A multidisciplinary intensive mobility program for community dwelling stroke survivors.

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Preface

This thesis consists of four chapters. **Chapter One** provides an overview of rehabilitation in the community after stroke. **Chapter Two** explores the rationale for an intensive mobility program which integrates multidisciplinary therapy and self-management. Together, Chapters One and Two provide a basis for the implementation study outlined in Chapter Three. **Chapter Three** is an original research paper presented as the manuscript that has been submitted for publication in *Stroke Research and Treatment*. This implementation study investigated the feasibility of an intensive mobility program implemented using a multidisciplinary team and embedded self-management. **Chapter Four** is a systematic discussion of the findings of this thesis. The findings of the research paper and strengths and limitations of the study are reflected on, and the implications for clinical practice and future research are discussed. The references for Chapters One, Two and Four are presented together after Chapter Four. The figure, tables and references for Chapter Three are presented at the end of the chapter.

Thesis Aims

The broad aim of this thesis is to examine the implementation of an intensive mobility program delivered with a self-management approach by a multidisciplinary team within a community rehabilitation setting. The specific objectives of this thesis are outlined below.

Chapters One and Two:

- Critically appraise the literature on amount of practice in community stroke rehabilitation.
- Explore current methods to increase amount of practice in rehabilitation after stroke.
- Review the evidence on the effectiveness of multidisciplinary approaches in rehabilitation after stroke and the need for self-management in stroke interventions.
- Summarise the rationale for the intensive mobility program delivered in Chapter Three.

Chapter Three:

- Examine the acceptability and adherence to an intensive mobility program by stroke survivors in the community and evaluate the feasibility of the program for longer term stroke rehabilitation.
- Report on the clinical outcomes which were observed after the program was implemented.

Chapter Four:

- Evaluate the implementation of the intensive mobility program completed in Chapter Three and discuss the factors which influenced implementation.
- Review the strengths and limitations of the study completed in Chapter Three.
- Review the research and clinical implications from the intervention and directions for future practice.

Abstract

This thesis explores the implementation of a novel intensive mobility program for community dwelling stroke survivors involving a multidisciplinary team and self-management approach.

Interventions aimed at increasing amounts of practice after stroke are known to improve functional outcomes such as mobility. Recently there has been a drive to quantify dosage of practice more accurately in stroke rehabilitation to better determine the effect of practice on functional outcomes. This is particularly pertinent in community settings, which do not commonly provide higher intensity rehabilitation when compared to acute or sub-acute rehabilitation settings. Traditionally, previous methods to increase practice in rehabilitation have included the use of additional therapy sessions, semi supervised practice, circuit, and group training and self-directed (independent) practice. Recently there has been more interest in structured intensive programs to increase the amount of practice completed in rehabilitation settings. The success of more intensive programs suggests they may be worth investigating later after stroke and to improve mobility outcomes in community dwelling populations.

To date, there have been only a small number of more intensive mobility programs offered to people after stroke, with little research into the feasibility of implementing intensive programs in the community. Programs which are developed for community rehabilitation should consider the unique needs and barriers of community dwelling stroke survivors and consider the complex relationship with function and self-management in the long term. While community dwelling stroke survivors generally exhibit high adherence to standard therapy programs, little is known about their adherence and the acceptability of more intensive mobility programs. Therefore, an implementation study was completed to investigate the feasibility of implementing an intensive mobility program for community dwelling stroke survivors. The program was delivered by a multidisciplinary team which included physiotherapy, occupational therapy and exercise physiology and included an embedded self-management program.

The findings of the study show that an intensive mobility program can be delivered feasibly to community dwelling stroke survivors with high adherence and acceptability. The study also shows that clinical outcomes observed after participating in an intensive mobility program are promising and warrant further investigation.

The intervention was able to be implemented successfully due to use of effective knowledge translation within the multidisciplinary team, including strategies to facilitate regular and ongoing communication, as well as clinical and participant resources. Future research should consider the use of clinical outcome measures, the setting of rehabilitation and the receptivity of participants.

Candidate's Statement

I, Avanthi Elisha Ball, certify that the work in this thesis titled 'A multidisciplinary intensive mobility program for community dwelling stroke survivors' has not been previously submitted for a degree nor has it been submitted as part of requirements for a degree to any other university of institution other than Macquarie University.

I also certify that the thesis is an original piece of research, and it has been written by me. Any help and assistance that I have received in my research work and the preparation of the thesis itself have been appropriately acknowledged.

In addition, I certify that all information sources and literature used are indicated in the thesis. The research presented in this thesis was approved by the Macquarie University Human Research Ethics Committee (520211072635749). This study was registered on 8 December 2021 (registration number ACTRN12621001677897p).

Avanthi Elisha Ball (Student No.: 44844379)

Date: 20 June 2022

Supervisor's Statement

As the supervisor of Avanthi Elisha Ball's Master of Research work, I certify that I consider her thesis 'A multidisciplinary intensive mobility program for community dwelling stroke survivors' to be suitable for examination.

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Date: 25 June 2022

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List of Abbreviations

ADL	Activities of Daily Living
AMAT-F	Arm Motor Ability Test Function
ARAT	Action Research Arm Test
BCT	Behaviour change technique
COPD	Chronic Obstructive Pulmonary Disease
COPM	Canadian Occupational Performance Measure
COVID-19	Coronavirus disease of 2019
ESES	Exercise Self Efficacy Scale
EQ-5D 5L	European Quality of Life Five Dimensions
FM	Fugel-Meyer
HRR	Heart Rate Reserve
ICF	International Classification of Functioning, Disability and Health
IDT	Interdisciplinary Team
MAS	Motor Assessment Scale
MDT	Multidisciplinary Team
MMSE	Mini Mental State Examination
PARQ	Physical Activity Readiness Questionnaire
RCT	Randomised controlled trial
RPE	Borg Rating of Perceived Exertion
SD	Standard Deviation
SF-12	Short Form Survey 12
SPPB	Short Physical Performance Battery
TaCAs	Taking Charge After Stroke
VO_2 max	Maximal Oxygen Consumption
WHO	World Health Organisation
2MWT	2 Minute Walk Test
6MWT	6 Minute Walk Test
12MWT	12 Minute Walk Test

Chapter One:
Community Rehabilitation and Intensive Practice

1.1 Introduction

Stroke is a leading cause of disability in Australia.[1] Advances in acute care mean the post stroke survival rate is high and nearly 65% of stroke survivors are discharged from hospital to home settings.[1] Many individuals continue to rely on formal or informal care post-discharge, indicating they may have reached a certain level of function, but have not yet reached independence in mobility or activities of daily living (ADL).[2] As a result many stroke survivors need ongoing rehabilitative care in order to address ongoing activity limitations and prolonged disability.[1, 3] There are a limited number of community programs which offer ongoing rehabilitation in the chronic stage of stroke.[4-9] But few of these programs are highly structured, intensive and multidisciplinary.[6] Currently, there is a definitive evidence gap in the development of intensive mobility programs for stroke survivors living in the community who want to improve their physical function, mobility, and quality of life in the longer term after stroke, and a lack of definition of what is considered an acceptable model of more intensive training for this population.[6]

In Chapter One and Two of this thesis the evidence for more intensive training in community stroke populations will be evaluated and the rationale for developing an intensive mobility program will be summarised. Current programs which are offered to community dwelling stroke survivors, include methods which increase the amount of practice, such as semi supervised and self-directed practice.[3, 4, 10-14] There is still substantial difficulty in translating what has been used previously in acute and inpatient rehabilitation settings to progress mobility in the community after stroke.[3, 4, 10-14] Given community dwelling stroke survivors experience unique and complex barriers to ongoing rehabilitation, including adherence and acceptability, the evidence for using multidisciplinary teams and self-management programs to deliver more intensive rehabilitation will also be considered.[15] The rationale for how the intensive mobility program was developed as a summary of the current best available evidence will be discussed in Chapters One and Two of this thesis and the study itself will be presented in Chapter Three of this thesis. Chapter Four will evaluate the implementation of the program and reflect on the strengths and limitations of the program and future directions for clinical practice.

1.2 Rehabilitation after stroke

Rehabilitation has a role in improving function, quality of life and mobility after stroke.[1] The aims of rehabilitation may differ across acute and community settings, and both have a role in supporting recovery of function after stroke.[1] A review of the unique role of community rehabilitation, suggests the increasing need for more developed rehabilitation programs. This is particularly important for stroke survivors who need or expect ongoing rehabilitation and functional recovery in the community.[3]

Rehabilitation after stroke can occur in several settings including inpatient, outpatient, home, and community rehabilitative settings. Rehabilitation is designed to address the deficits of motor and sensory systems which result in loss of independence in mobility or activities of daily living (ADL) and quality of life.[1] Many rehabilitative settings provide access to various health professions forming multidisciplinary or interdisciplinary teams.[16] Specialised rehabilitative teams may include rehabilitation physicians, physiotherapists, occupational therapists, exercise physiologists, speech and language pathologists, psychologists and dietitians.[16] In these settings the stroke survivor alongside their family, carers and supports are given the opportunity to identify goals to address persisting impairments, activity limitations and progress independence.[16]

Australian national guidelines for care following stroke recommend that comprehensive and multidisciplinary care begin early after stroke, followed by care in a specialist stroke unit and a period of rehabilitation.[3] Community rehabilitation is increasingly considered with early supported discharge to reduce length of stay and reduce the instance of institutionalisation after stroke. A recent national stroke audit indicated that 64% of stroke survivors are referred for further rehabilitation in the community after formal discharge from hospital, regardless of discharge destination.[1] Those hoping for ongoing goal directed rehabilitation should be afforded this opportunity in the longer term. This opportunity may result in a higher demand for services which provide longer term rehabilitation in community after stroke.[1]

Due to the abrupt and often complex nature of stroke and shorter lengths of stay spent engaging in inpatient rehabilitation, many stroke survivors are given little time to prepare for life after stroke and return to home settings.[16] This results in many stroke survivors only experiencing the true impact of their disability after discharge home and often worsening function.[16] While inpatient rehabilitative settings help people reach certain thresholds of functional independence to prevent further health decline, community rehabilitative settings may progress function to better facilitate independence, community participation or social engagement.[3] Often stroke survivors are discharged home from high support settings to family members or informal supports who are not prepared or resourced to provide ongoing care or facilitate rehabilitative progress in home settings.[16] Rehabilitation in the community may offer this level of support and goal directed opportunity.[16]

Rehabilitation is an opportunity to improve function, mobility, and quality of life after stroke.[17] While more acute rehabilitation may prevent further health decline, the role of community rehabilitation may be to provide a means for ongoing recovery, ongoing goal achievement and improved independence well after the stroke.[3] There is an increasing population of stroke survivors being discharged directly to the community, which increases demand for services. Therefore, there is a need for investigation into rehabilitation which provides both evidenced-based and cost-effective models of ongoing rehabilitation to this population.[1, 10]

1.3 Rehabilitation and amount of practice

Rehabilitation involves structured repetitive practice to drive neuroplasticity after stroke.[18] A large amount of practice is required for motor adaptation and learning after stroke.[18] However, the exact amount of practice to achieve optimal functional outcomes is currently unknown.[18] Pre-clinical and clinical trials have shown that performing a larger amount of repeated and challenging movement tasks result in neural adaptions including larger brain representations of areas controlling the movement and subsequently changes in motor systems and function.[18, 19] This process of reorganizing and consolidating neural pathways is called neuroplasticity or neural reorganisation and is the basis of neurological rehabilitation after injury such as stroke.[20] Neuroplasticity driven recovery after stroke is dependent on

several factors including the location and extent of the original injury, time since stroke, context of training and the activity trained.[21] While most neuroplasticity is thought to occur in the initial three months after stroke, there is evidence that it continues at a slower rate years after the initial stroke.[21] It has not yet been determined how much practice, what level of challenge or task specificity influences motor learning and functional recovery later after stroke.[20] Nor how these practices can be successfully implemented in higher intensity training in the chronic stage of recovery after stroke.[19]

It is challenging to measure practice in rehabilitation and accurately describe practice in research.[15] With increasing clarity as to how practice can be measured, structured reporting of amounts of practice may help translate findings from more acute trials into other settings such as in the community.[15, 22] There is a relationship between rehabilitation setting and therapy time, and therapy time and amounts of practice.[23] Acute and mixed settings provide methods to increase therapy time and practice through use of additional therapy, semi supervised, circuit or self-directed practice which may be helpful in developing evidence-based models to increase the amount of practice in community settings after stroke.[23] Intensive programs have been used in mixed settings with some success.[23, 34, 38-41] There are a number of considerations to implementing more intensive models after stroke including hesitancy, education, and resources, which should be considered when implementing higher amounts of training.[12, 24] To date, few intensive practice programs have been offered to community dwelling survivors.[25, 26] Later in this chapter the dosage and types of programs offered in the community will be analysed in view of the current evidence around amount of practice and models for rehabilitation after stroke.[2, 4, 10, 11, 27, 28] A review of the current literature shows that amount of practice in community settings remains relatively low and does not reflect the intensity that inpatient settings offer, nor preclinical and clinical amounts of practice believed to positively drive neuroplasticity.[6]

1.3.1 Defining and measuring ‘amount of practice’ in rehabilitation

There is a known positive ‘dose-response’ relationship in stroke rehabilitation.[18] However, there is still ambiguity about what this term means and how it can be

implemented in clinical practice in community stroke settings.[15] Lohse and colleagues (2014) defined ‘response’ as an improvement in function or a reduction in impairment and is generally well reflected in most studies as any positive gain because of training.[18] Multiple systematic reviews suggest the greater amount of time in rehabilitation, the greater the response or functional benefit, regardless of time after stroke.[18, 20, 29] However, they do not specify the amount (dosage) or the contents of the interventions in comparable terms.[20] It is important that descriptions of the types and amount of practice used in rehabilitative interventions be clear for the research to be clinically useful.[22]

