td>
<td>0.04*</td>
</tr>
<tr>
<td>6MWTdiff (outlier removed)</td>
<td>51.0m</td>
<td>-15.7 to 117.7</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*Significant at alpha=0.05
4.6.3 Secondary objective 3: To assess adherence to the rehabilitation programme

4.6.3a Adherence to the rehabilitation sessions

A Poisson regression analysis, with treatment adherence as the response variable, was used to explore the relationship between treatment session adherence and the rehabilitation setting. An offset was used for the number of sessions prescribed. The results of this analysis are presented in Table 4.16. The estimated Poisson regression coefficient (B), comparing location one (home) and location two (clinic), gives a difference of 0.03. The exponential of this coefficient [Exp (B)] is the estimate for the ratio of mean number of sessions between home and clinic: 1.03 (95% CI 0.68 to 1.56); p=0.89, giving a non-statistically significant result. This suggests that there was no difference in adherence rates to the rehabilitation sessions between treatment locations.

Table 4.16: Poisson regression analysis for adherence to the rehabilitation sessions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std Error</th>
<th>95% CI</th>
<th>Sig.</th>
<th>Exp (B)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.16</td>
<td>0.16</td>
<td>-0.47 to 0.15</td>
<td>0.31</td>
<td>0.85</td>
<td>0.62 to 1.16</td>
</tr>
<tr>
<td>Location 1 versus Location 2</td>
<td>0.03</td>
<td>0.21</td>
<td>-0.39 to 0.45</td>
<td>0.89</td>
<td>1.03</td>
<td>0.68 to 1.56</td>
</tr>
</tbody>
</table>

Location 1= home; Location 2= clinic

4.6.3b Adherence to the HEP

A Poisson regression analysis was also used to compare rate ratios for adherence to the HEP, both by days and by repetitions. The response variables were adherence to the number of days and adherence to the number of repetitions of the HEP. The results of the analysis for adherence to the HEP by days are presented in Table 4.17 and for adherence to the HEP by repetitions in Table 4.18.

Table 4.17 shows that the home-based participants had a statistically significant lower rate of adherence to the HEP by days than the clinic-based participants: 0.69 (95% CI 0.53 to 0.90); p=0.01. In addition, the results in Table 4.18 show that the home-based participants also had a statistically significant lower adherence rate to the HEP by repetitions than clinic-based participants: 0.68 (95% CI 0.66 to 0.71); p=0.00.
### Table 4.17: Poisson regression analysis for adherence to the HEP - days

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std Error</th>
<th>95% CI</th>
<th>Sig.</th>
<th>Exp (B)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>0.13</td>
<td>0.10</td>
<td>-0.08 to 0.33</td>
<td>0.22</td>
<td>1.14</td>
<td>0.93 to 1.40</td>
</tr>
<tr>
<td>Location 1 versus Location 2</td>
<td>-0.38</td>
<td>0.14</td>
<td>-0.64 to -0.11</td>
<td>0.01</td>
<td>0.69</td>
<td>0.53 to 0.90</td>
</tr>
</tbody>
</table>

Location 1= home; Location 2= clinic

### Table 4.18: Poisson regression analysis for adherence to the HEP - repetitions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std Error</th>
<th>95% CI</th>
<th>Sig.</th>
<th>Exp (B)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>0.19</td>
<td>0.01</td>
<td>0.17 to 0.22</td>
<td>0.00</td>
<td>1.21</td>
<td>1.19 to 1.24</td>
</tr>
<tr>
<td>Location 1 versus Location 2</td>
<td>-0.38</td>
<td>0.02</td>
<td>-0.42 to -0.35</td>
<td>0.00</td>
<td>0.68</td>
<td>0.66 to 0.71</td>
</tr>
</tbody>
</table>

Location 1= home; Location 2= clinic
Chapter Five: Discussion

5.1 Introduction
This present study is, to the best of the researcher’s knowledge, the first that examines whether differences exist between group and individual rehabilitation settings for community-based patients with stroke, and more specifically whether the rehabilitation setting has an influence on motivation and clinical outcomes. The main objective of this study was to carry out the feasibility work, including calculating the required sample size, for a future RCT that would investigate whether the rehabilitation setting influences motivation for rehabilitation and outcomes. To detect a minimum difference of five points on the AES, with the level of significance set at 0.05 and power of 0.8, an equally-sized two arm parallel groups trial requires a total sample size of 96 participants, based on AES2 estimates of variance. To detect a minimum change of 16 points on the interest/enjoyment sub-scale of the IMI a total sample size of only eight is suggested. The secondary objectives compares motivation levels, walking distance as measured by the 6MWT, and adherence to the rehabilitation programme between the two treatment locations. No statistically significant difference in motivation levels between the two settings was found when using the AES; however, the point estimates were consistent with higher motivation levels in the group clinic-based setting when using the IMI, but with wide confidence intervals. There was no statistically significant difference in the change in 6MWT distance between the two groups, although the point estimates favoured home-based participants with wide confidence intervals. Finally, there was no statistical evidence of a difference in the degree of adherence to the rehabilitation sessions between the two settings. However, the group clinic-based participants had a statistically significant higher level of adherence to the prescribed HEP, for both days they completed the exercises and the number of repetitions they completed.

The remainder of this chapter discusses the findings of each of the objectives in more detail, and compares the results to previous research. Following this, the strengths and limitations of the study are considered, and recommendations for future research are detailed.

5.2 Primary objective: To determine the utility and characteristics of the motivation questionnaires and the required sample size for an RCT
The first part of this section discusses the utility of the AES and IMI for measuring motivation
in patients with stroke undergoing community rehabilitation. The second part of the section discusses the characteristics of the AES and IMI and relates the findings of the present study to previous research. The last part of this section discusses the required sample size for a future RCT.

5.2.1 Utility of the AES

Previous research has established the utility of the AES for measuring apathy, or a lack of motivation, in patients with stroke (Marin et al. 1991; Resnick et al. 1998; Andersson et al. 1999; Brodaty et al. 2005). However, most of these studies assessed patients in the inpatient setting, and although the participants in Marin’s et al. (1991) study were community-dwelling, they were not undergoing rehabilitation. This is to the best of the researcher’s knowledge the first study to use the AES to compare motivation levels of participants in two community rehabilitation settings. In the present study, the AES-S, a self-rated version of the AES, was used to determine participants’ motivation levels before and after completion of the rehabilitation programme. The AES-S was simple to administer and none of the participants reported any difficulties with understanding the questions, or distinguishing between possible answers. Previous research has highlighted problems with participants being able to make out the difference between the “somewhat” and “slightly” options on the Likert scale (Mayo et al. 2009). This did not prove to be problem in this study. The AES-S was simple to score and the results were easy to interpret against the pre-determined cut-off score, which provided a simple way to discriminate between participants with and without apathy. Previous research reports that the AES-S is able to differentiate between apathetic and non-apathetic patients. However, potentially limiting the clinical utility of the AES-S is the suggestion that apathetic patients may underestimate the severity of their apathy when using this form of the scale (Marin et al. 1991). A recent study of people with brain injury (including stroke) endorses this concern, as participants tended to underrate their symptoms of apathy when using the AES-S compared to the AES-I (Njomboro & Deb 2012). In fact, AES-S scores were significantly lower than AES-I scores (p<0.001). As the present study only used one version of the AES, it was not possible to verify the accuracy of the participants’ reports of their motivation levels.

Previous research has found that the AES is a significant predictor of functional outcome, as measured by the BI, at discharge from an inpatient rehabilitation setting (Resnick et al. 1998). The AES score at admission accounted for 31% of the variance in BI score at discharge.
While the current study did not formally evaluate whether the AES scores at baseline predicted 6MWT distance at reassessment, the ability of this measure to account for differences in functional outcome is clinically useful.

One drawback of the AES is the lack of agreement of a cut-off score as a criterion for apathy, and associated with this a lack of normative data. Previous research has used various cut-off scores to discriminate between participants with and without apathy, with scores including thirty-four points (Andersson et al. 1999; Sagen et al. 2010), thirty-seven points (Brodaty et al. 2005), and thirty-eight points (Marin et al. 1993; Njomboro & Deb 2012). In addition, a number of studies have suggested that the mean score of control subjects plus two SD can be used as the cut-off score (Andersson et al. 1999; Brodaty et al. 2005). The control subjects in the original validation study had a mean (SD) score of 28.1 (6.4) on the AES-S (Marin et al. 1991). This gives a cut-off score of forty-one points, which is higher than has been used in the research reviewed. The current study did not have a control group, therefore this method could not be used to select a cut-off score. Thirty-six points, the mid-point between thirty-four and thirty-eight points - the highest and lowest scores used in the research reviewed - (Marin et al. 1993; Andersson et al. 1999; Sagen et al. 2010; Njomboro & Deb 2012) was chosen. The utility of the AES for this study would have been enhanced if a definitive score to use as the criterion for apathy was available, as selecting a lower or higher cut-off score may have resulted in different apathy rates in the present study.

Not only does the AES lack a clear criterion score for apathy, there is also limited normative data available (Tate 2010). Marin et al. (1991) assessed a control group of thirty-one well elderly subjects aged between fifty-five and eighty-five years and determined mean scores on each of the three versions of the AES (AES-C=26.0; AES-I=26.3; AES-S=28.1). The number of subjects used to determine these mean scores was small, and it has been suggested that the sample size is in fact inadequate to determine normative scores ("Guidelines for Apathy Evaluation Scale"). In a more recent study, Brodaty and colleagues (2005) assessed ninety-two controls, and reported a mean score of 24.1 using the AES-I. This is slightly lower than the score of 26.3 reported for this version of the scale in Marin’s et al. (1991) study. Further research to establish both normative scores, and a specific cut-off score would be useful to increase the utility of this measure when evaluating motivation levels for rehabilitation.

In summary, the AES-S has some clinical utility for evaluating motivation levels in patients
with stroke undergoing community-based rehabilitation. The advantages of using this scale are that it is quick and simple to administer, easy to score, and the results can distinguish between patients with and without apathy. The main concern of this version of the scale is that participants may underestimate the degree of apathy they are experiencing. In addition, the lack of a definitive cut-off score as a criterion for apathy means that the rate of apathy may vary, depending on which cut-off score is selected.

5.2.2 Utility of the IMI

The IMI has been used extensively in research to establish motivation for a particular activity (University of Rochester 1996-2008). Only recently have studies used this questionnaire to evaluate motivation levels in patients with stroke. Colombo et al. (2007) report that theirs was the first study to use the IMI to measure patient motivation following stroke. The authors assessed motivation levels for robot-aided rehabilitation. Since then, other studies have also used the IMI to evaluate motivation levels in patients with stroke who are undertaking rehabilitation activities with assistive technologies (Choi et al. 2011; Sampson et al. 2012). This is, to the best of the researcher’s knowledge, the first study that has used the IMI to evaluate participant motivation for ‘traditional’ community-based rehabilitation following stroke, and to compare motivation levels in two different rehabilitation settings. In the present study, a twenty-five item version of the IMI was used.

In the present study, the IMI was a useful post-intervention questionnaire to assess participant motivation levels specifically for the rehabilitation programme. The flexibility in allowing slight modifications to the wording enhanced its clinical utility. In addition, while the full questionnaire has forty-five items, only those with relevance to this study needed to be used. The outcome measure was simple to administer, and easy to score, with higher scores indicating a greater degree of motivation. The IMI in this study consisted of three sub-scales relating to the construct of intrinsic motivation: interest/enjoyment, value/usefulness and perceived choice. The following sections discuss the utility of each of these dimensions.

The interest/enjoyment sub-scale is described as a self-report measure of intrinsic motivation, and is the only sub-scale of the IMI that specifically measures motivation (University of Rochester 1996-2008). This sub-scale was therefore the most useful to measure motivation for the rehabilitation programme. It was simple to differentiate between high and low levels of intrinsic motivation, using the pre-determined scores of forty points and twenty-four points,
respectively. Markland and Hardy (1997) however, highlight some concerns with using this sub-scale to determine intrinsic motivation for an activity. They suggest that participants may appear intrinsically motivated for an activity because of the level of enjoyment reported, however that this enjoyment may be for the external outcomes, rather than for the activity itself. The authors therefore propose that in fact, this sub-scale may only assess the intensity of motivation, not the orientation of the motivation. Despite these concerns, the interest/enjoyment sub-scale was clinically useful to measure the intensity of the participants’ motivation for the rehabilitation programme, irrespective of the type of motivation it measured.

The value/usefulness category of the IMI was important to measure in this study, to determine whether the participants considered the rehabilitation programme helpful in improving their mobility. This dimension of the scale has been used previously in studies investigating the internalisation of activities that may be uninteresting, yet important, and SDT proposes that people are inherently motivated to internalise these important activities (Deci et al. 1994). Being able to measure the value participants place on rehabilitation is useful, as those participants who perceive rehabilitation to be important to their recovery, and who see value in undertaking rehabilitation, will have more self-determined forms of motivation. This is important, as the degree of self-determined motivation is positively associated with the level of HEP adherence following discharge from a formal rehabilitation programme (Russell & Bray 2009).

The perceived choice sub-scale was useful to measure in the current study, to evaluate whether participants felt they had a choice in participating in the rehabilitation programme. SDT suggests that providing choice may enhance self-determination, and in turn increase intrinsic motivation (Deci & Ryan 1985), therefore perceived choice is thought to be a positive predictor of intrinsic motivation (University of Rochester 1996-2008). In addition, research suggests that having choices before and during a task may increase performance on that activity (Choi et al. 2010), and that people will be more intrinsically motivated to continue with an activity that allows opportunities for choice (Patall et al. 2008). Participants in the present study were offered the choice of in which setting they received their rehabilitation, therefore being able to measure whether they perceived that they had a choice was valuable. In addition, it is recommended that to be confident in the assessment of intrinsic motivation, perceived choice and interest/enjoyment sub-scales should be highly
In summary, the IMI is a clinically useful measure to evaluate the motivation levels of participants for a rehabilitation programme. The ability to adapt the wording of the IMI to measure constructs specific to this research made the tool particularly useful. There were no difficulties in administering the questionnaire in the community setting. Each of the sub-scales has its own utility for measuring intrinsic motivation, or a construct related to it. The total IMI score proved less useful than each of the individual sub-scale scores. The interest/enjoyment sub-scale, with pre-determined cut-off scores, provided a simple way to differentiate between participants with high and low levels of motivation for the rehabilitation programme.

5.2.3 Characteristics of the AES
The present study found three of the sixteen (18.8%) participants had apathy at baseline, and five of fifteen (33.3%) participants had apathy at reassessment, using thirty-six points as the criterion for apathy. The prevalence of apathy at baseline is consistent with a number of previous studies, which report apathy occurring in approximately 20-25% of patients with stroke (Starkstein et al. 1993; Hama et al. 2007; Jorge et al. 2010). The percentage of participants with apathy at reassessment in the present study is higher than this range, however Mayo (2009) reports apathy may in fact occur in up to 55% of patients with stroke. The results of the present study suggest that the number of participants with decreased motivation levels is within the range expected for patients with stroke. However, the increase in the number of participants with apathy over the rehabilitation period is unexpected. A previous study investigating apathy in patients after hip fracture, suggests that rehabilitation may provide an “anti-apathy effect” (Lenze et al. 2009), consistent with a decrease rather than an increase in apathy rates during rehabilitation. In Lenze’s et al. (2009) study the rate of apathy decreased by 5% over a two-week period of rehabilitation. The results of that study however, may not be generalisable to patients receiving rehabilitation following stroke. Research suggests that recovery of independence with basic ADL within the first year following hip fracture occurs in about 73% of patients (Koval et al. 1998). In contrast, a study of sixty patients one year post stroke found that only 32% of patients were independent with bathing, 41% with dressing and 39% with mobility on stairs (Hartman-Maeir et al. 2007). Despite rehabilitation, chronic disability affects many people with stroke (Stroke Foundation of New Zealand & New Zealand Guidelines Group 2010), and therefore the “anti-
apathy effect” of rehabilitation seen in patients with hip fracture may not occur to the same extent during stroke rehabilitation. This may account for the increase, rather than decrease, in apathy rates seen in the present study during the rehabilitation period.

In the present study, the range of AES1 scores was 24 to 41 points, with a mean (SD) score of 31.2 (5.3). The range of AES2 scores was 18 to 48 points, with a mean (SD) of 31.3 (8.7). The maximum scores in the current study are lower than in previous research using the AES-S, where maximum scores were 55 (Sagen et al. 2010) and 57 (Njomboro & Deb 2012). The mean scores in this study did not reach the criterion for apathy; however, the results are consistent with previous research (Marin et al. 1991; Brodaty et al. 2005; Sagen et al. 2010; Njomboro & Deb 2012). Marin et al. (1991) assessed nineteen patients with left hemisphere stroke (mean age: 66.2 years), and twenty-two patients with right hemisphere stroke (mean age: 70.1 years) who were between three months and three years post stroke. Using the AES-S, patients with a left hemisphere stroke had a mean (SD) score of 32.2 (8.6), and using the AES-C 31.9 (9.6). Patients with a right hemisphere stroke had a mean score (SD) score of 31.6 (6.7) using the AES-S, and 34.7 (7.3) using the AES-C. Brodaty and colleagues (2005) assessed 135 patients with stroke at three to six months post stroke, and reported a mean (SD) score of 32.2 (10.3) on the AES-I. The patients in that study were slightly older (mean age: 72.2 years) than the participants in the current study, but other demographics, such as the ratio of males and females, were similar in both studies. In another study investigating the core features of apathy, eighty-five patients were assessed at four months post stroke (Sagen et al. 2010). These authors reported a mean (SD) score of 33.4 (8.4), using the AES-S. Patients in that study were slightly younger than participants in the present study (mean age: 64.9 years), but other reported characteristics were similar. Finally, Njomboro and Deb (2012) assessed twenty-four patients with stroke who were at least six months post stroke, and reported a mean (SD) score of 34.3 (9.3) using the AES-S. These patients were considerably younger than participants in this study (mean age: 54.4 years), but other characteristics were similar. Overall, the mean AES scores in the current study are aligned with previous research that has evaluated apathy in patients with stroke with similar characteristics.

The mean AES scores in the present research were stable over the study period of up to ten weeks, and the estimated value for the difference in AES scores (AESdiff) was -0.3 (95% CI -3.6 to 3.0); p=0.87. This confirms that there was no statistically significant difference in mean scores between baseline and reassessment. Although previous research suggests apathy
may increase over time (Angelelli et al. 2004; Withall et al. 2011), given the short study period of this current research, it is not unexpected that the mean AES scores did not change significantly. Despite this, between baseline and reassessment there was a small increase in the number of participants who reached the criterion for apathy. In a larger study, Withall and colleagues (2011) assessed 106 patients at three to four months post stroke and again twelve months later. They found that the number of patients with stroke with pure apathy decreased over the twelve months, but that the total number of patients with a degree of apathy (e.g. a combination of apathy and depression) increased over time. As depression was not measured in the current study, it is not possible to differentiate between those participants with pure apathy, and those with a combination of apathy and depression.