The terms ‘dosage’ or ‘amount of practice’ in rehabilitative studies are often described in vastly different terms, making the findings from successful trials difficult to translate into clinical practice. This also makes accumulating high quality evidence in order to translate current findings into other settings, such as from the acute setting to the community setting, immensely difficult.[15] The current Australian Stroke Guidelines recommendation on the amount of practice after stroke is defined as time spent in practice.[17] They recommend stroke survivors engage in as much scheduled therapy as possible, aiming for three hours per day or at least two hours of ‘active practice’ in acute or subacute hospital settings.[17] As the guidelines are a living guideline, it is essential that research provides evidence to support what type of practice, level of challenge, specifics on timing or type of task or the effect of goal-oriented training for this amount of practice to better inform community clinical practice.[17]

Previous investigations aiming to increase the amount of practice in rehabilitative settings have developed their own definitions of the amount of practice, either defining the duration (number or length in time of sessions) or the intensity (amount of repetitions or practice per session).[20] Using this method, a systematic review by Schneider and colleagues (2016) showed that at least an extra 240% of rehabilitation (of the same content) in time (duration) is required to improve activity in either lower or upper limb after stroke.[30] Scrivener and colleagues (2011) reported that counting repetitions is a valid method of quantifying amount of practice in inpatient rehabilitation.[22] The observational study also suggested by this method, selected participants can measure their own amount of practice or dosage more

accurately and may be able to do so without direct supervision by a clinician.[22] The authors proposed that simply considering the time an individual spent in practice of a given task does not reflect the rate or intensity of practice completed. This is because time spent in practice may not account for time spent in rest versus active practice. Subsequently, recording time only may not accurately reflect any clinical changes as direct result of dosage.[22]

A review of previous studies investigating 'higher intensity' of training in all its forms results in substantial difficulty in translating early stroke recovery clinical findings to determine what is best practice for community stroke rehabilitation.[15] In recent times, there has been a call for clarification of the framework for reporting the amount of practice in neurorehabilitation, as there is no international framework for reporting intensity, duration, frequency, and difficulty of training provided in rehabilitative settings.[15] Only recently, was a structure suggested around a standardised measure for implementing amounts of practice in stroke rehabilitation by Hayward and colleagues (2021).[15] In their definition of dosage, practice should be accounted for by time in active practice (time on task), schedule of practice (frequency of sessions per week or day), the difficulty and intensity of the task (measured in terms of Borg rating (RPE), heart rate reserve (HRR), metabolic equivalent of task or number of task repetitions).[15] Their definitions of reporting amount of practice will be used later in this review to report on interventions which have been developed to increase amount of practice in community stroke settings.[15]

1.4 Rehabilitation setting and amount of therapy in Australia

The amount of rehabilitation delivered is strongly related to improved stroke rehabilitation outcomes, including mobility, activities of daily living (ADLs) and upper and lower limb function.[23] More therapy, particularly in the first six months after stroke, also improves rate of recovery.[3] The time an individual spends engaged in therapy appears important in the amount of practice they engage in and can impact their functional outcomes after stroke.[23] A recent prospective observational study in Queensland, Australia, showed that the dose of therapy received after stroke depends on the service type and rehabilitative setting.[23] Grimley and colleagues

(2020) found that stroke survivors who had engaged in acute stroke care followed by inpatient rehabilitation received more therapy time than those who had engaged in just one of those settings.[23] In the study of rehabilitative settings, higher frequency of therapy in hours was delivered in inpatient settings (median = 29 hours) than community settings (median = 6 hours) per week.[23] Despite this, the overall amount of therapy in duration (137 minutes per weekday) in inpatient rehabilitative settings, was well below national recommended guidelines.[3, 17, 23]

Severity of stroke also determined the subsequent pathway individuals undertook in their recovery.[23] Those who had more severe early functional impairments were more likely to engage in inpatient rehabilitation and those with milder deficits more likely to be discharged to community-based rehabilitation.[23] Those who had completed inpatient rehabilitation had a better chance of overall functional improvement (modified Rankin scale, OR = 3.6, 95% CI = 1.7–7.7), between discharge and follow up than those who completed no rehabilitation. Those who had commenced rehabilitation in a community setting had the same chance of functional improvement as those who had no rehabilitation (OR = 1.6, 95% CI = 0.7–3.8). [23] This suggests that sufficient dosage for the stroke population discharged to community rehabilitation settings may be important to prevent functional decline.[23] Given well-coordinated, multidisciplinary and early supported discharge shortens length of stay and improves functional outcomes after stroke, improved function may reduce the burden of care on formal or informal supports ongoing in the community.[23] These findings suggest that there is a need to close the gap in the delivery of quality and evidenced based dosage of therapy post stroke across acute, sub-acute and community settings.[3]

1.5 Translating strategies to increase practice from acute settings

Rehabilitation programs struggle to implement the amount of practice recommended by the clinical guidelines for stroke or the amount required to initiate functional changes in acute, sub-acute and community settings.[2, 6, 10] Where inpatient settings are limited by opportunity for increased amount of practice, community settings may

not have such limitations, and may be uniquely primed to offer diverse modes of therapy to increase dosage in rehabilitation.[31] Judging by the number of larger studies only, acute and sub-acute inpatient settings may be more likely to attempt to implement recommended amounts of practice than community settings.[10, 20, 22, 29, 30, 32-35] Since most studies looking at implementation of increased amounts of practice have been done in inpatient settings, these may offer some structure to translating higher amounts of practice into community settings in stroke rehabilitation.[12, 20, 30, 32, 34-36]

Previous strategies to increase the amount of practice in rehabilitation include additional therapy sessions, semi supervised or circuit group classes, independent practice and family mediated practice.[10, 18, 30, 32, 35-37] Participants are more likely to practice with the supervision of a clinician in therapy time, so adding additional therapy sessions is the most apparent way to increase therapy and practice time.[18] Semi supervised practice either by group programs or circuit training is another method to increase amounts of practice, within existing resources.[10, 32, 35, 37] An observational study by Dorsch and colleagues (2018) showed that up to 41% of practice in an inpatient rehabilitation setting could be completed without direct supervision by a clinician and did not compromise safety or quality of practice.[35] In this study, therapy was implemented either with a clinician's or family member's assistance or was performed with no direct supervision.[35] It could be assumed that if this model was feasible in inpatient settings which are often considered more 'high risk', they may be readily translated to community settings.[35]

Circuit classes and self-directed programs are examples of models which increase practice and have been successfully translated into community settings.[37] Along with self-directed or supported practice, circuit classes have been useful to increase amounts of practice without increasing the burden of time resources or staffing on providers.[10, 32, 37-39] Self-administered exercise programs have been successfully prescribed for the upper limb in inpatient settings with positive results for improved upper limb function.[38] The success of these acute methods to increase practice have been used to develop programs in community settings and will be discussed in more detail later in this chapter.[38, 39]

In summary, the amount of practice needed to drive neuroplasticity and recovery after stroke suggests higher amounts of practice result in better outcomes.[13, 19] It is important that the development of rehabilitation models later after stroke consider the amount of practice needed for functional recovery, how it is measured and reported on, and how it is implemented throughout the pathway of rehabilitation after stroke.[15] Traditionally more acute rehabilitative settings have provided more therapy time, and more practice, and continue to offer more therapy than community rehabilitative settings.[23] The methods to increase the amount of practice in more acute settings, including increasing the amount of training time or sessions, using semi supervised or circuit training and self-directed training which should inform ways to increase practice in community settings.[10, 18, 30, 32, 35-37]

1.6 Increasing the amount of practice through intensive blocks of therapy

Interest in more 'intensive' forms of training as a structured therapy program post stroke has been gaining traction in recent years.[24-26, 36, 40, 41] This type of structured and high dosage training is based on the hypothesis that a large amount of rehabilitation is likely to produce significant clinical improvements for stroke survivors.[40, 42] It may also be more appealing for a stroke survivor to focus on achievement of a goal over a specified time period. However, it has yet to be determined whether this model of training is more suitable in the acute or subacute stages of stroke due to the proposed period of heightened neurological recovery or later after stroke in the chronic period of recovery.[25] The difficulty in reviewing previous studies is the limited number and the application of the term 'intensive' or 'higher' dosage or amount of practice.[12, 24, 43] Most studies investigating more intensive therapy models have investigated the use of assistive technology to do this.[42, 44, 45] To date the limitations of previous studies have been the lack of significant functional change or retaining gains well after a highly resource intensive intervention.[42, 44, 45] For the purpose of this review, an 'intensive' program, is defined as a large amount of practice in time, intensity, and difficulty of training, often scheduled with a high frequency in consecutive days and weeks, in order attain goal directed skills in a shorter amount of time.[12, 15, 20, 24, 25]

A number of recent intensive upper limb programs have shown promise for improving function in upper limb impairment after stroke.[25] A recent single blind, intervention study identified that long duration, high dosage upper limb therapy delivered for more than 150 hours results in small clinical gains in upper limb function via the Arm Motor Ability Test-Function (AMAT-F) (mean difference 0.47, 95% CI 0.23 to 0.55) and coordination measured by the Fugl-Meyer (FM) (mean difference 9.8, 95% CI 7 to 11) in individuals with moderate to severe impairment who were more than 6 months after stroke.[25] The study also identified that post treatment upper limb gains in function were maintained at 3 months after treatment, AMAT-F (mean difference 0.57, 95% CI 0.34 to 0.73) and FM (mean difference 9.4, 95%CI 5 to 13). A single group study, with the minimal clinically important difference for AMAT-F 0.44 and the FM 4.25, the study suggests there may be a relationship between higher doses of training and sustained improvements in function.[25]

The recent success of the multidisciplinary Queens Square single group study adds to the evidence base of intensive training in upper limb rehabilitation.[26, 41] The program was run as a combination of group and individual sessions.[26, 41] While the Queens Square study had no control group, they demonstrated higher doses of training are readily acceptable in a mixed sub-acute population and demonstrated an improvement in upper limb function (FM, ARAT and Chedoke Arm and Hand Activity Inventory) in a proportion of stroke survivors compared to baseline performance.[26] Improvements were sustained at the six month follow up and were hypothesized to also be the result of building self-efficacy and education into the program.[41] While well resourced (staffing ratio of one-to-one staff to participant) and offering a very high intensity of training, the study suggests high doses and intensity of training may be successfully delivered much later in stroke recovery and shows promise these gains may drive positive outcomes outside ‘optimal’ periods in neurological recovery, at least in some stroke survivors.[26, 41]

To date, there seems to be more research in the utility of intensive programs for upper limb training rather than lower limb or mobility training.[25, 26, 40, 41, 46] However the recent Determining Optimal Post-Stroke Exercise (DOSE) trial by Klassen and colleagues (2020) provided preliminary evidence that higher doses of frequent therapy in inpatient rehabilitation as a formal ‘intensive’- style program, can improve

walking recovery acutely post stroke.[46] The phase II, blinded assessor, randomised control trial compared two doses of more intensive therapy delivered across six settings over the first four weeks post stroke.[46] Both 'DOSE1' (1 hour, 5 days/week) and 'DOSE2' (2 hours, 5 days/week) demonstrated greater walking endurance and quality of life compared to the control group who received usual care.[46] 'DOSE2' who in addition to the 'DOSE1' activity (30 minutes at intensity 40%-60% Heart Rate Reserve (HRR) and achieving >2000 steps and usual therapy), also received an additional 60 minutes weight bearing and walking activities, including strength and balance exercises. 'DOSE2' in addition to endurance and quality of life benefits, also increased walking speed compared to the control group.[46] The trial reported both clinicians and participants viewed the higher intensity of the program positively and clinicians reported surprise at the high adherence rate (99% 'DOSE1' and 94% 'DOSE2').[46] At 12 months follow up, high intensity groups continued to improve in walking endurance (but not speed).[46] The success of this study indicates that more intensive training may improve walking ability during time critical periods of neurological recovery.[46]

1.7 Considerations for implementing more intensive training later after stroke

From a review of the literature, the best evidence for post stroke rehabilitation is intensive and repetitive task specific practice, however there are several considerations for implementing more intensive training after stroke.[12, 24] The success of the most recent intensive programs suggest that it is possible to implement large amounts of practice to large groups, but often at great resource and time expense.[12, 24, 25] As a result, intensive post stroke rehabilitative training programs are met with low uptake in clinical settings and lower levels of practice in both in acute and chronic stroke rehabilitation.[12, 24]

The reasons for hesitancy to provide intensive therapy programs should be considered when implementing programs later after stroke.[12, 24] Hesitancy on the part of service providers and clinicians, rather than stroke survivors may have a role in delivery of more intensive rehabilitative programs.[24] In the DOSE and Queen Square studies, stroke survivors reported no barriers to implementing higher

intensity rehabilitation, and most were generally positive towards more intense programs.[12, 41, 46] Following the Graded Repetitive Arm Supplementary program (GRASP) in which participants completed a self-directed intensive upper limb program over four weeks, a qualitative study explored the implementation and opinions of clinicians delivering the program. [24] In interviews with clinicians providing the DOSE trials and a review of the GRASP upper limb trial, interventions which tend to offer higher intensities were often pared down when applied to clinical practice outside the intervention by clinicians.[24] This may be due to continued concerns that 'intensive' therapy may exacerbate stroke related impairments such as poor coordination or spasticity, concerns over adverse events, or not being able to grade or monitor intensity appropriately.[6, 12, 24] Further to this, post intensive interviews suggest that clinicians reported a lack of confidence in administering or delivering this type of training.[6, 12] Some felt burdened by high expectations to achieve functional results by participants who were working hard or were concerned quality of training was substituted by quantity of training.[41]

Previously there has been scepticism over the tolerance and self-efficacy of stroke survivors in intensive programs, though adherence rates in more intensive and community programs suggests that higher amounts of training may be more tolerable than initially thought.[6, 11, 16, 41] Thus the lack of implementation of more intense models which increase amount of practice may be more due to lack of resources such as cost, education, programs, staff training or the need to demonstrate the feasibility of this type of training in producing functional outcomes.[12, 24, 41] Regardless, a survey of the small number of intensive therapy models to date suggest that rehabilitation intensity in both acute, mixed and community settings is an area which requires more research.