In summary, the results of the current study suggest that this cohort of participants undergoing community rehabilitation is similar to groups of patients with stroke assessed in previous studies in terms of the prevalence of apathy and the range and mean scores on the AES. Despite the small sample size of this pilot study, the results using the AES-S are generally consistent with previous research. Importantly, the results are similar to other studies that have used the AES-I and the AES-C (Marin et al. 1991; Brodaty et al. 2005), which are described as having more favourable psychometric properties than the AES-S (Njomboro & Deb 2012).

5.2.4 Characteristics of the IMI

In the present study, the range of total IMI scores was 100 to 172, with a mean (SD) score of 148.8 (21.6). The range of scores on the interest/enjoyment sub-scale was 32 to 56, with a mean (SD) score of 44.9 (8.0). The pre-determined score used as a criterion for low levels of motivation was 24 points. Based on this, none of the participants were considered to have low motivation levels for the rehabilitation programme. The mean score suggests that participants were in fact highly motivated for rehabilitation. The interest/enjoyment score in the present study is consistent with previous research investigating robot-aided rehabilitation interventions for patients with stroke (Colombo et al. 2007; Choi et al. 2011). These authors reported high levels of patient motivation for the rehabilitation intervention they were assessing. Scores were reported on a seven-point scale and were 6.17 (Choi et al. 2011) and 6.00 (Colombo et al. 2007), which would equate to 49.4 and 48.0 respectively, on the scale used in the present study.
The range of scores on the value/usefulness sub-scale in the current study was 45 to 63, with a mean (SD) score of 58.9 (6.2). Previous research suggests that a high score and low SD on this sub-scale means that participants are satisfied with the results they obtained with the treatment (Colombo et al. 2007). The results in the current study suggest that participants saw value in the rehabilitation programme to help improve their mobility, and that they were satisfied with the outcomes they achieved. The score on this sub-scale is in line with previous research, where scores were 6.34 (Choi et al. 2011) and 6.15 (Colombo et al. 2007). These scores convert to 57.1 and 55.3, respectively, on the scale used in the current study.

The range of scores on the perceived choice sub-scale was 20 to 56, with a mean (SD) of 45.0 (11.6). The same values as for interest/enjoyment were used to distinguish between high (forty points) and low levels (twenty-four points) of perceived choice. One participant had a low perception of choice for participating in rehabilitation; however, the mean score shows that generally participants felt like they had a high degree of choice about participating in the rehabilitation programme. Choi and colleagues (2011) used this sub-scale in their study, and reported a mean score of 6.43, equating to 51.4 points on the fifty-six point scale used in the present study.

In summary, the results of the current study show that participants had a high level of motivation for the rehabilitation programme. In addition, the results show that participants found the rehabilitation programme valuable for improving their mobility and that they felt that they had a choice about participating in the programme. Importantly, in this study investigating ‘traditional’ community rehabilitation, the mean scores on each of the sub-scales compare favourably with previous research using more novel approaches to rehabilitation.

### 5.2.5 Sample size for a future RCT

In order to detect a clinically important difference in motivation levels between rehabilitation settings if it exists, it is important that a future RCT have sufficient participants. The estimates of variance of the AES2 and the IMI interest/enjoyment sub-scale were used to calculate the required sample size for a future study. The calculation using the variance of the IMI interest/enjoyment sub-scale gave a required total sample size of only eight participants, which would be too small to detect even a nine-point difference in apathy between groups using the AES (see Table 4.11). To detect the smallest clinically important difference on the AES, a sample size of much larger than eight would be required. With power set at 80% and
a 5% level of significance, the calculation using the variance of the AES2 estimates a total sample size of ninety-six participants would be required to detect a five-point difference in apathy between groups.

5.3 Secondary objectives

This section discusses the results of the study in relation to each of the secondary objectives, and findings are compared with previous research.

5.3.1 Secondary objective 1: To compare the mean scores of the AES and the IMI in the two rehabilitation settings

The present study found the participants in the home-based setting had mean (SD) AES scores of 32.0 (6.4) and 32.9 (10.3) at baseline and reassessment, respectively. Clinic-based participants had mean (SD) scores of 32.9 (10.3) and 28.8 (5.2). One-way ANOVA showed that there was no statistically significant difference in AES scores between the two treatment settings at either baseline [MD=2.0 (95% CI -4.0 to 8.0); p=0.49] or reassessment [MD=4.1 (95% CI -5.9 to 14.0); p=0.39]. In addition, there was no difference in the change of AES scores over time between the two treatment settings, with an estimated value of 1.5 (95% CI -5.5 to 8.5); p=0.65.

Despite the non-significant results, the range of AES scores (see Table 4.3 and Figure 4.3) show that only participants in the home-based group reached the cut-off score to indicate apathy, or a lack of motivation, at either time point. In addition, a comparison of the IMI scores between treatment settings shows a trend towards higher motivation levels in participants in the group clinic-based setting compared to participants treated at home. This is in line with previous qualitative studies, which have reported increased patient motivation in a group setting (Carin-Levy et al. 2009; Jones et al. 2009). Carin-Levy et al. (2009) reported that participants in their study described “high levels of enjoyment” from the group setting. The mean IMI interest/enjoyment score of the group clinic-based participants in the present study is consistent with those reported high levels of enjoyment. Participants in the group clinic-based setting scored a mean (SD) of 50 (5.1), out of a possible 56 points on the interest/enjoyment sub-scale. In contrast, participants treated in the home-based setting scored a mean (SD) of 42 (8.1) on this sub-scale. The mean difference between groups [-8.0 (95% CI -16.8 to 0.80; p=0.07] was in favour of participants in the clinic-based setting, and suggests that their levels of motivation for the rehabilitation programme were higher than for
home-based participants. Carin-Levy and colleagues (2009) also reported that participants felt that the classes not only motivated them to attend each session, but also to complete some of the practiced activities at home. Participants in the clinic-based setting in the present study had higher levels of adherence to the HEP than the home-based participants. Differences in the adherence rates between the rehabilitation settings in the present study are discussed in detail in section 5.3.3.

Research suggests that providing patients with choice about their treatment, such as where they receive it, is a simple motivational technique (Guthrie & Harvey 1994). In addition, SDT posits that providing choice increases intrinsic motivation by enhancing self-determination (Patall et al. 2008). Based on these assertions, and the fact that all participants in the current study were given the choice of in which setting they received their rehabilitation, it may be expected that motivation levels should be reasonably similar between the two treatment settings. However, in addition to a higher interest/enjoyment score in the clinic-based setting, these participants also had a higher score on the perceived choice sub-scale compared to the home-based participants [MD=-12.4 (95% CI -24.9 to 0.0); p=0.05]. As perceived choice is thought to positively predict intrinsic motivation (University of Rochester 1996-2008), the higher perceived choice score in the clinic-based group may account for their higher motivation levels. In fact, there was a strong positive correlation between the interest/enjoyment and perceived choice sub-scales, with perceived choice scores accounting for 53% of the variance in the interest/enjoyment scores. Although the majority of home-based participants reported that they were satisfied with receiving their rehabilitation at home, as measured by question twenty-six of the IMI, two of the nine (22.2%) participants indicated that they would have preferred to attend the group clinic-based rehabilitation programme if they had been able to. This may go some way to explaining the difference in levels of perceived choice between the two rehabilitation settings.

It is important to note that it is not possible to determine with certainty if the rehabilitation setting (clinic or home) itself is the important factor influencing participant motivation and choice of rehabilitation venue, as the setting was confounded by the rehabilitation delivery method (individual or group). It is unclear whether the IMI results and participant choice of rehabilitation venue would have been similar if only individual therapy had been offered at both venues. A recent qualitative study investigating stroke survivors’ preference for exercising, found that there was a greater preference for exercising in a group, rather than
alone, compared to a group of healthy individuals (Banks et al. 2012). One of the reasons cited for this preference is that the group provides social interaction for the stroke survivors, as well as an opportunity to exercise, and the authors highlighted the fact that isolation can be a major problem following stroke. This has previously been suggested as a concern for patients with stroke receiving their rehabilitation in the home setting (Young & Forster 1991; Hale 2004). In another recent study, Cramp and colleagues (2010) investigated a community-based group exercise programme for patients with stroke. They reported that participants enjoyed coming to the class not only because of the improvements in physical functioning that they achieved, but also for the social opportunities it afforded. Social support is described as crucial in maintaining patient motivation for rehabilitation (Maclean et al. 2002). Although the construct of social support was not evaluated in the current study, a hypothesis is that the group rehabilitation programme provided greater social support, and therefore may explain the trend towards higher participant motivation in the clinic-based setting. Therefore, it may be the method of delivering rehabilitation (individual or group) that is the important factor influencing patient motivation, rather than the setting (clinic or home). Further research would be required to confirm these theories.

Despite a trend towards higher motivation levels and perceived choice in the clinic-based setting, there was no difference in value/usefulness scores between the two settings [MD=-2.0 (95% CI -9.7 to 5.7); p=0.59]. This suggests that participants in both settings found the rehabilitation programme useful in improving their mobility. While the mean change in distance that participants were able to walk, as measured by the 6MWT, did not reach clinical significance, the value/usefulness scores may reflect a subjective improvement in the participants’ walking ability, which the 6MWT does not measure. Differences in 6MWT results between the two treatment settings are discussed in more detail in section 5.3.2b.

The correlation analyses examining the relationship between the two motivation questionnaires found a negative correlation between them, with higher scores on the AES being associated with lower scores on the IMI. This was as expected. Participants with apathy, or a lack of motivation, score more highly on the AES, and lower scores on the IMI indicate lower levels of motivation. Total IMI scores correlated more strongly with AES2 scores than with AES1 scores and this held true for IMI sub-scale scores as well. Interestingly, there was only a weak correlation between AES1 scores and the IMI dimension directly measuring motivation, the interest/enjoyment sub-scale. AES1 scores only accounted
for 4% of the variance in the IMI interest/enjoyment scores. In contrast, the AES2 explained 19% of the variance in interest/enjoyment scores. This difference is not unexpected, as the AES2 and IMI were measured at the same time point, whereas the AES1 and the IMI were measured up to ten weeks apart and the number of participants with apathy, or a lack of motivation, increased during the study period. Of note, both AES1 and AES2 scores were highly correlated with IMI value/usefulness scores. The AES1 and AES2 scores explained 34% and 36% of the variance in value/usefulness scores, respectively. The value that patients place on achieving a successful outcome through the rehabilitation process is one factor that is suggested to influence motivation, with highly motivated patients tending to place a high value on a successful outcome with rehabilitation (Geelen & Soons 1996). This theory may explain the high correlation between the AES and the IMI value/usefulness sub-scale. Finally, the AES scores were highly correlated with perceived choice scores. The AES1 score explained 21% of the variance in IMI perceived choice scores, and the AES2 accounted for 29% of the variance. Opportunities for choice are thought to have an influence on motivation for rehabilitation (Guthrie & Harvey 1994), therefore it is not unexpected that those participants with lower AES scores, suggesting higher motivation levels, have higher perceived choice scores.

5.3.2 Secondary objective 2: To evaluate the characteristics, including feasibility, of the 6MWT in both settings
This section firstly discusses the characteristics of the 6MWT for all participants and compares the findings to previous research. Following this, the results comparing the 6MWT distances in the two rehabilitation settings are discussed, and are compared with previous studies. Finally, consideration is given to the feasibility of using the 6MWT with patients with stroke undergoing community rehabilitation.

5.3.2a 6MWT for all participants
The 6MWT is an outcome measure commonly used by physiotherapists to measure sub-maximal functional capacity in patients post stroke (van Bloemendaal et al. 2012). It was used in the present study as a measure to reflect the participants’ ability to walk in the community. Previous research suggests that in order to achieve community mobility, older adults need to be able to walk a minimum distance of 200m (Brown et al. 2010). However, the authors note that for a “typical trip” in the community, which includes visiting several
places within a location, 600m is a more accurate reflection of the distance needed to be able to walk. This longer distance is more in line with other research, which has suggested to mobilise safely in the community, individuals need to be able to walk 360m (Cohen et al. 1987), 480m (Robinett & Vondran 1988) and 500m (Hill et al. 1997).

In the present study, the range of 6MWT distances was 59m to 399m, and participants walked a mean distance of 199.3m before treatment, and 212.5m after treatment. Healthy adults are able to walk a mean distance in six minutes of between approximately 390m and 570m, depending on age and gender (Steffen et al. 2002). In comparison, adults with sub-acute or chronic stroke are able to walk only 40-50% of the distance of healthy adults (Pohl et al. 2004) and the results of the present study are consistent with this. The results also suggest that many of the participants in this study would have had difficulty walking safely in the community, even after rehabilitation. Even if, as Brown et al. (2010) suggest, the minimum distance needed to achieve community mobility is 200m, seven of the participants at baseline were not able to walk this distance in six minutes, and five of the participants at reassessment were still not able to walk this far (see Figures 4.4 and 4.5). Despite these results, it is not possible to confirm whether participants were mobilising safely and independently in the community, as this was not directly assessed in this study.

Many studies have evaluated walking distance in patients with stroke using the 6MWT. The mean distances in the present study are similar to distances walked by participants in a number of previous studies (Pohl et al. 2002; Patterson et al. 2007; Liu et al. 2008), however are considerably lower than distances reported in several other studies (Pang et al. 2005; Yang et al. 2006). Pohl et al. (2002) assessed seventy-two patients with stroke, with a mean time post stroke of 73.3 days, and reported a mean walking distance of 215.8m. Patterson and colleagues (2007) evaluated seventy-four patients and reported a mean walking distance of 216m. These patients had a mean time post stroke of 48 months. Liu et al. (2008) assessed eighty-three patients with stroke, with a mean time post stroke of 227 days, and over two trials reported a mean distance of 196m and 197m. The participants in their study were slightly older (mean age: 72 years) than participants in the current study, however the results were the most similar. In contrast, the participants in the two studies with the longer walking distances, walked mean distances of 328.1m and 392.7m (Pang et al. 2005) and 352.3m and 392.8m (Yang et al. 2006). The mean time post stroke in these studies was much longer than in the current study, and in Yang’s et al. (2006) study participants were also younger (mean
The mean change in walking distance between baseline and reassessment for all participants was 14.1m (95% CI -20.6 to 48.9); p=0.40. This change is not statistically significant, although the confidence interval does not rule out the MCID. The MCID was set at 50m for a substantial change and 20m for a small change (Perera et al. 2006). The change in walking distance in the present study is lower than is reported in other intervention studies, where point estimates for improvements in walking distance have been recorded as 40m (Salbach et al. 2004), 40.6m (Yang et al. 2006) and 59m (Duncan et al. 1998). One of the reasons for the greater improvement in walking distance in these studies may be the higher intensity of the intervention. The participants in each of the three studies attended treatment sessions three times per week, whereas in the present study participants received treatment only once a week. Salbach and colleagues (2004) suggest that participants with mild walking deficits, defined as having a walking speed of \( \geq 0.7\text{m/s} \), may require a more intensive intervention to increase endurance, and therefore walking distance on the 6MWT, compared to participants with more severe walking deficits. While there are no clear guidelines as to the optimum intensity of community rehabilitation, a widely held belief is that increased intensity assists with recovery following stroke (Langhorne et al. 2011). Indeed, a study comparing intensive community-based rehabilitation (six contacts per week) following stroke, with usual care (three or fewer contacts per week) found small, but significant differences in social participation and HRQoL in favour of participants who had received the more intensive therapy (Ryan et al. 2006). This study did not report on outcome measures relating to mobility.

### 5.3.2b 6MWT results by rehabilitation setting

In the present study, the range of 6MWT distances for home-based participants was 59m to 333m, with a mean distance of 146.4m at baseline, and 188.4m at reassessment. The clinic-based participants walked further at both time points, with a mean walking distance of 287.4m at baseline and 255.9m at reassessment. The range of distances walked by participants in the clinic setting was 143.0m to 399.0m. One-way ANOVA, with one clinic-based outlier removed (see Figure 4.16), found a statistically significant difference between baseline 6MWT distances in the two rehabilitation settings. The clinic-based participants walked a mean distance of 118.6m further [(95% CI 29.8 to 207.5); p=0.01] at baseline than home-based participants. One potential reason to account for this difference is that participants who
had higher levels of mobility at baseline self-selected to the clinic-based rehabilitation setting.

While a difference in walking distance existed at baseline, the most important result to consider is whether changes in 6MWT distance between baseline and reassessment (6MWTdiff) were different between the two settings. Home-based participants had a mean improvement in walking distance of 37.9m over time, whereas clinic-based participants had a mean deterioration in walking distance of 28.7m. Both values represent only a small clinical change in walking distance (Perera et al. 2006). With the outlier removed from the clinic-based group (see Figure 4.15), the mean deterioration in walking distance for this group was only 13.1m, which does not represent a clinically important change. Analysis of 6MWTdiff between treatment locations showed a statistically significant difference of 66.6m, in favour of the home-based group (p=0.04). However, following removal of the outlier from the analysis, the difference between groups was no longer statistically significant [MD=51.0m (95% CI -15.7 to 117.7); p=0.12]; however the confidence intervals are wide and the point estimate is consistent with a clinically important difference between groups. While the home-based participants had a greater improvement in walking distance than clinic-based participants, it is not possible to say with any certainty whether this was due to the rehabilitation programme itself, or because of differences in participant characteristics at baseline. The result in the present research is in contrast to a recent study comparing the effect of a twice-weekly group circuit-training programme with individual clinic-based physiotherapy (van de Port et al. 2012). The authors found a statistically significant difference in the improvement in 6MWT distance, in favour of the group exercise programme, although this difference did not reach clinical significance. In addition, the authors reported that there was no statistically significance difference in the proportion of patients who achieved a clinically significant improvement (≥50m) on the 6MWT (p=0.06), with 50% of participants treated individually and 61% of participants treated in the group reaching this level of improvement. It is important to note that the participants who received individual rehabilitation in that study were treated in an outpatient setting, not at home and therefore, the results may not be directly comparable with the present study.

Despite the improvements seen in the home-based group, the mean distances that these participants walked (146.4m at baseline and 188.4m at reassessment) suggest that within this group, many of the participants would have difficulty walking safely in the community. Using 200m as the criterion for minimum walking distance to attain community mobility
(Brown et al. 2010), seven of the ten home-based participants would not have been able to achieve this at baseline (see Figure 4.6). At reassessment, four of the home-based participants were still only able to walk less than 200m. In contrast, all six of the clinic-based participants were able to walk further than 200m at initial assessment, therefore had achieved the minimum distance required to mobilise in the community. Previous research found no difference in functional mobility status, as measured by the FAC, after eight weeks of rehabilitation between patients who received day hospital or home-based physiotherapy (Young & Forster 1991); however, at six months significantly more patients were able to walk independently outdoors in the home-based group. While that research is in contrast to the current study, the differences seen in the present study are likely to be due to differences in participant characteristics at baseline.

The lack of improvement in walking distance in the group clinic-based participants contrasts with previous research which found group exercise programmes improve mobility outcomes after stroke (Eng et al. 2003; Yang et al. 2006; Wevers et al. 2009; van de Port et al. 2012). Because there were higher motivation levels and higher levels of adherence to the prescribed HEP in the clinic-based group in the present study, outcomes should have improved. Participants in the group clinic-based setting had a mean baseline walking distance of approximately half the distance that of healthy adults, consistent with previous research (Pohl et al. 2004). It may be that these participants had already reached close to their maximum walking distance by the baseline assessment, and this would therefore explain the lack of improvement. However, previous research suggests that patients with stroke, with higher mean walking distances, can still improve sometime after stroke (Yang et al. 2006). Two studies investigating group exercise programmes for community-based patients with stroke, had participants with higher mean walking distances at baseline than in the present study, yet both reported improvements in 6MWT distance (Yang et al. 2006; van de Port et al. 2012). The participants in these studies had a mean improvement of 40.6m (Yang et al. 2006) and an increase from 339m to 412m (van de Port et al. 2012). It is not clear therefore, why clinic-based participants in the present study failed to improve their walking distance on the 6MWT.