1.8 Group programs to increase practice in community settings

To date, very few intensive practice programs have been offered to stroke survivors living in the community.[25, 26, 40] Usually increased practice is in the provision of group programs as they are feasible to implement, cost efficient and can be replicated multiple times per week.[6, 11] Pang and colleagues (2005) demonstrated that progressive training via circuit group (60 minutes, three sessions per week)

training using the fitness and mobility exercise (FAME) program is feasible in older community dwelling stroke populations.[11] A cohort of 63 participants, more than a year after stroke, improved in cardiorespiratory fitness measured by maximal oxygen consumption (VO2max) (mean difference = 2.0, 95% CI 0.8 to 3.1), walking capacity, measured by 6 Minute Walk Test (6MWT) (mean difference = 64.6, 95% CI 45.3 to 83.8) and bone mineral density (BMD) (-0.01, 95% CI -0.02 to 0.00) compared to an upper limb training control group over 19 weeks.[11] The cohort was not followed up to report on retention of positive outcomes but demonstrated that higher amounts of training may be well tolerated by this population.[11]

This study was followed by a randomised control trial by Mudge and colleagues (2009) which showed circuit based rehabilitation in a community setting improves gait endurance but does not change activity or gait speed.[27] In the study of 58 participants, the circuit group improved in walking endurance, measured by 6MWT but did not improve in their physical activity levels (as measured by daily step count).[27] The participants completed a progressive 50–60-minute functional strength, balance and walking circuit group three times weekly for four weeks.[27] While most participants in this program reported they enjoyed attending classes and would like ongoing access to similar training, physical activity and endurance gains were not maintained in three months follow up.[11]

Similarly, in a randomised control trial of 151 community dwelling stroke survivors, participants engaged in a 45–60 minute circuit class (once per week) supplemented by a home program (three time per week) using the weight bearing exercises for better balance (WEBB) program of task related training, progressive balance, strength and mobility training.[4] At 12 months the exercise group demonstrated small improvements in their walking, walked 0.07m/s faster (95% CI =0.01 to 0.14) but had comparable falls, physical activity and quality of life to the control.[4] The results of these circuit and group classes indicates while they may transiently improve walking capacity and speed, and provide ongoing physical activity, they do not routinely result in ongoing changes in mobility, independence, or quality of life in community dwelling stroke survivors in the long term.[4]

1.9 The dosage of programs offered in community settings

There have been numerous programs offered to stroke survivors living in the community, however no study to our knowledge has evaluated the dosages commonly offered to stroke survivors nor their responsiveness in clinical outcome or adherence to this dosage after stroke.[2, 4, 10, 11, 27, 28] Appendix 1 provides a summary of the randomised controlled trials and studies to date which have aimed to increase the amount of practice offered to stroke survivors living in the community. The studies have been represented in the format suggested by Hayward and colleagues (2021) for standardising the way amount of practice is reported in order to make comparison between existing programs offered to community dwelling stroke survivors.[15]

A review of the current literature reflects the diversity of type and frequency offered to community stroke populations (see Appendix 1, Table 1). A common factor in these studies is that the amount or dosage remains relatively low and do not reflect the intensity that inpatient settings offer, nor preclinical and clinical amounts of practice believed to positively drive neuroplasticity.[4] Only one study by Langhammer and colleagues (2009) compared an 'intensive' training group (who completed a minimum of 80 hours of training over 12 months) with a 'self-initiated' training group.[7] In the study, both self-initiated and more intensive methods of training improved frequency of training with comparable functional outcomes.[11] In addition to mostly being group or circuit-based groups, other trends in currently offered community programs are suggested. Most candidates for more intensive community-based programs are between 62 and 74 years of age (comparable to average stroke populations), and at between one and nearly six years post stroke and can walk 10 metres or more with or without an aid.[1] Surprisingly most interventions offered have a high program adherence rate of between 63-94%, perhaps contradicting beliefs that stroke survivors in chronic stages may not tolerate higher amounts of practice.[6]

The content of interventions offered to community stroke survivors was diverse but included well known exercise programs such as the weight bearing exercises for better balance (WEBB) program and fitness and mobility exercise (FAME)

program.[4, 11] Most contained a combination of strength, balance, walking or mobility training.[2, 4, 7-11, 27] The Community Living After Stroke for Survivors and Carers (CLASSiC) program combined exercise with education delivered by a multidisciplinary team for rural stroke survivors.[2] Four of the studies reported the intensity of training either as heart rate reserve (HRR), Borg Rating of Perceived Exertion (RPE) or used strength (repetition maximum) and a different four studies recorded progressing the difficulty or the intensity of the intervention provided to participants.[4, 8, 11, 15, 27]

Together, these findings suggest, when interventions are offered to community or chronic stage stroke survivors, they are offered in group or circuit settings, typically have around up to three sessions per week of training of up to an hour in duration, and may inconsistently offer progressive training methods.[2, 4, 7-11, 27] This amount of practice is low compared to what is currently known about the amount of practice and functional recovery after stroke. Little is reported on the content of interventions and if they attempted to address the community participation aspects of later stroke recovery more than regaining or progressing function.[4, 8, 11, 15, 27] From a review of current programs, it may also be assumed that the low functional improvements resulting from existing programs may be due to lacking in the resources to deliver functional improvements or be reflective of the lack of evidence on what drives significant gains in function later after stroke. The high adherence to most programs suggests that there is an interest in rehabilitation in community settings which may not be adequately addressed by current programs.[4, 6] Future research should consider the evidence which suggests stroke survivors later after stroke may be more receptive to higher amounts of practice which have predominantly offered earlier in rehabilitation, and if it can be effectively used to promote improvements in mobility, function, and quality of life.

Rehabilitation after stroke should include high intensity, repetitive task training in order to drive neuroplasticity, cortical change and functional recovery.[19, 29] While there is more evidence for functional recovery as a result of neuroplasticity earlier after stroke, gains can be made later in stroke recovery.[13] There is a need for more research into how larger gains in function can be made after the early period of neural recovery, and if larger improvements can be made with higher amounts of

training.[25] Previous studies which have been explicit in how much practice is delivered, by quantifying practice, have aided the accumulation of evidence in stroke recovery.[22, 30] Therefore, in order to determine accurate measures of amounts of practice or dosage, standardised measures of amount of practice should be used across clinical settings and when reporting interventions in research.[15] Using the structured method suggested by Hayward and colleagues (2020), a survey of the literature on rehabilitation after stroke suggests that the amount of practice implemented in community settings is much lower than acute settings.[15] Intensive programs may be a means by which higher amounts of practice are implemented later in stroke rehabilitation. To address hesitancy and the resource intensity required by such programs, it may be worth integrating methods which have been successfully in acute settings to increase practice without increasing resources. Methods such as additional therapy and semi supervised practice have already demonstrated positive outcomes across acute and community settings and may be worthwhile integrating.[25] However, as there remains little evidence for the success of intensive programs in the community, more research is required.

Chapter Two:

Implementation of more intensive practice in community rehabilitation

2.1 Ongoing stroke rehabilitation in the community

Ongoing recovery after stroke is a complex relationship between individual goals, needs, impairments and activity and participation restrictions. Further to this, stroke survivors may have trouble maintaining the self-efficacy to adhere to rehabilitative programs or ongoing physical activity.[47] The development of programs which address the rehabilitative needs of community dwelling stroke survivors should consider the unique needs and barriers to ongoing rehabilitation after stroke and the use of therapy supports such as multidisciplinary teams or self-management programs. This section explores the rationale behind an intensive mobility intervention and the challenges of translating the existing research to develop the intervention delivered in Chapter Three. This chapter seeks to answer the 'why' and 'how' intensive mobility programs can be feasibly implemented in community after stroke. In this next section we describe how major components or 'active ingredients' of the intervention were identified, and which evidence sources were used to develop the program.[48-50]

2.1.1 The unique needs and barriers to ongoing stroke rehabilitation in the community

Stroke survivors often report difficulty in re-integration into community life, accessing ongoing rehabilitation, and feel a lack of support from formal services upon hospital discharge.[47] Once discharged from formal care, many stroke survivors will return home to several barriers to independence and limited options for ongoing structured recovery and rehabilitation.[47] Barriers to activity and ongoing rehabilitation include lack of support, physical impairment, access and cost difficulties alongside the lack of resources.[47] Rimmer and colleagues (2017) suggest that those who do meet the functional threshold for rehabilitation (a level required to reduce their health risk and loss of function) at discharge experience the challenge of needing ongoing support in the community without the structures or frameworks ready to provide this.[47]

A commonly reported barrier to community independence is walking ability.[46] There is a strong relationship between amount of physical activity, walking speed and dependence and disability after stroke.[51] Those who are physically inactive are

more likely to be ‘disabled’ after stroke than those who are active.[51] Stroke survivors do not achieve recommended amounts of physical activity, even when ambulatory.[1] They are comparable to elderly and chronic disability populations in amount and intensity of exercise they undertake in community settings.[52] In Appendix 1, several of the community programs currently offered to stroke survivors reflect these findings. Community interventions which target community mobility, with a view to progressing independence after stroke do not routinely exist.[53] Therefore there is a need for feasible programs which offers structured and ongoing rehabilitation to this population. These programs should also consider the complexity of ongoing disability after stroke, the unique needs of community survivors and the current lack of programs which address their needs holistically and consider a feasible method to provide structured ongoing rehabilitation.[16, 53, 54]

2.2 Using multidisciplinary teams to support community stroke rehabilitation

Multidisciplinary care is the coordinated and comprehensive care delivered by collaboration between different health disciplines and the person presumed to benefit.[55] Objective evidence on the impact of multidisciplinary teams on treatment effects in stroke rehabilitation remains limited.[16] Multidisciplinary teams may be a facilitator to support community interventions after stroke, however currently, little to no research has identified how a multidisciplinary approach may better address the multifaceted impairments of community dwelling stroke survivors.[16] This is unusual given the magnitude of people affected by stroke and the prolonged and multifaceted disability they typically experience.[1] While there is no current direct recommendation by the Australian stroke clinical guidelines about the utility of the multidisciplinary team in ongoing community rehabilitation after stroke, the guidelines do recommend that hospital services allow for opportunity to discuss post discharge needs with relevant team members such as those of an interdisciplinary or multidisciplinary team.[17] This is possibly due to the limited number and low quality of previous studies evaluating their efficacy beyond primary care settings.[56]

Neurological conditions such as stroke have impairments which are prolonged and multifaceted. Thus, the justification for an ongoing multidisciplinary intervention may be drawn from application of the International Classification of Functioning, Disability and Health (ICF) model.[57] Chronic conditions and disabilities such as stroke have several characteristics which impact all domains of the ICF.[57] The complex nature of stroke means that survivors experience multifaceted barriers to physical activity and adequate rehabilitation post stroke, including lack of motivation, external support, and stroke related impairments.[58] Recently, there have been calls for community rehabilitation to better their use of the multidisciplinary team.[53] This would involve creating programs which address all the aspects of the ICF holistically, rather than siloing disciplines into specific domains as traditionally practiced.[53] For example in mobility training, the use of multiple disciplines such as physiotherapy, exercise physiology and occupational therapy could better address building the skills required for real world mobility environments, than one discipline alone.[16, 53]

To date multidisciplinary (MDT) and interdisciplinary (IDT) teams have been used successfully across other health settings and conditions, for example palliative and cancer care, inpatient orthopaedic and neurological rehabilitation, and in chronic conditions such as cerebral palsy.[59-63] In these settings, when used well, MDTs can enhance decision making, have the capacity to improve participant experiences and outcomes as well as clinical and organisational outcomes. [60] In outpatient multidisciplinary cancer rehabilitation, there is a small amount of evidence that suggests people with access to a MDTs reported higher degrees of quality of life compared to usual care and inpatient care without the use of a multidisciplinary care.[59] This may be due to the ability of MDTs to better manage the interconnectedness of the biopsychosocial aspects of chronic diseases.[59] In orthopaedic rehabilitation systematic care by a specialist geriatric team increases mobility and function in activities of daily living compared to usual care.[60] In inpatient specialist stroke units, MDTs typically meet weekly to discuss patient's progress and report on treatment and discharge plans. Such meetings have been shown to improve communication and recovery without increasing resources.[61]

The use of MDTs in neurological conditions such as cerebral palsy may be an example model of how MDTs can continuously deliver quality and integrated therapy

approaches in longer term rehabilitation.[62] As cerebral palsy is a lifelong condition, MDTs utilising the ICF and biopsychosocial models of health care are used to provide intensive, continuous and capacity building approaches to ongoing rehabilitation.[62] In cerebral palsy management, MDTs with a congruent focus promote goal directed rehabilitative interventions which may more appropriately address the diversity of life contexts including motivation, relationships, working and home life and be more individual and goal specific in nature.[62] While there is very limited evidence on the role of MDTs in complex and chronic conditions such as stroke, their previous use in complex and chronic conditions, such cerebral palsy and cancer appear promising.[59, 62] To evaluate their influence on certain populations in the community such as stroke, and their potential to support novel and more integrated and intensive approaches, further research is needed.

In summary, given the diverse and complex needs which arise from ongoing and persistent disability after stroke, MDTs may provide a holistic means to address the several multifaceted impairments. Very little research to date has evaluated models of therapy in the community which integrate multiple disciplines in the delivery of community, stroke specific rehabilitation.[53] MDTs have been successfully used in speciality teams for conditions which are unique, such as palliative or cancer care and for conditions which are lifelong, such as cerebral palsy.[59-63] In more acute settings, MDTs improve patient care and discharge outcomes.[59-63] Future research into the use of MDTs to provide community programs is warranted, the MDT may identify needs more holistically and provide tailored supports.