One of the reasons for the deterioration in walking distance in a number of the participants may be due to the influence of co-morbidities. Although co-morbidity data were not specifically collected, the rehabilitation programme adherence form (see Appendix Nine) included reasons for non-attendance at the rehabilitation sessions. For a number of the
participants, the reason given for non-attendance was due to another medical condition. Although these conditions did not contraindicate physiotherapy assessment or intervention, they may have had an influence on the participants’ walking ability and endurance, and therefore walking distance on the 6MWT. A second possible reason for a lack of improvement on the 6MWT, as described in section 5.3.2a, was the frequency of the rehabilitation programme. In addition, because the participants in the group clinic-based setting had a reasonable level of mobility at baseline, the intensity of the treatment itself may not have been sufficient to improve endurance, and therefore walking distance on the 6MWT.

The group rehabilitation programme in the current study includes similar aspects of stroke rehabilitation, such as strengthening lower limb muscles and balance retraining, as previous research (Yang et al. 2006; van de Port et al. 2009; van de Port et al. 2012); however, many of the exercises focus on improving impairments. In contrast, Yang’s et al. (2006) and van de Port’s et al. (2012) studies used task-oriented, functional exercises. In fact, Carr and Shepherd (2003) suggest that in order to optimise functional recovery after stroke, exercises that are “functionally relevant” should be practiced. While the group clinic-based rehabilitation programme in the current study included a functional retraining station, this was only a small component of the programme. Previous research has demonstrated the effectiveness of functionally-based, group exercise programmes at improving mobility outcomes, so a review of the current content of the clinic-based rehabilitation programme is recommended to more closely align practice with research.

5.3.2c Feasibility of using the 6MWT

The 6MWT is feasible for use with patients with stroke undergoing community rehabilitation to assess sub-maximal functional capacity as a reflection of community mobility. However, all participants in the present study chose to be assessed at home, and challenges arose to find sufficient space in the home environment to measure the 6MWT. Therefore, the track distances used in the current study were shorter than is recommended by the ATS (American Thoracic Society 2002). Previous research has found that track length has an influence on walking distance over six minutes, with a longer track leading to higher mean walking distances (Ng et al. 2011). Despite this, the results in the present study are consistent with previous research using longer tracks (Salbach et al. 2004; Liu et al. 2008). The treating therapists in the current study used the longest distance available within the participants’ home. This lead to a number of different track lengths being used to evaluate walking
distance. However, importantly the same track length was used for each participant at baseline and reassessment to allow for a valid and reliable comparison, as recommended by Ng and colleagues (2011). Recommendations for improving the practicality of using this measure in a community rehabilitation setting are described in section 5.5.

5.3.3 Secondary objective 3: To assess adherence to the rehabilitation programme
The first part of the section discusses adherence to the rehabilitation sessions, and compares adherence rates between treatment locations. The next part of this section discusses participant adherence to the prescribed HEP, and compares the adherence rates between the two treatment locations. The final part of the section considers the feasibility of using an exercise adherence diary to measure adherence to the HEP.

5.3.3a Adherence to the rehabilitation sessions
The present study found a high adherence rate to the rehabilitation sessions, with a mean percentage of 86.2% of prescribed sessions attended by participants. Home-based participants attended 87.7% of sessions prescribed, and clinic-based participants attended 85.9% of the prescribed sessions. A comparison of the rate ratios of adherence to the rehabilitation sessions found no statistically significant difference in adherence rates between the treatment settings. This is in line with previous research in the field of CR. A systematic review that compared home-based and clinic-based CR programmes concluded that there was no difference in adherence rates between the two rehabilitation settings, despite conflicting results across the nine studies (Dalal et al. 2010). In contrast, a study that compared individual and group rehabilitation programmes for chronic knee pain, both delivered in a clinic setting, found that patients receiving the individual programme had significantly higher adherence to the rehabilitation sessions than those receiving group rehabilitation (Hurley et al. 2007). The authors suggested that the reason for this was that individual sessions were able to be arranged at a convenient time for the patient, while the group sessions were at a fixed time, and sessions that were missed could not be rescheduled.

5.3.3b Adherence to the HEP
The present study found high adherence rates to the prescribed HEP, both in terms of days the HEP was completed and the number of repetitions completed. High adherence was defined as completing 67% or greater of the HEP (Chen et al. 1999; Sjösten et al. 2007). Across both treatment locations, participants completed their exercises on 90.2% of days prescribed, and
completed 98.7% of the repetitions prescribed. Furthermore, six of the fifteen (40%) participants were 100% adherent to the HEP. This is a slightly higher percentage than in a study investigating HEP adherence in patients with upper limb injuries, which found 35% of patients were 100% adherent to the programme (Chen et al. 1999). While in a recent pilot study investigating the adherence of patients with stroke to a HEP both during and after the formal treatment period (Jurkiewicz et al. 2011), the authors reported that all patients (n=7) were 100% adherent to an aerobic-based and a resistance-based HEP during the treatment period.

In the current study, a number of participants completed the HEP more often than prescribed, or completed more repetitions than prescribed. Mayo (1978) reported that completing more treatment than is recommended can be considered a form of non-adherence. In the present study, participants who completed more of the HEP than was prescribed were not considered non-adherent. Research suggests that when a medical condition causes a number of activity limitations and participation restrictions, and the condition is perceived to be serious, adherence is likely to be higher (Haynes 1979; Bassett 2003). Stroke is a condition that can lead to many activity limitations and participation restrictions (Gordon et al. 2004), therefore this may account for the high level of adherence to the HEP during formal rehabilitation in this study. In addition, the use of an exercise adherence diary has been suggested to enhance adherence to the HEP by acting as a reminder to complete the exercises (Bassett 2003). Indeed, in a study of patients with complex regional pain syndrome, the use of an exercise adherence diary increased adherence by 8% (Moseley 2006). Furthermore, in a qualitative study investigating patients’ experience of CR, participants reported that using an adherence diary to record the exercises they had completed helped motivate them, as they knew that the nurse would be coming to visit (Jones et al. 2009). The fact that participants in the current study knew that their exercise diary was going to be collected and their level of adherence to the HEP evaluated, may have increased their adherence to the HEP.

While there was no difference in adherence rates for the rehabilitation sessions between the two treatment locations, participants in the clinic-based setting had higher adherence to the HEP than participants treated at home. This was confirmed by the Poisson regression analyses for both the number of days the HEP was completed [0.69 (95% CI 0.53 to 0.90); p=0.01] and for the repetitions completed [0.68 (95% CI 0.66 to 0.71); p=0.00]. The results of both analyses show that participants in the group clinic-based setting had a statistically
significant higher adherence rate to the HEP. Previous research has found self-motivation to be a significant predictor of HEP adherence (Brewer et al. 2000), and self-determined forms of motivation have also been shown to be positively related to the amount of independent exercise completed (Russell & Bray 2009). Although the difference between treatment settings for the level of intrinsic motivation (as measured by the interest/enjoyment sub-scale of the IMI) was not statistically significant, there was a trend towards higher scores in the clinic-based group (p=0.07). Given that intrinsic motivation is the most self-determined form of motivation (Ryan & Deci 2000b), the higher levels of motivation in the clinic-based group may account for the higher HEP adherence rates.

5.3.3c Feasibility of using an exercise adherence diary to measure adherence

The exercise adherence diary was a simple and inexpensive way to measure participant adherence to the HEP in the current study. There were no reported difficulties with completing it. Although the accuracy of the participants’ self-report of adherence can not be verified in this study, previous research suggests that participants overestimate their adherence by approximately 10% (95% CI 3.0 to 16.9) when using an exercise diary (Moseley 2006). Despite this, the author suggests that using an exercise diary is a useful way to estimate patient adherence to a HEP, taking into account the likely overestimation. Bassett (2003) describes a number of other methods of measuring adherence to exercise, such as electromyographic feedback, stopwatches used in conjunction with video players, and pedometers, but notes that these are costly and are therefore not likely to be feasible for the average physiotherapy practice. Certainly, in the CRT, these methods are not available. It seems that in the clinical setting an exercise diary is a simple and feasible way for therapists to gauge approximate HEP adherence.

5.4 Strengths and limitations of the research

The major strength of this study is that it investigated two rehabilitation programmes in a real clinical setting. The participants who took part in the study are ‘real’ patients who were referred for community rehabilitation following stroke, and the treatment programmes that they completed during this study were the same as ‘usual practice’. This means that the results of this study are likely to be widely generalisable to other patients with stroke undergoing community rehabilitation using similar treatment content. A second strength was the broad inclusion criteria for entry into this study. This lead to patients with both sub-acute and chronic stroke being enrolled and the participants had varying levels of mobility at
baseline. In addition, participants with reduced cognition were not excluded, providing they were able to follow instructions for the testing procedures. This means that the sample of participants in the present study is likely to be representative of patients with stroke with a diverse range of abilities, therefore increasing the generalisability of the results. Finally, there were minimal missing data, with complete data sets obtained from thirteen of the sixteen participants. This may have been because the study period was of a relatively short duration, and was during the period that the participants were undergoing formal rehabilitation. This means that for most of the data analyses there were close to complete data sets to use, which was important given the small sample size of the study, and reduces the risk of bias having affected the results.

Despite the strengths of the study, a number of limitations should be noted. Firstly, the study had a small sample size and consequently confidence intervals were very wide, which shows considerable uncertainty about the precision of the results. Therefore, conclusions drawn from this study should be interpreted with caution, and further research with a larger sample size is required to confirm the results. Secondly, multiple statistical comparisons were carried out in this study without controlling the rate of Type I error. This means that some of the statistically significant results could be due to chance alone.

A third limitation relates to the lack of therapist blinding and participant randomisation. These were not used to allow for the continuation of usual practice within the CRT. The lack of therapist blinding may have introduced bias to the results, as the physiotherapists who carried out the 6MWT assessment were aware of in which setting the participants were receiving rehabilitation. However, to minimise this risk, the research hypotheses were not discussed with the therapists. It is important to note that some risk of introducing bias still existed as the researcher also assessed outcomes, as part of her role as physiotherapist within the CRT. Randomisation was not used in this study to allow participants to choose the setting in which they receive rehabilitation, as is usual practice in the CRT; however, this leads to the risk of selection bias. Indeed, in the present study clinic-based participants had a statistically and clinically significant higher mean walking distance at baseline compared to the home-based participants. This means that care needs to be taken when interpreting the results examining the effect of the two rehabilitation interventions on the 6MWT. It is not possible to say with any certainty whether the difference between the two settings was due to the rehabilitation programme, or due to differences in participant characteristics at baseline. In
addition, it is not possible to determine whether the trend towards higher motivation levels in the clinic-based setting was due to the setting itself, or whether participants with higher levels of motivation chose to receive their rehabilitation in the clinic setting, while those participants with lower levels of motivation chose to be treated at home. Further research, using randomisation, is required to truly determine the effect of the intervention on mobility outcomes, and to determine whether the setting does in fact influence motivation for rehabilitation.

Fourthly, the design of the study meant that the rehabilitation setting (home or clinic) was confounded by the method of delivering rehabilitation (individual or group). This has lead to a lack of certainty over which factor is important in influencing patient motivation for rehabilitation. Fifthly, difficulties arose with measuring the 6MWT in the participants’ home environment, as described in section 5.3.2c. There tended to be a lack of adequate space to measure this outcome, which lead to inconsistencies in 6MWT track length between participants. This may have had an influence on the distance participants were able to walk, however importantly track length was consistent between baseline and reassessment for all participants. Section 5.5 discusses potential options to ameliorate this problem in any future research. Finally, the lack of a known MCID for the two motivation questionnaires, and limited research comparing groups of participants using these questionnaires made it challenging to determine the most clinically appropriate minimum difference needed to be observed to use in the sample size calculation.

5.5 Recommendations for future research

The findings of this study support the need for further research investigating the effect the rehabilitation setting has on motivation following stroke. Future research needs to address the limitations identified in the present study, in order to improve the robustness of the research. Firstly, a larger sample size is required to detect a difference in motivation levels between the two rehabilitation settings, if one exists. The current pilot study suggests in order to detect a five-point difference on the AES, with 80% power and 5% level of significance, a sample size of ninety-six participants is required. Secondly, to reduce the risk of introducing bias to the results, randomisation of participants to the rehabilitation setting, and blinding of an outcome assessor should be used.

Thirdly, while the 6MWT is a feasible outcome measure to use in the community setting to
reflect community mobility, changes to measurement procedures are required to improve the reliability of the results. Future research should consider assessing all participants in the clinic setting, so that the recommended 30m track can be used. However, this may require providing transport for participants, so that they are able to get to the clinic for assessment. Another alternative would be to use a measuring wheel outdoors. This method, using a pre-determined course in the patient’s neighbourhood, has recently been found to be a feasible and reproducible way to evaluate endurance in patients with stroke (Wevers et al. 2011). One potential difficulty that may arise with this method, if the same community rehabilitation setting is used in a future study, is the hilly nature of the environment. A flat course near the participants’ home would need to be found in order to safely use this method to evaluate 6MWT distance. A further option would be to select a short distance that would be suitable for measuring the 6MWT in the home environment. This distance could be used for all participants, and would allow improved standardisation of the measurements and a more accurate comparison of the distance participants walked.

Fourthly, adherence to the HEP was significantly higher in the clinic-based group during the formal rehabilitation period. It would be useful to explore whether adherence rates remain higher following discharge from physiotherapy, as previous research suggests that there is a significant decline in the level of adherence following completion of treatment (Sluijs & Knibbe 1991; Sluijs et al. 1993). If participants who received group rehabilitation maintain higher HEP adherence rates after discharge from the formal rehabilitation programme, this could have implications for the delivery of physiotherapy services. Long-term exercise adherence is important for patients with stroke, to maintain the gains achieved during rehabilitation (Shaughnessy et al. 2006) and to manage risk factors for recurrent stroke (Damush et al. 2007).

Fifthly, while the current study considered whether differences in motivation, clinical outcomes and adherence existed between the two rehabilitation settings, it did not determine whether any of the individual variables, influenced the results of other variables. It would be worthwhile for future research to undertake a more complete analysis to consider not only if differences exist between the rehabilitation settings, but also whether there are associations between the different variables examined. In addition, it may be useful to consider using a mixed methods design for future research. This would enable the researcher to undertake qualitative interviewing with some of participants following the completion of their
intervention. This would give insight into the participants’ views of receiving rehabilitation in the home or clinic setting, and may provide a greater understanding of quantitative findings. Finally, future research may also need to investigate the cost of providing physiotherapy treatment at home versus in a clinic. This is important, so that the most cost-effective method of delivering physiotherapy treatment can be identified.

5.6 Conclusion
This pilot study shows a trend towards higher motivation levels for participants receiving group clinic-based rehabilitation following stroke. In addition, there was a higher rate of adherence to the prescribed HEP for participants in the clinic-based setting. While there was no statistically significant difference in the change in 6MWT distance between rehabilitation settings, the home-based participants did have a clinically significant improvement compared to clinic-based participants. It was not possible to determine the cause of this difference however, as limitations in the design of the study lead to significant differences in baseline 6MWT results.

This study shows that it is possible to measure the motivation levels of community-based patients with stroke using the AES and the IMI. In addition, the use of an exercise adherence diary is a simple and feasible way to measure adherence to a prescribed HEP. The 6MWT is a reliable and valid outcome measure, and proved a useful tool to use as a reflection of community mobility for patients with stroke undergoing rehabilitation. Challenges arose in the measurement of the 6MWT in the home environment; however, with changes to the measurement procedure this outcome would be feasible for use in future community-based research.

The limitations of this study limit the clinical applicability of the results, however further research, using more robust methods and a larger sample size, is warranted to explore whether the rehabilitation setting affects motivation and outcomes following stroke. This is important, so that the most effective method of delivering physiotherapy services can be provided to patients undergoing community rehabilitation for stroke. In addition, the research has highlighted the need for a review of the current content of the group clinic-based rehabilitation programme, to more closely align practice with research.
References


Xie, K., Durrington, V. & Yen, L.L. (2011). "Relationship between Students' Motivation and their Participation in Asynchronous Online Discussions." Journal of Online Learning and
Teaching 7(1): 17-29.


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Dear Sir/Madam,

You have been invited to potentially participate in a study being completed by Stephanie Thompson, a Master's student at the University of Otago.

This is a preparation study which aims to establish how many participants are needed for a future, larger study. The future study will investigate whether the rehabilitation setting (clinic or home) influences client motivation for rehabilitation and whether this has an effect on the outcome of rehabilitation.

Please read through the information sheet provided. Please feel free to ask me about anything you do not understand or if you have any questions.

Kind regards,

Stephanie Thompson
Physiotherapist, BPhy, PGDipRehab
Phone: (04) 918 6355
Participant Information Sheet

Effect of the rehabilitation setting on motivation post stroke – a pilot study

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Stephanie Thompson</th>
<th>Phone (04) 918 6355</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Supervisor</td>
<td>Associate Professor Will Taylor</td>
<td>Phone (04) 385 5541 ext 4801</td>
</tr>
</tbody>
</table>

Invitation

You are invited to take part in a preparation study evaluating differences in motivation between two groups taking part in rehabilitation programmes for stroke. The purpose of this information sheet is to give you the information you need to be able to decide whether or not to take part in this research study. You can keep this to read and consider before making up your mind.

Please remember that:

- Your participation in this study is entirely voluntary (your choice). You do not have to take part in this study, and if you choose not to take part, you will still receive your usual treatment and your future health care will be in no way affected.
- If you do agree to take part in this study, you are free to withdraw at any time, without having to give a reason and this will in no way affect your current treatment or your future health care.
- The study is being carried out by a researcher undertaking a Master of Health Sciences through the University of Otago.
- The researcher works as a physiotherapist and you may receive your physiotherapy treatment from her. Her work as a physiotherapist is entirely separate to this study.
This information sheet will explain the research study. Please feel free to ask about anything you do not understand or if you have questions, at anytime.

**What is the purpose of the study?**
The main purpose of this study is to establish how many participants are needed for a future, larger study. The future study will investigate whether the rehabilitation setting (clinic or home) influences client motivation for rehabilitation and whether this has an effect on the outcome of rehabilitation.

**How are participants chosen for this study?**
Participants are being invited to take part in this study if they are identified as meeting all of the following criteria:
- Have a diagnosis of stroke
- Will receive physiotherapy treatment
- Are able to complete a walking test
- Are able to follow instructions

**Where will the study take place?**
If you are receiving physiotherapy at your home, all assessments and treatment will take place there. If you are receiving group physiotherapy at the clinic, your treatment will take place at the gym at Ewart Building, 2 Coromandel Street, Newtown, Wellington. You can choose whether your assessments take place at your home or at the clinic.