2.3 Using self-management to support rehabilitation

Self-management is the process by which an individual is enabled to manage all the aspects of their health condition through building new health behaviours and supporting skills.[64] Self-management skills are integral to the effective management of chronic conditions such as stroke and vital to the sustainability of health changes.[64-66] Self-management programs may improve quality of life, participation, self-care, self-determinism and may improve an intervention's success or quality of engagement.[66] A systematic review of nine studies reporting self-management strategies used for people after stroke include a large

umbrella of terms and approaches.[67] Common approaches appear to be goal setting, decision making, problem solving, development of care plans, promoting healthy behaviours and lifestyles, educating people on specifics of their condition, teaching self-monitoring skills, managing complex biopsychosocial impacts of their condition and providing connections with other survivors.[67] However, the evidence on the best practice of implementing self-management programs is limited due to the diversity of methods or their varied theoretical bases. Some of the most common theoretical bases of existing programs include Cognitive Behavioural Theory, Self-Determinism Theory or Bandura's Social Cognitive Theory.[64, 67] Two systematic reviews on self-management programs for people with chronic conditions, including brain injury, demonstrated across all theoretical bases, those which were holistic and used multifaceted approaches were more beneficial in improving physical activity and improving health related outcomes.[65, 67]

2.3.1 The use of self-management programs and community stroke rehabilitation

Self-management programs may better facilitate participation and functional outcomes for community dwelling stroke survivors.[67] However, research into the use of self-management programs in stroke populations lags other chronic conditions such chronic obstructive pulmonary disease (COPD) or arthritis.[68] Australian Clinical Stroke Guidelines recommend that stroke survivors who are cognitively able should be made aware of self-management programs upon discharge from hospital and supported to access these when living in the community.[17] A collaboratively created self-management program can then be used to develop and optimise stroke survivors self-management skills.[17] However, only half the number of stroke survivors in Australia were provided information about self-management programs when discharged from formal rehabilitation.[1] This is despite most health professionals acknowledging that the level of structured professional support post discharge significantly declines.[68]

Self-management skills, in particular adherence and the development of new health behaviours, are integral to the effective management of stroke and vital to the

sustainability of health changes after initial intervention.[67] Exercise and physical activity are known to improve ability after stroke, however adherence to ongoing rehabilitation or physical activity is poor stroke populations living in the community.[69] Fewer than 30% of independently mobile stroke survivors engage in recommended amounts of physical activity.[69] The World Health Organisation (WHO) defines adherence in a health setting as the extent to which a person's behaviour aligns with the health recommendations provided .[69] However, in the management of diseases such as stroke, adherence to health advice or rehabilitative programs declines over time, even when provided progressive and individualised programs.[4]

In a study of the adherence of 98 survivors to rehabilitation after stroke, Yao and colleagues (2017) report an 'S' shaped curve of rehabilitation adherence patterns.[70] In the first six weeks following stroke, participants have 'rapid increase phase' (AB) in which patients had a strong will and the resource intensity to promote functional recovery.[70] In the following six to twenty-first weeks, survivors experienced a 'slow decrease phase' (BC), in which many were discharged home and did not have access to structured rehabilitative resources and adherence rates to rehabilitative exercises declined.[70] And finally, beyond the twenty-first week post stroke, survivors experienced a 'stable phase' (CD) in which after a rapid increase and slow decline, neurological function plateaued and became accustomed to a certain level of post stroke function.[70] Yao suggests after this point, without intervention they may continue to remain at the same level of function and consistent with their adherence and new baseline health behaviours.[70]

This 'S' shaped adherence curve follows a similar trend to functional neurological recovery after stroke trends.[70] Yao suggests a decline or plateau in function seems to correspond to reduced level of support in community settings, and complex interaction between psychological perspectives and behaviour control.[70] Taken with a review of community programs currently offered to stroke survivors (see Appendix 1), while adherence during programs is high, most programs however intensive or individualised, report the clinical improvements to be transient.[4, 7, 27] Together these findings suggest that stroke survivors have a pattern of adherence and rehabilitative health behaviours. Even when provided more intensive and individualised programs,

without structured self-management skills, clinical improvements may be transient with interventions and may not provide ongoing or lasting functional change.[4] There are a limited number of studies which have implemented stroke specific self-management programs for survivors in the community.[66, 67] Individualised and condition specific self-management programs may help improve participation, function and self-efficacy after stroke, especially in longer term rehabilitation.[66]

A small number of studies have investigated the feasibility of these type of programs after stroke with some favourable outcomes.[67] The Taking Charge After Stroke (TaCAs) trial showed that self-efficacy and independence after stroke matters to stroke survivors in the community.[66] In a study of 388 stroke survivors more than 16 weeks post stroke living in the community, completing the Taking Charge program improved self-reported physical health related quality of life with participants who had completed the program scoring 2.9 points (95% CI 0.95 to 4.9) higher on the SF-36 12 months post stroke than the control. The study also demonstrated small improvements in instrumental activities of daily living (95% CI 0.8 to 4.6) and independence (95% CI 0.04 to 1.0) compared to controls at 12 months without a physical rehabilitation intervention.[66] The receptivity to the self-management approach used in Taking Charge suggests stroke specific self-management programs should be considered alongside physical rehabilitation as a facilitatory strategy to rehabilitation programs.

One trial in Australia to date, has attempted to integrate a self-management program alongside a physical rehabilitation intervention after stroke.[2] A randomised control trial of 25 rural dwelling community dwelling stroke survivors using task specific training, self-management training to improve health related behaviour and included education on diet, exercise and prevention, and was facilitated by a multidisciplinary team.[2] The trial demonstrated small improvements in physical performance and quality of life which continued at 12 weeks follow up.[2] Two similar trials have also attempted to integrate supervised exercise delivered with education increased physical activity in mild disability after stroke.[71, 72] One was successful in improving physical activity and self-efficacy in stroke survivors discharged directly home from acute settings.[72] The integration of self-management programs as facilitators of rehabilitation after stroke show promise to improve physical activity and self-efficacy,

with the view that this may translate to long term independence, participation and quality of life.[66, 67, 71, 72] However there remains scope for translation of this type of facilitatory programming into more intensive training to aid adherence, with the added benefit of functional gains.

In summary, self-management skills enable individuals to better manage their complex health conditions, and create new health behaviours.[67] A review of the evidence around current self-management programs suggests that they may be important for developing the skills to manage ongoing and persistent disability, such as what is experienced by community dwelling stroke survivors.[68] There have been developments in programs which are tailored to stroke populations, but many of the existing programs appear to lag behind the persistent problem of adherence and engaging in ongoing health behaviour change.[66, 67] The evidence suggests that stroke survivors do need to build self-efficacy and have a pattern of adherence in rehabilitative health behaviours.[66, 67, 70] A very limited amount of evidence suggests that self-management programs are readily available alongside or targeted towards facilitating existing rehabilitative practices in the community.[2] While stroke survivors tend to have a strong adherence to existing community programs, without extra support, such as multidisciplinary care or tailored self-management skills, continuity of behaviours or clinical improvements may continue to be transient with interventions and not provide lasting functional changes.[4] Future research should consider these factors when attempting to implement rehabilitation in this population.

2.4 The rationale and development of an intensive mobility program in the community after stroke

In this section the rationale behind the key or ‘active’ components used in the development of the intensive mobility program are described. Developing the program implemented in Chapter Three involved defining the scope of rehabilitation after stroke in the community, identifying the key aspects to investigate and using existing implementation strategies and evidence base to develop the program.[49, 50] Later sections of this thesis will examine other aspects which contributed to the rationale and implementation, including the development of adherence and

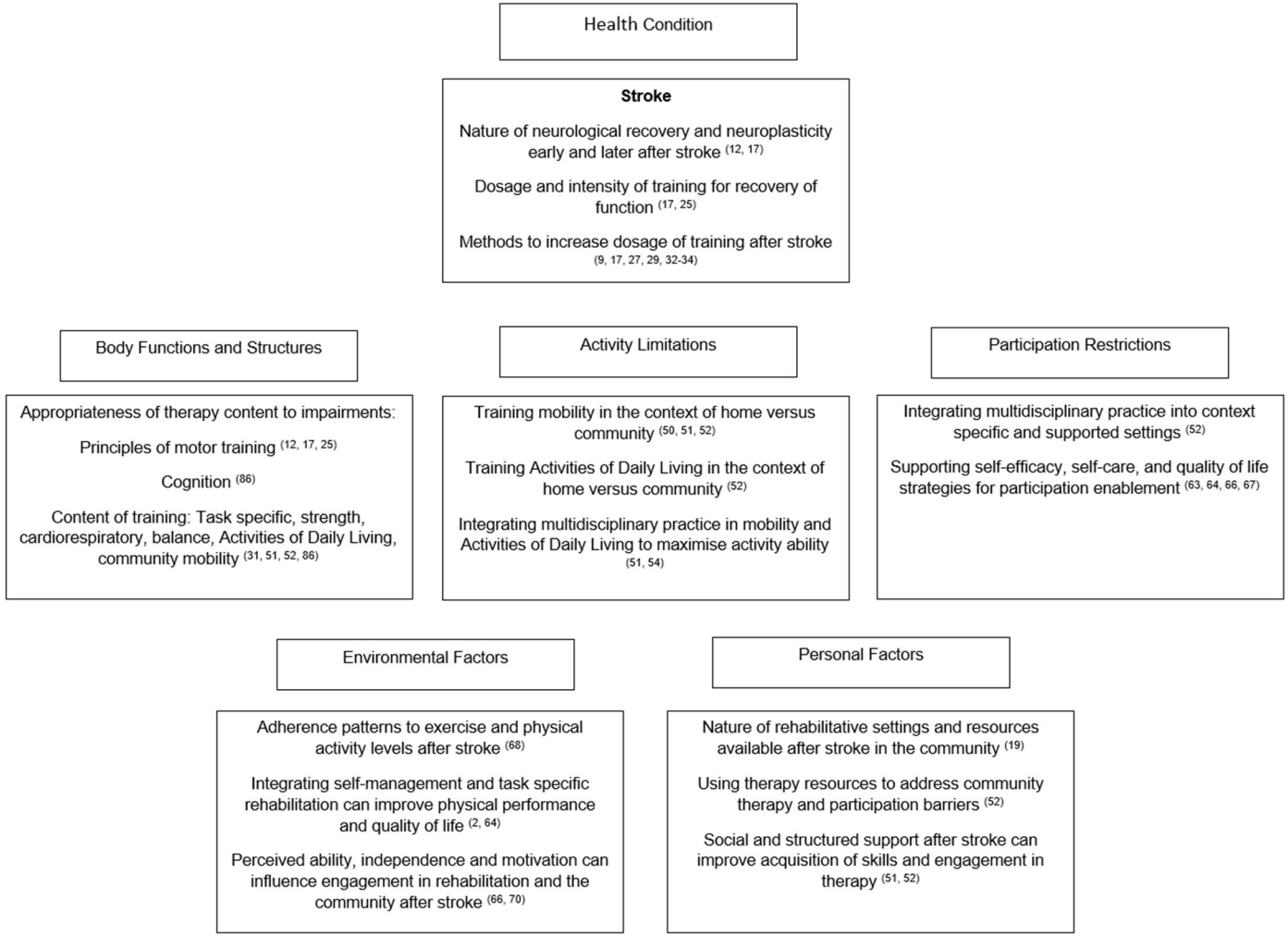
acceptability measures, reflection on the impact on clinical outcomes, factors which facilitated or influenced implementation and the utility of the clinical outcome measures used in the study described in Chapter Three.[49, 50]

Firstly, to determine the scope of the program within a community setting, the definition of rehabilitation after stroke was examined based on the Australian and global stroke clinical guidelines and the World Health Organisation definition.[17, 73, 74] According to these sources, rehabilitation is 'a process aimed at enabling (individuals) to reach and maintain their optimal physical, sensory, intellectual, psychological and social functional levels. Rehabilitation provides disabled people with the tools (strategies) they need to attain independence and self-determination'.[17, 73, 74] According to the Australian Clinical Stroke Guidelines, stroke rehabilitation should involve aspects of education, goal setting, appropriate amounts and types of practice, involvement of the multidisciplinary team and encourage self-management as a means for long term health management.[17] These elements; function, strategies for independence and self-determination, education, goal setting, amounts and types of practice and multidisciplinary interventions, were considered in the scope of the intensive mobility program.

The key aspects or 'active ingredients' which should be included in the intensive mobility program were identified as intensive, and goal directed task specific training, multidisciplinary support, and self-management, based on the above definitions and scope of the program.[49, 50] The existing evidence supporting the implementation of these 'active ingredients' in both acute and community settings was used to provide a framework for the intervention.[49, 50] Evidence for intensity of practice, goal directed training, multidisciplinary support and self-management was sourced from Australian Clinical Stroke Guidelines as a guide for how these aspects have been implemented previously.[17] The rationale for centring implementation on clinical guidelines was based on the evidence that interventions based on clinical guidelines improve rate of recovery and patient outcomes in stroke.[48] In the absence of explicit guideline direction around the use of multidisciplinary teams, the ICF model was used to extrapolate areas of importance and apply existing evidence.[57] In the absence of evidence around intensive programs and community programs in the clinical guidelines, a small literature review was undertaken of recent trials and

studies in these fields, described in Chapter One and Two of this thesis to identify the elements which have been implemented successfully in community and intensive stroke settings previously.[2, 4, 6-9, 11, 26, 27, 40, 46] The summary of existing programs in community settings is provided in Appendix 1. Figure 1 describes how the existing evidence based resourced from the current Australian and global clinical guidelines and published studies was applied to the ICF framework in the development of active ingredients in the intervention.[17, 57, 73]

Figure 1. The implementation rationale process, applying the existing literature base on rehabilitation after stroke to the ICF model in the development of the key components of the intensive intervention



2.5 Summary

In summary, there is a definitive evidence gap on models of intensive mobility training in community settings after stroke, and how these programs can be feasibly implemented.[1, 10] Programs which offer more intensive training for community dwelling stroke populations should consider the evidence base on amount of practice and functional recovery after stroke.[18, 29] Gains in function can continue to be made later after stroke, however how much practice is required or how much function can be regained is yet to be determined.[19] Rehabilitation continues to be offered in the community to stroke survivors but does not offer the same intensity of practice or therapy time as acute settings.[23] This is problematic considering the proportion of stroke survivors who enter community life without the skills to manage persistent disability, the access to appropriately dosed programming or the multidisciplinary teams which enable them to reach their potential.[47] Community programs currently offered to stroke survivors appear to be pared down either due to lack of resources, hesitancy on the part of providers or clinicians or due to lack of knowledge around the adherence and acceptability of these programs.[12, 24] Further research into programs offered to this population should consider the amount of practice needed, how it is structured, and factors which affect the feasibility of implementing new models of therapy.[15] Programs developed for this population should also consider the barriers this population face when engaging in rehabilitation later after stroke as well as the proposed ‘active’ or key ingredients of intensity of practice, goal directed task specific training, multidisciplinary support, and self-management.