**What will happen during the study?**
You will receive your usual physiotherapy treatment. In addition to usual assessments, all participants will be asked to complete a 6 minute walking test and 2 motivation questionnaires. You will also be asked to keep an exercise diary for the first 2 weeks and last 2 weeks of the study. Your physiotherapist will keep a record of the number of rehabilitation sessions you attend during the study. Information about your age, gender, ethnicity, when your stroke was and the side affected by the stroke will also be collected. As part of usual care, if you require an interpreter one will be provided for you.

*Effect of the rehabilitation setting on motivation post stroke – a pilot study, version 1, 02/02/2011.*
What is the time span for participant involvement in the study?
You will be involved in the study for up to 10 weeks. If your physiotherapy treatment is finished before week 10, your reassessment for the study will take place at the time of your last physiotherapy appointment.

What are the risks of the study?
There should not be any risk to you from this study. All assessments and treatment will be provided by a New Zealand registered physiotherapist.

How will this study help?
This preparation study will help to establish how many participants will be needed for a future, larger study. The results will also add to what is already known about how the rehabilitation setting influences the outcome of rehabilitation for people recovering from stroke.

How will my privacy be protected?
All information you give will be kept confidential. The information will be kept in a locked cabinet. No material that could personally identify you will be used in any reports on this study.

Compensation
No harm is likely to happen to you from taking part in this study. However, in the unlikely event of a physical injury as a result of your participation in this 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 on 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 investigators.

**What will happen with the results?**
The results will be used to calculate how many participants are required for a future, larger study. A summary of the results will be provided to health professionals at Capital & Coast District Health Board.

**Will I be able to have a copy of the results?**
If you would like a summary of the results these will be sent to you at the end of the study. There may be quite a delay between collecting information and letting people know about the results.

**If you have any concerns or questions?**
If you have any questions please feel free to contact Stephanie Thompson, or the principal supervisor of this Master’s project:

Stephanie Thompson Phone: 918 6355
Email: thost258@otago.ac.nz

Associate Professor Will Taylor Phone: 385 5541 ext 4801
Email: william.taylor@otago.ac.nz

**Statement of Ethical Approval**
This study has received ethical approval from the Central Ethics Committee, ethics reference number CEN11/03/015. If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact an independent health and disability advocate:
Free phone: 0800 555 050
Free fax: 0800 2 SUPPORT (0800 2787 7678)
Email: advocacy@hdc.org.nz
Appendix Three

Consent Form

Effect of the rehabilitation setting on motivation post stroke -
a pilot study

<table>
<thead>
<tr>
<th>Language</th>
<th>I wish to have an interpreter</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>I wish to have an interpreter</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Deaf</td>
<td>I wish to have a NZ sign language interpreter</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Māori</td>
<td>E hiaha aha ki tetahi kaiwhaka Māori/kaiwhaka pakeha korero</td>
<td>Ae</td>
<td>Kao</td>
</tr>
<tr>
<td>Cook Island Māori</td>
<td>Ka inangaro au itetai tangata uri reo</td>
<td>Ae</td>
<td>Kare</td>
</tr>
<tr>
<td>Fijian</td>
<td>Au gadreva me dua e vakadewa vosa vei au</td>
<td>Io</td>
<td>Sega</td>
</tr>
<tr>
<td>Niuean</td>
<td>Fia manako au ke fakaaga e taha tagata fakahokohoko kupu</td>
<td>E</td>
<td>Nakai</td>
</tr>
<tr>
<td>Sāmoan</td>
<td>Ou te mana’o ia i ai se fa’amatala upu</td>
<td>Ioe</td>
<td>Leai</td>
</tr>
<tr>
<td>Tokelaun</td>
<td>Ko au efofou ki he tino ke fakalili te gagana Peletania ki na gagana o na motuo to Pahefika</td>
<td>Ioe</td>
<td>Leai</td>
</tr>
<tr>
<td>Tongan</td>
<td>Oku ou fiema’u ha fakatonulea</td>
<td>Io</td>
<td>Ikai</td>
</tr>
</tbody>
</table>

This is a preparation study which aims to establish how many participants are needed for a future, larger study. The future study will investigate whether the rehabilitation setting (clinic or home) influences client motivation for rehabilitation and whether this has an effect on the outcome of rehabilitation.

I have read and I understand the information sheet dated ____________ for volunteers taking part in this study.

I have had the opportunity to discuss this study with the researcher. I am satisfied with the answers I have been given.

I have had the opportunity to use family members, whānau support or a friend to
help me ask questions and understand the study.

I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time and this will in no way affect my current treatment or future health care.

I understand that my participation in this study is confidential and that no material which could identify me will be used in any reports on this study.

I have had time to consider whether to take part.

I know who to contact if I have any questions about the study.

I wish to receive a copy of the results  YES / NO

I agree to my GP being informed of my participation in this study  YES/NO

I ________________________________ (full name) hereby consent to take part in this study.

Date ______________

Signature ____________________

Full name of Researcher:  Stephanie Thompson, NZRP
Phone: (04) 918 6355  Email: thost258@otago.ac.nz

Research Supervisor:  Will Taylor
Phone: (04) 385 5541 ext 4801  Email: william.taylor@otago.ac.nz

Project explained by ________________________________

Project role ________________________________

Signature ________________________________

Date ________________________________

A copy of the consent form is to be retained by the participant, and a copy will be placed in the medical file.

Effect of the rehabilitation setting on motivation post stroke – a pilot study, version 1, 02/02/2011.
Date:

Dear Dr ________________,

RE:

Patient name:
NHI:

______________________ has been enrolled in the study “Effect of the Rehabilitation Setting on Motivation and Clinical Outcomes Post Stroke – a Pilot Study”. This study is being undertaken by Stephanie Thompson, a Master's student at the University of Otago. Your patient will receive usual community rehabilitation, and will be involved in this study for up to 10 weeks.

Yours sincerely,

Stephanie Thompson
Physiotherapist
Phone: 918 6355
Email: thost258@otago.ac.nz
Appendix Five

Participant demographics

ID: ___________________

Age: __________________

Sex:  Male ☐   Female ☐

Ethnicity: _______________________

Length of time since stroke: _________ days
                                  _________ months

Side of hemiplegia:  Right ☐      Left ☐
Apathy Evaluation Scale (Self-rated)

ID: ___________                Date: ___/___/___

For each statement, circle the answer that best describes the subject’s thoughts, feelings, and activity in the past 4 weeks.

1. I am interested in things.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

2. I get things done during the day.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

3. Getting things started on my own is important to me.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

4. I am interested in having new experiences.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

5. I am interested in learning new things
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

6. I put little effort into anything.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

7. I approach life with intensity.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

8. Seeing a job through to the end is important to me.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT

9. I spend time doing things that interest me.
NOT AT ALL    SLIGHTLY    SOMEWHAT    A LOT
10. Someone has to tell me what to do each day.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

11. I am less concerned about my problems than I should be.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

12. I have friends.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

13. Getting together with friends is important to me.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

14. When something good happens, I get excited.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

15. I have an accurate understanding of my problems.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

16. Getting things done during the day is important to me.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

17. I have initiative.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

18. I have motivation.

   NOT AT ALL    SLIGHTLY   SOMEWHAT    A LOT

The Apathy Evaluation Scale was developed by Robert S. Marin, M.D. Development and validation studies are described in RS Marin, RC Biedrzycki, S Firinciogullari: “Reliability and Validity of the Apathy Evaluation Scale,” Psychiatry Research, 38:143-162, 1991
Six minute walk test

ID: ____________                      Date: ____________

Setting: Home                     Clinic

Length of track: ______________

<table>
<thead>
<tr>
<th>Minute</th>
<th>Number of lengths</th>
<th>Number of rests</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SpO₂    Pre:_______  Post:__________
HR      Pre:_______  Post:__________
Borg RPE Pre:_______  Post:__________

Total distance:_________________

Comments:    ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
               ______________________________________
Exercise adherence diary

- Please fill in the exercise diary when you complete your exercises at home
- On the days that you complete the exercises write the number of repetitions of each exercise you complete in the box marked “Repetitions completed”
- If you do not complete an exercise, please leave the box blank

Example:

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Monday Repetitions completed</th>
<th>Tuesday Repetitions completed</th>
<th>Wednesday Repetitions completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging x5</td>
<td>5</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Knee bends</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

- Complete these exercises ____ times per week
- Please return the completed exercise diary to your physiotherapist
## Exercise adherence diary

### Week 1

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
</tr>
</tbody>
</table>
## Week 2

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
<td>Repetitions completed</td>
</tr>
</tbody>
</table>
### Adherence to the rehabilitation programme

(To be completed by treating physiotherapist)

**ID:** ________

**Rehabilitation programme:**
(please circle) Group Individual

#### For group participants:

<table>
<thead>
<tr>
<th>Week</th>
<th>Group attended? Yes/No</th>
<th>Reason for non-attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### For individual participants:

<table>
<thead>
<tr>
<th>Week</th>
<th>Appointment(s) booked (date)</th>
<th>Appointment attended? Yes/No</th>
<th>Reason for non-attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Week 4</td>
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<tr>
<td>Week 5</td>
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<td></td>
<td></td>
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<tr>
<td>Week 6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix Ten

Intrinsic motivation inventory

The following items concern your experience with the rehabilitation programme. Please answer all items. For each item, please indicate how true the statement is for you, using the following scale as a guide:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all true</td>
<td></td>
<td></td>
<td>Somewhat true</td>
<td></td>
<td></td>
<td>Very true</td>
</tr>
</tbody>
</table>