Chapter Three:
High dosage mobility training is possible in community stroke rehabilitation: Implementation of a multidisciplinary intensive mobility program

This chapter is presented in the format of the manuscript which was submitted to *Stroke Research and Treatment*. See Appendix 2 for submission guidelines for *Stroke Research and Treatment*.

Statement from co-authors confirming authorship contribution of the Master of Research candidate

As co-authors of the paper '**High dosage mobility training is possible in community stroke rehabilitation: Implementation of a multidisciplinary intensive mobility program'**, we confirm that Avanthi Elisha Ball has made the following contributions:

- Participant recruitment
- Collection and extraction of data
- Analysis and interpretation of the findings
- Leading the writing of the manuscript and critical appraisal of the content

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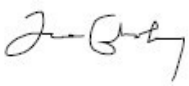
Dr Joanne Glinsky  Date: 15/06/2022

A Macquarie University Author Contribution form has also been added to the Appendix of this thesis.

High dosage mobility training is possible in community stroke rehabilitation: Implementation of a multidisciplinary intensive mobility program.

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High dosage mobility training is possible in community stroke rehabilitation: Implementation of a multidisciplinary intensive mobility program.

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Abstract

Background: Ongoing rehabilitation to improve mobility for community dwelling stroke survivors remains difficult due to concerns over adherence, acceptability, and feasibility. Multidisciplinary, intensive mobility programs, implemented with a self-management approach may be a way to facilitate mobility improvements in longer term rehabilitation.

Objectives: To review the implementation of a multidisciplinary intensive mobility program by evaluating the adherence and acceptability to participants and determine if feasible in the community after stroke. To describe the mobility, self-efficacy, and quality of life outcomes after program participation in participants.

Methods: An implementation study was conducted in a community-based rehabilitation clinic in Sydney Australia. Mixed methods were used to review the adherence and acceptability of the program to participants, feasibility of the program, and clinical outcomes. An implementation framework was used to review the success of program implementation. Participants undertook the intensive mobility program of physiotherapy, exercise physiology and occupational therapy for 45 hours over 3 weeks. Demographic information was recorded at baseline. Adherence and acceptability measures were sourced from study records (training logs) and a purpose-built survey. Clinical outcomes including mobility, exercise self-efficacy and physical related quality of life were measured at baseline, program completion (Week 3) and follow-up (Week 6).

Results. Five participants with stroke were recruited and completed the study. Adherence to the program was high (92%). The program had excellent acceptability with 100% of participants reporting they would recommend the program to others. Participants completed a mean (SD) of 185 (8) minutes and 1869 (543) repetitions per day. Training difficulty was maintained at an RPE of 6/10 on average per day. Implementation was successful due several facilitatory strategies. The program had a low number of adverse events. Mobility improved in 60% of participants, and all participants experienced an improvement in physical related quality of life.

Conclusion. A multidisciplinary intensive mobility program with a self-management approach is feasible to implemented for community stroke survivors with high adherence and acceptability.

Introduction

Stroke is a leading cause of death and persistent disability worldwide.(1) Once discharged from acute care, stroke survivors are rarely offered structured rehabilitation in the longer term.(2) Interest in more 'intensive' forms of training post stroke has been gaining traction in recent years.(3-6) Intensive training means a large amount of practice (duration, repetitions), scheduled frequently over consecutive days and weeks.(4, 7-10) The purpose of intensive training is to accelerate the attainment of goal directed skills.(5, 9, 11) Multidisciplinary programs targeting mobility and self-efficacy after stroke have also not been well studied.(12-14) Thus, community programs which integrate multidisciplinary and intensive training are an area of interest in longer term stroke rehabilitation.(3-5)

Evidence suggests that while mobility gains are made in inpatient rehabilitation, long term mobility declines over time with 21% of stroke survivors experiencing a significant deterioration in their mobility between one and three years post stroke.(15) While 70% of survivors may regain functional home ambulation, only 35-60% will regain the ability to ambulate in community settings.(16) Taken with the generally high adherence rate of community interventions post stroke, and more recently via eHealth platforms during COVID-19, this suggests there is a demand for ongoing rehabilitation for community dwelling stroke survivors.(2, 14, 16-18) Apart

from determining adherence, the feasibility and acceptability of resource demanding interventions later after stroke should be evaluated to determine what can be implemented to meet this need.(2, 15)

Successful implementation of complex health interventions depends on several interacting components.(19) Several implementation frameworks exist in health settings to describe how components are developed and delivered, including the framework developed by Carrol et al. (2007) and modified by Hasson et al. (2010).(19, 20) With a large body of high quality evidence on recovery after stroke, implementation science can help identify which aspects are key or facilitatory to help upscale an intervention or apply them in other settings.(19, 20) Therefore, the purpose of this study was to examine stroke survivors' acceptability and adherence to an intensive mobility program by in the community and evaluate the feasibility of implementing the program for longer term stroke rehabilitation.

Therefore, the specific aims of this study were to:

1. Review the implementation of a multidisciplinary intensive mobility program by evaluating participants adherence to and the acceptability of the program, to determine if it is feasible to implement in the community after stroke.
2. Describe participants clinical performance before and after participation in the intensive mobility program (including mobility, self-efficacy, and physical related quality of life).

Materials and Methods

Study design

A mixed methods implementation study was conducted in a private community-based rehabilitation clinic in Sydney Australia. The first and last participants were recruited in November 2021 and March 2022 respectively. The study was approved by the Macquarie University Human Research Ethics Committee (approval number 520211072635749). This study was registered on December 8, 2021 (registration number ACTRN12621001677897p).

Study Participants

People with stroke were recruited across two sites of a private community-based rehabilitation clinic. Enrolment in the intensive mobility program was based on a predetermined eligibility criterion. Community dwelling stroke survivors were included if they were an adult and had sufficient mobility (achieving 3 or more in the sitting component and 2 or more in the sitting to standing component of the Motor Assessment Scale for Stroke [MAS]).(21) Participants were screened for inclusion by their physical or medical readiness to participate using the Physical Activity Readiness Questionnaire (PARQ).(22) Participants were excluded if they could not read or understand verbal or written English or did not have sufficient cognition to participate in semi supervised or self-directed practice, determined by their performance on the Mini Mental State Examination (MMSE), achieving less than 24/30.(23) Information such as age, sex, time since stroke, side of hemiparesis, cognition and current frequency of weekly therapy was collected to describe the characteristics of the sample.

Intervention

The intervention was an intensive mobility program of 45 hours over three weeks provided by a multidisciplinary team in a community rehabilitation clinic, with the option to complete self-directed training at home. The multidisciplinary team consisted of physiotherapy, exercise physiology and occupational therapy. The intervention was exercise based and included task specific training, strength, cardiorespiratory training and was progressive in amount and difficulty. The types of exercises prescribed in the intensive mobility program included part or whole task training of sitting, standing, transfers, walking, stairs, and pre-running drills. The intensive mobility program also included lower and upper limb strength and cardiorespiratory training and activities of daily living (ADL) training. The program commenced with assessments that were directly supervised by each discipline, who then collaboratively developed a therapy plan for the three weeks. Subsequent sessions were a mix of direct supervision, semi supervised practice, circuit training and self-directed practice. The program was delivered with a self-management approach using the Taking Charge After Stroke (TaCAS) program, see Table A of the appendix.(24) The intensive mobility program itself consisted of three main components, intensive and goal directed training, multidisciplinary involvement, and self-management, the rationale for each is detailed in Table B of the appendix.

Theoretical implementation framework

The implementation framework used to evaluate the intensive mobility program was developed by Carroll et al. (2007) and was modified by Hasson et al. (2010).(19, 20) According to this framework, adherence influences implementation and is measured by coverage (reach of intervention), dosage (frequency, duration) and content of the intervention.(19, 20) The adherence measures used in the framework were used to compartmentalise different aspects of participant engagement with a novel program. Given the program was being tested for feasibility, the transferability of coverage and dosage, was of interest for future studies. The framework was adapted to include acceptability as a factor which influences implementation and describe facilitatory factors which may have influenced implementation. Secondary to this, the key outcomes were examined, being clinical outcomes of mobility, self-efficacy, and physical related quality of life. Application of the theoretical framework developed by Carroll et al. (2007) for this study is depicted in Figure 1.(20)

Data Collection and Sources

Intervention and participant outcomes were collected at three timepoints; baseline, at program completion (Week 3) and three weeks post the intervention (Week 6). The specifics of when data were collected, and the data sources are detailed below.

Intervention

Data relating to the first aim of the study was collected during the intervention and Week 3 by clinicians delivering the intervention in dedicated intensive mobility program workbooks. This included adherence outcomes of coverage, dosage, content, and acceptability outcomes. Adherence was calculated by percentage of possible sessions attended out of potential sessions. Total adherence to the program excluded discontinuing due to COVID-19 by Participant 5. Subcategories of adherence to certain components, such as therapies attended, or session types attended were calculated by how many sessions were attended proportional to what was prescribed as the target attendance. Each clinician collected dosage completed by participants in dedicated workbooks. Repetitions were calculated based on pre-defined definitions, and in consultation with a previous study which counted repetitions in a rehabilitation setting.(25) A repetition was defined as a repetitious

movement which had a definitive starting and ending position. For example, one step or one revolution of a cycle ergometer was considered one repetition. To obtain number of repetitions for walking practice, time and speed walking on treadmill was used to calculate the distance walked. For this, one metre counted as one repetition. Facilitatory (moderating) factors, which supported implementation, were also collected during the program and at Week 3 by the clinicians delivering the program and members of the research team. Each of the outcomes and the data sources for each are detailed in Table 1.

Clinical Outcomes

All clinical outcomes were collected at baseline, at program completion (Week 3) and follow up (Week 6).

Mobility

Three mobility assessments used were the 2 Minute Walk Test (2MWT), Motor Assessment Scale (MAS) and the Short Physical Performance Battery (SPPB).These measures were administered by a treating physiotherapist.(21, 26, 27) Walking speed was calculated from the 2MWT which measured the participant's self-paced walking ability during two minutes of continuous walking.(28) In the MAS, the three sub-sections relating to mobility (items 3-5) were scored on a scale of 0-6.(21) The SPPB scored each participants performance in three areas; walking speed, standing up and balance.(26) A higher score on the 2MWT, MAS and SPPB indicated a better performance in the areas of assessment.

Self-Efficacy and Physical Related Quality of Life

Self-efficacy was measured using the Exercise Self-Efficacy Scale (ESES), in which the participant rated confidence in exercise over 10 items via self-reported paper survey post intervention and at follow up.(29) A higher score on the ESES indicated a better exercise related self-efficacy. Physical related quality of life was measured using the Short Form Survey-12 (SF-12) by self-reported paper survey post program and at follow up.(30) The values for SF-12 were compared to the general population score of 50 (as a normative value) provided by the developers of the online tool.(30)

Data Analysis

Intervention and Clinical Outcome Data Analysis

Demographic data was reported via descriptive statistics. Qualitative content analysis was conducted and summarised in narrative form using a modified version of the process evaluation framework described by Carroll et al. (2007) and Hasson et al. (2010).(19, 20) Clinical outcome data analysis for quantitative data was conducted using Excel to calculate the mean, standard deviations and interquartile ranges. Calculation of the SF-12 was done using the online calculating tool version 1.0 (1994).(30)

Results

Characteristics of study participants

Forty-eight people were screened, thirteen participants were identified for inclusion in the study, and all were contacted for study recruitment. Eight people declined to participate and the reasons for declining were not recorded. The remaining five consented to study participation. Of those who were not included, nineteen did not have a primary diagnosis of stroke. Two people did not meet the benchmark criteria based on their MMSE and six did not meet the language requirement. Eight people did not meet the MAS and PARQ benchmarks. [19, 20, 21] The mean (SD) age of participants was 51.6 (14.5) years. There was large variation in the time since stroke, mean 18 (13) months. Most participants were female and had a right hemiparesis. The mean (SD) frequency of allied health therapy prior to commencing the intensive mobility program was 3.6 (1.5) hours per week. The characteristics of participants, including the types of allied health disciplines participants saw before the intervention, their mobility status and use of aids is described in Table 2.

Adherence and Acceptability of the intervention

Adherence to the intervention

Coverage (Completion and adherence with the intensive mobility program)

Adherence to the total intervention was measured by the percentage of the program completed by each participant in time. Of those who participated in the program, 60% (3/5) completed the entire program with an 100% adherence rate. On average 92% of the possible sessions were attended. This adherence included Participant 5 who completed 100% of the program in the first week but did not finish the program due to illness.

Dosage (Frequency and Duration)

A mean of 185.6 minutes of training was completed by participants in the program each day, with a target of 180 minutes per day. Participants were encouraged to complete 900 repetitions per day. Participants completed a mean (SD) of 1869 (543) repetitions per day. Therapy was designed to deliver an intensity of difficulty between 6-8/10 RPE throughout the sessions, which is reflected in the average RPE of practice per day.(31)

Content of the intervention sessions

Of the total intensive mobility program, 53% was delivered by physiotherapy, 33% exercise physiology and 13% occupational therapy. The intensive mobility program was delivered by direct supervision (13%), semi supervised practice (44%), circuit training (27%) and self-directed practice sessions (16%). Attendance was comparable between direct supervision (87%) and self-directed practice sessions (83%). Reasons for non-attendance were being unwell, with Participant 5 missing two weeks of the program due to COVID-19.