1. I believe that doing the rehabilitation programme could be of some value for me

2. I believe I have some choice about doing the rehabilitation programme

3. While I was doing the rehabilitation programme, I was thinking about how much I enjoyed it

4. I believe that doing the rehabilitation programme is useful for improving my walking

5. The rehabilitation programme was fun

6. I think that doing the rehabilitation programme is important for my improvement

7. I enjoyed the rehabilitation programme very much

8. I really did not have a choice about doing the rehabilitation programme

9. I did the rehabilitation programme because I wanted to

10. I think doing the rehabilitation programme is important
11. I felt like I was enjoying the rehabilitation programme while I was doing it

12. I thought the rehabilitation programme was very boring

13. It is possible that doing the rehabilitation programme could improve my walking

14. I felt like I had no choice but to do the rehabilitation programme

15. I thought doing the rehabilitation programme was very interesting

16. I am willing to do the rehabilitation programme again because I think it is somewhat useful

17. I would describe doing the rehabilitation programme as very enjoyable

18. I felt like I had to do the rehabilitation programme

19. I believe doing the rehabilitation programme could be somewhat beneficial for me

20. I did the rehabilitation programme because I had to

21. I believe doing the rehabilitation programme could help me walk better

22. While doing the rehabilitation programme I felt like I had a choice

23. I would describe doing the rehabilitation programme as very fun

24. I felt like it was not my own choice to do the rehabilitation programme

25. I would be willing to do the rehabilitation programme again because it has some value for me.
26. I would have preferred rehabilitation in a group setting but I am unable to attend for reasons such as cost, or a lack of available transport to the group.
Serious Adverse Events Form
Effect of the rehabilitation setting on motivation post stroke – a pilot study

Participant information

ID number: __________________

Gender: Male ☐  Female ☐

Rehabilitation setting: Clinic ☐  Home ☐

Date of the serious adverse event: ____________

Type of serious adverse event:

- Fall ☐
  - was equipment involved? YES ☐  NO ☐
  - type of equipment: ________________________________

4. Clinical emergency

- bleeding ☐
- cardiac ☐
- respiratory ☐
- other ☐  ________________________________

Description of the serious adverse event

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Outcome of the serious adverse event

- Severe/death  
- Major  
- Moderate  
- Minor  
- Minimal  
Appendix Twelve

11 April 2011

Associate Professor William Taylor
University of Otago - Wellington School of Medicine
Rehabilitation Teaching and Research Unit
University of Otago Wellington
PO Box 7343
Wellington

Dear Associate Professor Taylor -

Re: Ethics ref: CEN/11/03/015 (please quote in all correspondence)
Study title: Effect of the Rehabilitation Setting on Motivation and Clinical Outcomes
Post Stroke - a Pilot Study
Investigators: Associate Professor William Taylor, Professor Mark Weatherall, Ms Stephanie Thompson
Approved Localities: Capital and Coast District Health Board

This study was given ethical approval by the Central Regional Ethics Committee on 11th April 2011. A list of members of the Committee is attached.

Approved Documents

- National Application Form with requested amendments
- Signed part 4 declaration for Associate Professor William Taylor
- Signed Form A
- Approval letter from the Board of Graduate Studies in Health Sciences, University of Otago - signed and dated 9 December 2010 by Dr Jean Hay-Smith
- Study Protocol, version 1, dated 2 February 2011
- Six minute walk test, version 1, dated 2 February 2011
- Apathy Evaluation Scale (Self-rated), version 1, dated 2 February 2011
- Exercise Adherence Diary, Version 1, dated 2 February 2010
- Participant Demographics, version 1, dated 2 February 2011
- Adherence to the rehabilitation programme, Version 1, dated 2 February 2011
- Serious Adverse Events Form, Version 1, dated 2 February 2011
- Invitation letter, version 1, dated 2 February 2011
- Participant Information Sheet, version 1, dated 2 February 2011
- Intrinsic Motivation Inventory, Version 2, dated 21 March 2011
- Consent Form, Version 2, dated 21 March 2011
- Letter to GP, version 1, dated 21 March 2011
- Evidence of Maori Consultation - Letter signed and dated 9 March 2011 by Mark Brunton, Ngai Tahu
- Signed locality Assessment for Wellington Community ORA Team at Capital and Coast Health Board
This approval is valid until **11 April 2016**, 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
- information sheets and informed consent procedures.

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

**Annual Progress Reports and Final Reports**

The first Annual Progress Report for this study is due to the Committee by **11 April 2012**. The Annual Report Form that should be used is available at [www.ethicscommittees.health.govt.nz](http://www.ethicscommittees.health.govt.nz). Please note that if you do not provide a progress report by this date, ethical approval may be withdrawn.

A Final Report is also required at the conclusion of the study. The Final Report Form is also available at [www.ethicscommittees.health.govt.nz](http://www.ethicscommittees.health.govt.nz).

**Requirements for the Reporting of Serious Adverse Events (SAEs)**

SAEs occurring in this study must be individually reported to the Committee within 7-15 days only where they:

- are unexpected because they are not outlined in the investigator’s brochure, and
- are not defined study end-points (e.g. death or hospitalisation), and
- occur in patients located in New Zealand, and
- if the study involves blinding, result in a decision to break the study code.

There is no requirement for the individual reporting to ethics committees of SAEs that do not meet all of these criteria. However, if your study is overseen by a data monitoring committee, copies of its letters of recommendation to the Principal Investigator should be forwarded to the Committee as soon as possible.

Please see [www.ethicscommittees.health.govt.nz](http://www.ethicscommittees.health.govt.nz) for more information on the reporting of SAEs, and to download the SAE Report Form.
Statement of compliance

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

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

We wish you all the best with your study.

Please do not hesitate to contact me should you have any queries.

Yours sincerely

Laura Jayne Burlison
Administrator
Central Regional Ethics Committee
Email: central_ethicscommittee@moh.govt.nz
15 April 2011

Stephanie Thompson
Physiotherapist
Ewart Building
Wellington Hospital

Tena koe

Thank you for your request for appropriate support from Whanau Care Services for any Maori research participants, their whanau and any staff involved.

We are happy to be able to support this request. If you require Whanau Care Services brochures or have any further queries please do not hesitate to contact me.

Naku noa, na

[Signature]

Anne Natoli
Service Coordinator
Whanau Care Services
Maori Health Development Group
Appendix Fourteen

Ngāi Tahu Research Consultation Committee
Te Komiti Rakahau ki Kāi Tahu

08/03/2011 - 43
Wednesday, 09 March 2011

Associate Professor Taylor
Rehabilitation Teaching and Research Unit
Wellington

Tēnā koe Associate Professor Taylor

Title: Effect of the rehabilitation setting on motivation and clinical outcomes post stroke
- a pilot study

The Ngāi Tahu Research Consultation Committee (The Committee) met on Tuesday, 08 March 2011 to discuss your research proposition.

By way of introduction, this response from the Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum, it states "Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago". As such, this response is not "approval" or "mandate" for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology; they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

The Committee commends the researchers on their intention to collect ethnicity data be collected as part of the research project and recommends the use of the questions on self-identified ethnicity and descent, these questions are contained in the 2006 census.

The Ministry of Health website

The Ngāi Tahu Research Consultation Committee has membership from:

Te Rūnanga o Ōhikou Incorporated
Kāi Huirama Rūnaka ki Poketereaki
NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHAU KI KĀI TAHU

http://www.hauora.maori.nz/. These publications provide information on a range of Māori health issues and will assist in ensuring your research has an appropriate Māori health focus.

The Committee suggests dissemination of the research findings to Māori health organisations regarding this study.

We wish you every success in your research and the Committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 08 March 2011 to 08 September 2012.

The recommendations and suggestions above are provided on your proposal submitted through the consultation website process. These recommendations and suggestions do not necessarily relate to ethical issues with the research, including methodology. Other committees may also provide feedback in these areas.

Nāhaku noa, nā

Mark Brunton
Kaitakawaenga Rangahau Māori
Facilitator Research Māori
Research Division
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The Ngāi Tahu Research Consultation Committee has membership from:
Te Rūnanga o Ōtākou Incorporated
Kāi Huiŋa Rūnaka ki Puketeriki
19 April 2011

Stephanie Thompson
Wellington Community ORA Team
Ewart Building, 2 Coromandel St,
Newtown

Tēnā koe Ms Thompson

RAG-M 2011/122(2) – Letter of Endorsement

On behalf of the Research Advisory Group Māori I write in relation to your study titled “Effect of the rehabilitation setting on motivation and clinical outcomes post stroke – a pilot study.”

You have supplied a RAG-M cover sheet, a study protocol, participant information sheet, and a consent form.

Our reading of your proposal characterises the research as:
- A pilot study to determine the feasibility of and sample size for a future trial evaluating the difference in motivation between stroke patients taking part in group clinic-based and individual home-based rehabilitation programmes.
- A study involving around 20 patients requiring community rehabilitation recruited from the Wellington Community Older Adults, Rehabilitation and Allied Health service of CCDHB, of whom one may be Māori.
- A study in which participants will complete an exercise adherence diary for the first and last two weeks of their rehabilitation programme and complete assessments using the AES and 6MW at baseline and after eight weeks of treatment or on completion of treatment, and the IMI at completion.
We note that:

- you are seeking approval from the Central Region Health and Disability Ethics Committee;
- you will advise the Research Committee of the CCDHB of the conduct of this research.

Given the possibility of Māori stroke patients as participants, we would expect that:

- you would ensure that any Māori who participates is well informed and supported, including their whanau as appropriate;
- you would recognise any cultural expectations and seek to meet these expectations responsively;

We acknowledge your support agreement with Whanau Care Services.

RAG-M are satisfied that you have read and understood the expectations outlined in this letter. We have received your email dated 19 April 2011, acknowledging and addressing these expectations and therefore are happy to endorse this research project.

Upon completion of your study, it would be useful if a copy of your findings was sent to RAG-M.

We thank you for consulting RAG-M and wish you well in your study.

Nāku noa nā

Jack Rikihana
Chair RAG-M