Exercise programs were tailored to individuals participating in the intensive mobility program. Table 4 describes the content of sessions by type of exercise, the number of repetitions of each exercise and the average rate of repetitions per hour completed as a group in each of the sessions. Whole task walking practice made up most sessions (27%), followed by part practice of walking (21%) and cardiorespiratory training (20%). A small percentage of the program (4%) was dedicated to pre-running drills for higher mobility functioning Participants 1 and 5. Activity of Daily Living (ADL) training included activities such as cooking and cleaning. The rate of repetitions per hour was highest in physiotherapy sessions at 640 repetitions per hour. This rate was comparable to self-directed sessions (632 repetitions) in which participants completed their own program prescribed by physiotherapy, exercise physiology and occupational therapy.

Adherence to the intensive mobility program including coverage, dosage and content measures are described per participant in Table 3 and Table 4.

Acceptability of the intervention

Participant Feedback

All participants reported the program was satisfactory or very satisfactory and 4 found it easy to participate in the program. All participants reported they liked the multidisciplinary aspect, 4 liked the inclusion of TaCAs and self-management in the program.(24) The majority (80%) of participants liked the intensity of practice. The use of the participant workbook which included self-management aspects was useful for two participants.(24)

Facilitatory (Moderating) Factors

The intensive mobility program was successfully implemented as intended. Faciliatory (moderating) factors for implementation of the intervention are described below.

Strategies to facilitate implementation

Strategies used to facilitate the implementation of the intensive mobility program included the use of an intervention manual, participant workbook, peer (clinician) leaders, dedicated intensive teams, training sessions and multidisciplinary meetings. A summary of these strategies, frequency of use, format provided and reasons for their use is summarised in Table 5.

Quality of delivery

Feedback on the quality of the intensive mobility program delivery was based on participant feedback, interest in the self-management component, TaCAs, the utility of clinicians as interventionists and the replicability of the intervention at two sites.(24) All the participants elected to complete the TaCAs component of the intervention and provided positive feedback on the experience.(24) The program was able to be readily replicated at two intervention sites, with a total of four clinicians and one therapy student providing the entire intervention at one study site. A total of five clinicians and one therapy student providing the entire intervention at the second study site. Participants at each site engaged in comparable intensity of practice in time, repetitions and perceived difficulty and engaged in the same disciplines of therapy, physiotherapy, exercise physiology and occupational therapy.

Context

Cost

The total of 3 weeks of the intensive mobility program conducted in this study cost a total of $3653.03 Australian Dollars per participant. This cost was based on standard clinic fees.

Safety

The overall number of adverse events because of participating in the intervention appeared low, with one participant experiencing two falls which resulted in no injurious events nor required medical follow up. This participant was known to have regular falls prior to commencing the program and was supervised closely when possible, during the intervention.

COVID 19

The COVID-19 pandemic was a major external factor which may have influenced the implementation of the program. Due to changing government and organisational restrictions, elements of the program were facilitated via telehealth, such as the multidisciplinary case conferences. One participant became unwell during the intervention period due to COVID-19 and subsequently completed only one week of the intervention. Recruitment of participants was impacted by COVID-19 with some participants deferring to a later date to start the program due to the number of COVID-19 cases in Sydney.

Clinical Outcomes

The results and clinical outcomes and change in clinical outcomes from baseline to Week 3 for each participant are shown in Table 6. Overall, most participants improved in their mobility except for Participant 5 (who did not complete the whole program). The size of this change was small but meaningful in the majority of participants.(32) Participant 4 improved in their mobility from being a wheelchair user to mobilising with stand by assistance by the end of the intensive mobility program. Most participants did not improve on their self-reported exercise related self-efficacy (using the ESES), but most reported a small improvement in self-reported physical related quality of life (using the SF-12).(29, 30) Participant 5 was able to complete one week of the intervention and was unable to continue due to being unwell. At the

end of the intervention and follow up period, Participant 5's mobility, self-efficacy and physical related quality of life had remained similar.

Discussion

This study described the implementation of an intensive mobility program (45 hours over three weeks) delivered using a multidisciplinary team and self-management approach to community dwelling stroke survivors. The results of this study show that the intensive mobility program was able to be implemented as intended and had high acceptability with an adherence rate of 92%. Previously, intensive programs have been met with hesitancy due to concerns over tolerability, resource demands and difficulty monitoring safety.(2, 7) However the program was able to be implemented feasibly, across two private practice settings with an acceptable cost and low number of adverse events.

The amount of practice or dosage implemented in this intensive mobility program is significantly higher than typically offered in community settings.(2, 14, 33-35) A recent observational study showed that dosage depends on rehabilitation setting, with community settings routinely delivering lower dosages of therapy than acute settings.(36) The difficulty in comparison of our dosage to previous studies in community settings is the limited number of studies (most being upper limb programs) and the heterogeneity of reporting dosage.(7, 8) A review of existing programs shows in general community rehabilitation programs diversely report dosage (either as time or difficulty in heart rate reserve or Borg scale).(2, 14, 33-35) Almost no community studies report number of repetitions completed in a program, and most are non-progressive interventions.(2, 14, 33-35) The most similar intensive mobility study to date is the DOSE trial completed in inpatient rehabilitation by Klassen and colleagues (2020).(37) The study reported that two different dosages, DOSE 1 (1hour/5 days per week) and DOSE 2 (2 hours/week) delivered over four weeks results in improvements in walking endurance and quality of life after stroke.(37) Similar to our study, clinicians were surprised at a comparably high adherence (DOSE 1, 99% and DOSE 2, 92%) to higher dosages of mobility training by stroke survivors.(37)

The intensive mobility program in the community resulted in small improvements in mobility and physical related quality of life. Majority of the participants in the program were under 65 years of age, a population in which poor mobility may result in poor participation in education, work, and recreation.(38) A recent study found that walking speed in younger stroke populations (under 65 years of age) was a strong predictor of return to work.(38) The improvements in walking speed after the program are promising and warrant further investigation. Interestingly the clinical outcome which improved most was physical related quality of life in participants who completed the intensive mobility program. This may have been the result of embedding self-management and multidisciplinary rehabilitation as facilitatory strategies into an intensive mobility program for people living the community after stroke. Surprisingly, these elements are not often integrated in the community.(33)

There were several aspects of program delivery within our study that enhanced the implementation.(19, 20) Participants in this study responded positively to the multidisciplinary delivery and particularly liked the variability and diversity multidisciplinary collaboration offers. Participants found the self-management program, TaCAs, helpful for goal setting and conceptualising multidisciplinary therapy planning.(24) However, many found the principles of self-management hard to implement autonomously in training or even when given support. At a clinical level, adherence to higher intensity training was facilitated by clearly articulated dosage of practice including four key elements; task and environmental set up, repetitions achieved, time spent in practice and perceived exertion for regular monitoring and progression of participants. This was implemented in this study using the structure recommended recently by Hayward and colleagues (2021) for improving the articulation of dosage in stroke interventions.(4) At the organisational level, the use of a dedicated intensive multidisciplinary team assisted the implementation and monitoring of adherence and acceptability. Future studies should systematically identify the barriers and enablers to implementation either through standardised questionnaires or clinician focus groups to predetermine which facilitation strategies are best suited to community programs.(39) Previously, the successful implementation of multidisciplinary care in acute stroke units had a significant impact on lowering national deaths and disability in Australia and subsequently associated health costs.(40) It is likely that research into successful

models of therapy delivered in the community will continue to have a clinical and socio-economic impact, particularly for those accessing longer term rehabilitation through the National Disability and Insurance Scheme (NDIS) in Australia.

A strength of this study is that the model of intensive therapy was feasibly implemented in a real-world clinical setting and during a COVID-19 period. However, the current study is also not without limitations. Firstly, the sample size was small and had a diverse range of participant characteristics. Future research into community intensive mobility programs should consider larger sample sizes to better reflect the post stroke population living in the community. And secondly, the acceptability reported was based on a purpose-built survey. Further qualitative data collection may be helpful in determining other views on the intervention, including the perspective of the clinicians working in the multidisciplinary team. Future studies should also consider the responsiveness of common outcome measures given the diversity of motor abilities in community stroke survivors, a factor which may have limited the scope of this study.

Conclusion

Implementation of an intensive mobility program using a multidisciplinary team and using a self-managed approach is feasible in community stroke rehabilitation. The intensive mobility program was received with high adherence and was acceptable to community dwelling stroke survivors. Future implementation or upscaling of the intensive mobility program is warranted and should consider a larger trial with a control group to examine the effect on mobility, self-efficacy, and quality of life in community dwelling stroke survivors.

Data Availability

Data is available from the authors on request.

Conflicts of Interest

Avanthi Ball led the team who designed and implemented the intensive mobility program. Avanthi Ball was employed, and Dr Scrivener had a contracted role at the study site throughout the duration of the study. They declare no relevant material or

financial interests were to be gained subsequently from this study. All other authors declare no conflict of interest.

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Tables and Figures

Figure 1. Application of the theoretical process evaluation framework by Carroll et al. (2007) and Hasson et al. (2010) to the intensive mobility program.

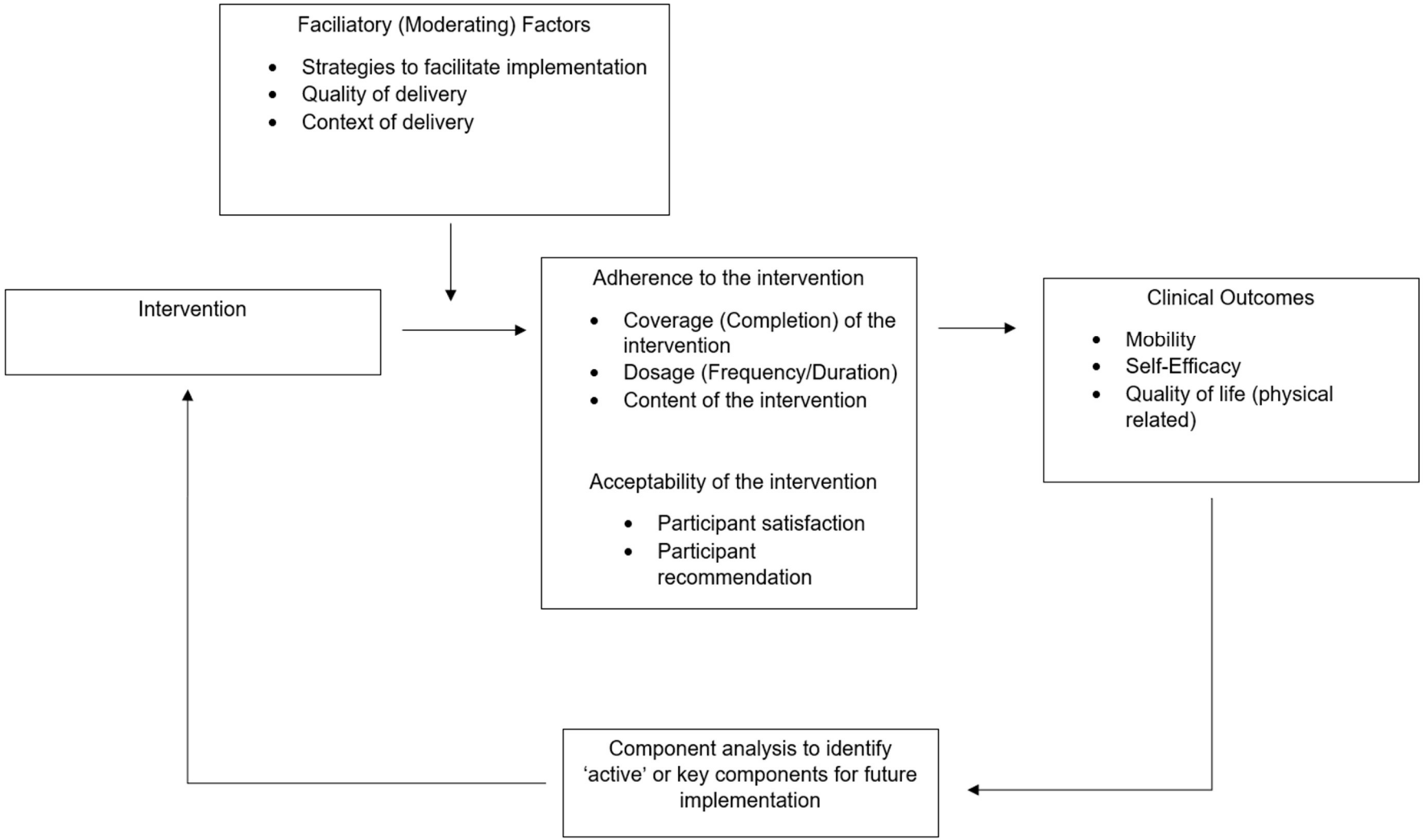

Table 1. Adherence and acceptability of the intervention including the questions and data sources

Areas to measure	Question	Measure	Data Sources
Adherence			
Coverage (Completion)	How much of the total program did participants attend?	Percentage of the program completed by participants.	Intensive mobility program workbooks
Dosage (Frequency/Duration Delivered)	How much of the intervention was completed by the participants?	Number of minutes completed by each participant per day. Intensity of practice completed per day recorded as number of repetitions and RPE.	Intensive mobility program workbooks and intervention documentation.
Content	How much of the intervention was Physiotherapy, Occupational Therapy or Exercise Physiology? How much was completed with direct supervision, semi supervised or independently? What was the content of the training sessions delivered?	Number of sessions and repetitions completed by each participant of each type of session.	Intensive mobility program workbooks and intervention documentation.

Areas to measure	Question	Measure	Data Sources
Acceptability			
Participant satisfaction and recommendation	How acceptable was the intervention? What aspects of the program did the participants like or dislike?	Feedback from survey results.	Intensive mobility program workbooks**.**
Faciliatory (Moderating Factors)			
Strategies to facilitate implementation	What strategies were implemented to support the intervention?	Description of the resources and training provided to support implementation by the study team.	Intensive mobility program workbooks, multidisciplinary team communication and documentation.
Quality of delivery	Did all the eligible participants elect to complete the Take Charge component of the intervention? Was the team who completed the training and intervention multidisciplinary?	Number of participants who completed the Take Charge component of the intervention. Number and type of clinicians who delivered the intervention.	Intensive mobility program workbooks.

Areas to measure	Question	Measure	Data Sources
	Was the intervention replicable with same intensity?	Number of sessions completed was comparable between participants.	
Context	Was the program able to be implemented with limited or no adverse events? Was the program viable for private practice?	Describe the number and nature of any near misses or adverse events which occurred. Cost reported per participant.	Intensive mobility program workbooks.

Table 2. Demographic data of intervention participants at baseline

Demographic data of participants at baseline					
Participant	1	2	3	4	5
Age	55	53	28	68	54
Sex	M	F	F	F	M
Time since Stroke (months)	6	33	28	5	19
Number of falls in last 12 months	0	0	43	0	0
Side of Hemiparesis	L	L	R	L	R
Mini Mental Examination Score (MMSE)	29	30	30	25	30
Mobility	AFO Independent	Crutch Independent	Walking stick Independent	Wheelchair	Walking stick + FES Walk Aid Independent
Current allied health therapy amount (hours per week)	2	2	5	5	4
Disciplines seen before intervention	PT	PT, OT	PT, EP	PT, OT	PT, OT, EP

Abbreviations: AFO = Ankle Foot Orthosis, FES = Functional Electrical Stimulation, PT = Physiotherapy, OT = Occupational Therapy, EP = Exercise Physiology

Table 3. Adherence to the intensive mobility program in coverage, dosage, and content of the intervention.

Adherence to program	**P1**	**P2**	**P3**	**P4**	**P5**	**Average Delivered**	**Total Target**
Coverage (Completion)							
Percentage of the program completed by each participant	78%	82%	100%	100%	100%	92%	100%
Dosage (Frequency/Duration)							
Duration completed by the participant (average minutes per day)	180	180	196	180	192	186	180
Intensity: Amount of practice completed per day (repetitions)	1637	1941	2386	981	2146	1869	900
Intensity: Average RPE of practice per day	5	4	6	6	6	6	6
Content of the intervention							
Number Physiotherapy sessions completed	17	17	21	21	6	82 (82%)	100 (100%)
Number of Exercise Physiology sessions completed	13	13	14	14	5	59 (79%)	75 (100%)
Number of Occupational Therapy sessions completed	3	2	4	4	2	15 (75%)	20 (100%)
Number of independent practice multidisciplinary sessions completed	5	5	6	6	3	25 (83%)	30 (100%)
Number of direct supervision sessions completed	6	5	6	6	3	26 (87%)	30 (100%)
Number of semi supervised sessions completed	16	14	19	19	6	74 (78%)	95 (100%)
Number of circuit sessions completed	11	11	12	12	4	50 (83%)	60 (100%)

Abbreviation: P = Participant

Table 4. Number of repetitions completed by participants in multidisciplinary, exercise physiology, physiotherapy and occupational therapy sessions and the rate of repetitions per hour of therapy.

Type of Training	MDT Self-directed Practice	EP Sessions	PT sessions	OT sessions	Total repetitions per training type	Percentage of the program
Task Training						
Sitting	355	0	718	300	1373	1%
Sit to standing	425	748	1386	0	2559	3%
Standing	0	547	1114	0	1661	2%
Transfers	920	0	1767	0	2687	3%
Part Practice Walking	1640	950	18452	0	21042	21%
Walking	4040	2811	20533	0	27384	27%
Stairs	547	0	1335	0	1882	2%
Pre-Running	2477	0	1947	0	4424	4%
ADL Training	1045	0	0	900	1945	2%
Strength Training						
Strength	2160	9465	5201	0	16826	17%
Cardiorespiratory (CR) Training						
CR Training	2200	17715	0	0	19915	20%
Total repetitions per therapy	15809	32236	52453	1200	101698	100%
Rate of repetitions per hour	632	537	640	80	559	

Abbreviation: MDT = Multidisciplinary, EP = Exercise Physiology, OT = Occupational Therapy, PT = Physiotherapy, CR Training = Cardiorespiratory Training, ADL Training = Activities of Daily Living task training

Table 5. Strategies to facilitate implementation and format and reasons for use

Facilitation strategy	Number/ frequency	Format	Provided by	Reason	Modification and Tailoring
Intervention manual	One	Soft and hard copies	Research Team	Provided clinicians with an overall description of the program, detailed the structure, logistics and the content of the intervention and study protocols.	None
Participant workbook	Once	Hard copies	Research Team	Provided participants with an overall description of the program, the rationale for the sessions and facilitated the self-management aspects of the program.	Reviewed by Speech Pathology team for Language Accessibility prior to distribution
Initial training	Once	Face-to-face/online	Research Team	Provided comprehensive information relating to the intervention and study protocols.	Facilitated online when required due to COVID-19
Peer (Clinician) leaders	Multiple, various	Face to face and online	Clinic Physiotherapists, Occupational Therapists and Exercise Physiologists	Facilitated the intervention and provided supervision and training to clinicians.	Peer (clinician) leaders were sourced from within each clinic to facilitate implementation prior to commencement of program
Dedicated Intensive teams	One, recurring	Face to face	Clinic Physiotherapists, Occupational Therapists and Exercise Physiologists	Worked in collaboration to review the intervention process, participant progress and facilitate the relay of information to the research team.	Dedicated intensive teams were sourced from each clinic to facilitate implementation prior to commencement of program
Information sheets	Multiple, various	Soft and hard copies	Research Team	Provided any additional information required by the clinicians, clinics, or participants.	None
Multidisciplinary case conferences	Multiple, recurring	Face-to-face/online	Research Team and Clinic Physiotherapists, Occupational Therapists and Exercise Physiologists	Facilitated relay of information from the research team and between the clinicians from different disciplines delivering the intervention.	Initially implemented at the beginning of the intervention. Additional sessions were added weekly at the request of the multidisciplinary team
Additional training	Multiple, as required	Online	Research Team	Allowed research team and clinicians facilitating the program to share information and documentation relating to the program.	Additional sessions were added weekly at the request of the multidisciplinary team

Table 6. Clinical outcome measures including mobility (MAS, SPPB, 2MWT) and exercise related self-efficacy (ESES) and physical related quality of life (SF-12) per participant at baseline, Week 3, Week 6 and the change from baseline to Week 3

Score	**MAS (LL items 3-5)**				**SPPB**				**2MWT (Walking speed m/s)**				**ESES**				**SF-12**			
Clinical outcomes per participant	T0	T1	T2	Change Baseline to Week 3	T0	T1	T2	Change Baseline to Week 3	T0	T1	T2	Change Baseline to Week 3	T0	T1	T2	Change Baseline to Week 3	T0	T1	Week 6	Change Baseline to Week 3
1	13	12	13	-1	6	12	12	6	0.98	0.94	1.00	-0.04	40	33	34	-7	39.62	41.78	47.29	2.16
2	18	18	18	0	12	12	12	0	1.14	1.28	1.35	0.14	35	36	37	1	35.53	51.70	51.00	16.17
3	17	17	17	0	10	12	12	2	0.83	1	1.08	0.17	21	27	26	6	45.17	51.40	47.95	6.23
4	9	13	13	4	0	4	4	4	0	0	0.27	0	32	33	36	1	34.60	35.50	37.80	0.9
5	17	*	18	*	12	*	12	*	0.95	*	1.02	*	34	*	35	*	20.10	*	21.91	*

**Data missing from participant 5 due to being unwell*

Abbreviations: MAS = Motor Assessment Scale, SPPB = Short Physical Performance Battery, 2MWT = 2 Minute Walk Test, ESES = Exercise Self Efficacy Scale, SF-12 = Short Form Survey-12, T0= Baseline, T1= Week 3, T2= Week 6

Appendix A

Table 1. Schedule of the intervention

Intervention Week	**Content**
Week 0	Initial assessment and program goal setting Taking Charge After Stroke Program Session.(24)
Week 1	Commence individualised program developed and implemented by physiotherapy, exercise physiology and occupational therapy.
Week 2	Continue individualised program developed and implemented by physiotherapy, exercise physiology and occupational therapy Mid-point assessment and goal review.
Week 3	Continue individualised program developed and implemented by physiotherapy, exercise physiology and occupational therapy Post intervention assessment and goal review.
Week 4	Return to either regular scheduled therapy programs or completing their home exercise program.
Week 5	Return to either regular scheduled therapy programs or completing their home exercise program.
Week 6	Follow up assessment.

Appendix B

Table 1. Rationale and intervention content for each of the intervention components

Component	Rationale	Content
Intensive and goal directed training	In acute and mixed settings, methods to increase amounts of time spent in therapy include additional direct supervision therapy, semi supervised practice, circuit training, and self-directed or independent practice.(13, 41) It was hypothesised that if these methods were feasible in inpatient settings which are often considered more 'high risk' they may be readily translatable into less acute settings such as community rehabilitation.(41) Intensive blocks of therapy practice are another method to increase practice and direct training towards goals to attain skills in a shorter amount of time. Improvements in upper limb function and mobility after stroke have been demonstrated in recently in mixed settings, suggesting the feasibility of this model of therapy.(5, 8)	The intensive mobility intervention was designed to integrate the types of training which are known to increase therapy practice in acute and mixed settings. The final structure of mixed supervision and self-directed practice to increase therapy time utilised therapy resources economically to determine if this model is feasible both clinically and organisationally in community rehabilitation settings. The use of a goal directed intensive structure was intended to keep training tailored to individuals who completed the program as a group of three, while allowing for tailored progression of training both in difficulty and independence.
Multidisciplinary Rehabilitation	Multidisciplinary care is coordinated, and comprehensive care delivered through the collaboration of different health disciplines. The use of multidisciplinary teams may be a facilitator of community interventions after stroke and provide a more wholistic approach to the diverse impairments experienced by stroke survivors in long term rehabilitation.(33, 42)	The intensive mobility intervention, while led by physiotherapy, was developed, and implemented by exercise physiology, occupational therapy, and physiotherapy clinicians. The pre-determined intensive multidisciplinary team provided the exercise prescription, ongoing assessment, goal setting and reviews and progression of the program in consultation each discipline and the participants. This was maintained through regular formal and informal multidisciplinary meetings throughout the intervention period.

Component	Rationale	Content
Self-Management Strategies	Stroke survivors often report difficulty re-integrating into community life, independence, accessing support and resources and maintaining adherence to healthy behaviours such as physical activity and exercise.(24) Common self-management approaches which exist in chronic health condition management include goal setting, decision making, problem solving, developing care plans, education, teaching self-monitoring skills, managing biopsychosocial impacts and providing connection with other survivors.(43) Taking Charge After Stroke (TaCAs) trial have showed a self-management program directed to people after stroke improves independence, physical health related quality of life and instrumental activities of daily living without physical rehabilitation.(24)	The intensive mobility intervention utilised an embedded self-management program to train participants for decision making, goal setting, problem solving, working collaboratively to develop therapy plans with multidisciplinary teams and develop self-efficacy towards self-rehabilitation using a participant workbook. The participants could elect to participate in the TaCAs program prior to engaging in the intensive program to develop their self-management skills, identify barriers and help identify goals for training.(24) Ongoing self-management was promoted using the participant workbook to help monitor goal progression, exercises and therapy plans and perceived effort in training. The structure of the therapy program was progressive, by both increasing the number of independent practice sessions and intensity of training as the program progressed. Reflective practice on the rehabilitative process was promoted by the intervention team daily through daily ‘huddle’ groups with the participants and the clinicians and through a daily journal provided in the participant workbook.

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Chapter Four:
Discussion

4.1 Overview

This thesis has investigated the feasibility of implementing an intensive mobility program for stroke survivors dwelling in the community and described clinical outcomes after the intervention. The original research presented in Chapter Three was a mixed method analysis of the intensive mobility program delivered in community rehabilitation. This section explores the three key findings from the study, that the program had a high adherence, acceptability and the clinical outcomes were positive and warrant further investigation. Both finding one of adherence and finding two of acceptability of the intervention will be used to support the feasibility of implementing an intensive mobility program in the community setting after stroke. The clinical implications of the study including the strategies which facilitated implementation and the use of outcome measures will be discussed later, as well as the strengths and limitations of the study. And finally, the key findings from the study and their implications for future practice will be explored in greater detail this final chapter.

4.2 Key findings

4.2.1 Finding 1: Adherence to the intensive mobility program was high

This section explores the finding from the study reported in Chapter Three of this thesis that adherence to the intervention was high. The finding will then be discussed in relation to the adherence reported in other community programs. Current research reports a high adherence rate to community programs generally.[2, 4, 7-9, 11, 27] Factors which affect adherence include the coverage or reach of the intervention, the dosage provided and the content of the intervention.[49, 50]

In the study reported in Chapter Three, the participants demonstrated a high adherence rate of 92% of sessions attended, with 60% of participants completing all the program. This finding was consistent with the hypothesis that the intervention would have a high adherence rate and would reach most participants. Reasons for non-attendance to sessions was not formally recorded, but for majority of cases was due to participants being unwell and not attending the whole day of the intensive mobility program. There are a limited number of community programs offered to

people after stroke with comparable amounts of practice, however this finding is at the higher end of what is commonly reported in these programs of adherence rates of between 63-94% adherence to existing in community programs (see Appendix 1).[2, 4, 7-9, 11, 27] The intervention completed in the study was only three weeks in duration. By comparison, existing community programs tend to provide a much longer program schedule of between four weeks to one year, but are substantially less intensive in dosage.[2, 4, 7-9, 11, 27] Shorter blocks of more intense therapy may be more tolerable or practicable given the high adherence found in this study findings. The study completed in Chapter Three did not have the scope for varied durations, however future studies determining the optimal length of community intensive mobility programs, may highlight more specific trends in adherence over time.

Adherence to the program was also measured by the amount of practice completed by participants. Participants exceeded the amount of practice compared to what was prescribed to individuals. The amount of practice (dosage) used in the study presented in Chapter Three was measured by both duration and intensity of practice completed by participants and was used to monitor and progress the program. Duration of practice was measured in time spent in session, and intensity of practice was measured as work completed by number of repetitions per session and the perceived difficulty of the task, a structure suggested by Hayward and colleagues (2021) for articulating dosage in stroke interventions.[15] In the study presented in Chapter Three, time spent in practice in minutes and number of repetitions was exceptionally high, exceeding the targeted amounts of 180 (8) minutes and 900 repetitions per day, with participants completing double the number of repetitions on average (1869 [543]). The difficulty of practice was maintained at 6/10 on a modified Borg (RPE) scale and exercise prescription was monitored and progressed based on these measures.[88] Compared to the six trials which implemented community programs for people after stroke, all reported frequency and duration of sessions, but only three trials reported on intensity of practice either by heart rate reserve (HRR) or RPE.[2, 7, 9, 11, 27, 78] Only one trial, the FAME trial, reported intensity as a method for monitoring and progression of practice in community settings.[11] Pang and colleagues (2005) increased intensity of their program by 10% HRR and increasing the prescribed repetitions each week.[11] Compared to existing community

programs, most offer one hour training per week, up to three times per week of non-progressive strength, balance and mobility training.[2, 7, 9, 11, 27, 78] Previous studies also routinely do not monitor number of repetitions or the content of their interventions as adherence measures.[2, 7, 9, 11, 27, 78] Our finding that adherence to higher dosages of training in both time, repetitions, and difficulty of training in a community setting is therefore a novel finding, as previous interventions have not delivered this level of training in community settings after stroke. However, like the study described in Chapter Three, the authors of the FAME trial were limited in making further conclusions about the effect of dosage of training in chronic stroke populations, only that it can be implemented successfully in community settings with a high adherence.[11]

Previous trials in the community with which to make a comparison to the study presented in this thesis, have been limited in reporting adherence because of how amount of practice is described.[15] A strength of the study described in Chapter Three was the clarity in articulating amount of practice as an adherence measure, thereby allowing quantification of how much work and the difficulty of work completed. Adherence due to poor monitoring of dosage was a concern which led to clinicians adapting the program to reduce repetitions achieved in the recently delivered DOSE trial by Connell and colleagues (2018).[12] This was not experienced in the study described in Chapter Three and may have been an advantage of clearly articulating dosage so it could monitored and progressed in the intervention by the clinicians.[12, 15] Another benefit of clearly articulating adherence in terms of amount of practice completed is also that amounts can then be directly compared to those previously achieved in acute settings or in other trials aiming to modify this aspect of clinical practice to determine effect on clinical outcome.[30, 46] The finding that adherence to amount of practice was high in the study described in Chapter Three may also help determine in future which people in the chronic stages of stroke are best suited to this type of intervention dosage.[46]

The third measure of adherence was delivery of the aspects of multidisciplinary therapy (physiotherapy, exercise physiology, occupational therapy) and different modes of therapy (direct supervision, semi supervised and self-directed practice, and

circuit training). Interestingly, self-directed practice sessions (83%) were attended at a similar rate to direct supervision (87%) and circuit sessions (83%). Existing community or intensive programs do not typically implement mixed discipline interventions, where participants are encouraged to participate in sessions facilitated by different therapies consecutively in an intervention period.[2, 4, 7-9, 11, 27] The Queen's Square study implemented mixed physiotherapy and occupational therapy with the assistance of therapy aids but did not directly report on adherence to multidisciplinary intervention.[26, 41] In community settings, of the six trials evaluated earlier in this thesis, 50% implemented circuit-based training and 50% implemented semi supervised practice, suggesting these are the most common modes of therapy delivery this population.[2, 4, 7-9, 11, 27] This is reasonable given group training is known to have a high adherence rate, is cost effective and readily replicable in the community setting.[32, 35, 37, 90] From the findings of this thesis, another mode of therapy delivery which may increase amount of practice without increasing cost is self-directed practice, given the high adherence rate of consecutive self-directed practice sessions when delivered alongside group or direct supervision training in the study described in Chapter Three.

In summary, the findings from the study described in Chapter Three suggest that adherence to more intensive, multidisciplinary mobility programs depend on several factors. These include attendance, ability to articulate amount of practice, ability to monitor and progress amount of practice, and ability to implement consecutive sessions of multidisciplinary therapy across directly supervised or indirectly supervised sessions. All four of these aspects were strengths of the study described in Chapter Three. These adherence findings are novel as the amount of dosage delivered in the intensive mobility program has not been implemented in community rehabilitation previously. Together these adherence measures support the feasibility for higher than previously delivered dosages of training in community settings after stroke and support the ability to implement a structured and multidisciplinary intensive mobility program to community dwelling stroke survivors.

4.2.2 Finding 2: Acceptability of the intensive mobility program was high

This next section of this discussion explores the finding that the acceptability of the intensive mobility program was high. Acceptability was chosen as a primary outcome measure as it is currently not known if intensive training in community settings is acceptable to community dwelling stroke survivors in longer term rehabilitation. Knowing the adherence and acceptability of an existing intensive mobility program is of interest to clinicians and service providers who are likely to consider delivering this intervention.[12, 24, 30] This section will discuss the possible factors contributing to the acceptability of the program and compare it to programs which have been implemented in similar settings.

In the study described in Chapter Three of this thesis, all participants completing the intensive mobility program reported finding the program satisfactory or very satisfactory, with 80% finding it 'easy to participant in' through a purpose-built survey. Previous studies investigating acceptability of interventions for community stroke survivors are limited.[12, 24, 91] This research area is complex due to several factors which influence rehabilitation in community settings. One main factor is that acceptability of interventions to stroke survivors is not often reported in the existing literature, in favour of adherence measures when they are reported.[12, 24, 91] However, in a recently published study conducted in the same clinical site, 77% of participants in a self-managed, video guided exercise program (TASK) found the intervention satisfactory or very satisfactory as reported by a purpose-built survey. The TASK program consisted of direct supervision and self-directed training, with 92% of participants reporting the program was easy to use.[91] Similar to the intervention described in Chapter Three of this thesis, the study reported that interventions which adapt to lower cost and less direct supervision can be acceptably and feasibly implemented without major safety issues in community stroke populations.[91] The use of purpose built survey facilitated feedback on acceptability and user perception and has been used previously to do so in community settings, suggesting the utility of this method for reporting acceptability after complex interventions in the community.[91]

Acceptability following intensive programs is of interest in determining the tolerability of more intensive interventions after stroke.[12, 24, 41] In the recent Queen Square study, 90 hours of upper limb therapy was delivered by a multidisciplinary team to chronic stroke survivors and interviews with focus groups were used to reflect on the acceptability of the program.[26, 41] Common themes from participants feedback were that participating in the program had psychosocial and behavioural training effects.[41] Participants reported enjoying the collaborative relationship in goal setting with clinicians, maintaining motivation in a 'gruelling yet rewarding environment' and the opportunity to learn new skills.[41] These themes resonated with the free text comments reported in the study described in Chapter Three, with participants reflecting that the relationship with clinicians to create collaborative therapy plans was central to what was perceived to be a successful intervention. An interesting finding in both the Queen Square study and the intensive mobility program, was that participants found intensive training 'very effective' and 'relished' the opportunity to be involved in a training program that challenged their capabilities.[41] This provides some initial evidence that intensive training much later after stroke is of value to stroke survivors in the later stages of their recovery, particularly those who are wanting to participate. This also contradicts a commonly expressed concern by clinicians and service providers over the tolerability of more intensive interventions after stroke.[6, 12, 24] However it should be noted that acceptability was measured in participants who were willing to engage in higher dosages of training. While five participants (out of a total 48 who were screened) were included in the study, all participants who were eligible were willing to adhere to higher dosages of training. Together our findings are consistent with previous studies examining acceptability after more intensive stroke interventions. This suggests that intensive or more commonly associated 'gruelling' interventions may be well mediated by collaborative therapeutic relationships which facilitate motivation and self-management efforts by participants who are willing to engage in higher amounts of practice.

In summary, together findings 1 and 2 of this thesis, that adherence and acceptability of the intensive mobility program to community dwelling stroke survivors was high, indicates that the program, while multimodal and complex was able to be delivered feasibly. Theoretical models of implementation science suggest that standardising

the quality of delivery (in terms of adherence) and reporting on receptivity (or acceptability) facilitates implementation.[48] The acceptability of the intensive mobility program described in Chapter Three of this thesis is consistent with previous findings in community rehabilitation, suggesting stroke survivors may be more accepting of more intensive and multimodal interventions than previously believed. The finding that acceptability was high and that intensive mobility interventions may be facilitated by collaborative relationships between clinicians is consistent with previous findings in intensive settings, suggesting this may be a facilitating factor for higher dosage training.

4.2.3 Finding 3: Clinical outcomes after participation in the intensive mobility program warrant further investigation

This section discusses the clinical outcome of mobility, physical related quality of life and self-efficacy reported prior to and after the intensive mobility program. The results of the study will be explored within the context of existing literature on clinical outcomes after higher dose mobility training. A review of the clinical outcomes after the intervention described in Chapter Three show post intervention improvements warrant further investigation in a randomised controlled trial. This result is consistent with the findings in previous studies that intensive training with large amounts of practice can result in changes at the functional level.[26, 30] However, it should be noted that it was not intended to determine clinical outcomes from the study described in Chapter Three. Moreover, it was not statistically powered to test for large changes in treatment outcomes nor was there comparison between groups. The comparison here is made on the results of this study in the context of what has been reported in previous studies. The study reported in this thesis demonstrated there can be no definitive interpretation of effect or absence of an effect on clinical outcomes and the study did not have scope to examine a definitive improvement on mobility and physical related quality of life nor self-efficacy.

As the study presented in Chapter Three was a small single group study there can be no definitive conclusions drawn about the effect of the intervention on mobility outcomes. Mobility in the study reported in Chapter Three was measured by performance in three outcomes, the mobility domains (items 3-5) of the Motor

Assessment Scale (MAS), Short Physical Performance Battery (SPPB) and walking speed taken from a 2 Minute Walk Test (2MWT).[79, 83, 85] Very little change was observed in the mobility domain of the MAS after participation in the intervention suggesting it would not be useful for future studies as a mobility measure.[79] Two participants, who were of lower functional mobility (participants 1 and 4) improved in their performance in the SPPB, particularly in the balance and walking speed domains of the battery over the three week intervention.[83] The mobility outcome which demonstrated the clearest change was self-paced walking speed, which was taken from the participant's performance in the 2MWT.[85] Three out of five of the participants in the intensive mobility program improved their baseline walking speed by between 0.21m/s and 0.27m/s over the three week intervention period. There is some controversy over the minimal clinically important difference in self-paced walking recovery in chronic stroke populations, however most studies report a change in 0.13 to 0.18m/s in subacute or chronic stroke to be clinically significant.[92, 93] The high adherence to the intervention this finding suggests that a follow up study with a control group is warranted to determine the strength of the relationship between higher doses completed in intensive mobility training and mobility outcomes. Walking speed using either the 2MWT or the walking component of the SPPB are likely to be beneficial for future studies or a future randomised controlled trial.

The content of training provided in this intervention, while of mixed disciplines, physiotherapy, exercise physiology and occupational therapy, was of typical strength, task specific and cardiorespiratory training provided in mobility rehabilitation. At present, theoretically these elements are consistent with Schneider and colleagues (2020) finding that the magnitude of extra rehabilitation of the same content of usual rehabilitation needed produce a beneficial effect in function is in the order of 240%.[30] A strength of the study described in Chapter Three was the dosage achieved, most participants had an increase in therapy time by between 300% and 750% their previously regular weekly therapy amount (see Table 2, Chapter Three). The review by Schneider and colleagues (2020) included studies within six months of stroke, and no study to date has determined the optimal dosage required to change function in community dwelling stroke populations.[30] A logical

next investigation should provide powered statistics with a larger sample size to provide more substantial evidence for this relationship and the magnitude of the relationship in chronic stroke.

The finding that intensive mobility programs may have a positive effect on mobility and quality of life outcomes is consistent with a similar study completed by Klassen and colleagues (2020) on the effect of higher dose training on walking recovery in subacute stroke populations.[46] In the Determining Optimal Post-Stroke Exercise (DOSE) trial, two dosages ('DOSE1', one hour per day for five days) and 'DOSE2' (two hours per day for five days) resulted in improvements in walking endurance and quality of life (EQ-5D 5L) compared to usual rehabilitation.[46] Effects of doubling dosage was not directly cumulative, with both dosages resulting in similar improvements, but 'DOSE2' participants demonstrated improvements in gait speed in 5m walk test compared to 'DOSE1'. Similar to the intervention described in Chapter 3 of this thesis, progressive task specific mobility training was implemented with a focus on high repetitions, with participants in the DOSE arms completing a mean (SD) number of repetitions of 2169 (1106) and 4747 (2083) compared to usual care 580 (440).[46] In the study described in Chapter Three, the mean number of repetitions completed was comparable at 1869 (543) repetitions per day. While overall amount of time spent in practice was lower than the intensive mobility program (185.6 minutes), the DOSE trial completed between 27(11) and 52 (24) minutes, the difficulty in training of between 40-60%HRR with a view to progress mobility training was comparable. Although in a subacute population, the results of the study showed a four week program with similar elements of progressive high repetition mobility training can result in changes in walking speed, distance, and quality of life with a high adherence (94-99%).[46] From these findings investigation into higher doses later after stroke to improve mobility and quality of life warrants further investigation given the feasibility of the program implemented in Chapter Three.

Theoretically embedding self-management and multidisciplinary collaborative therapy into a therapy program should result in improvements in self efficacy.[66, 68, 72, 91] Participants in the study described in Chapter Three maintained their levels of

self-efficacy as reported by the Exercise Self-Efficacy Scale but did not report large improvements in the score after participation in the intensive mobility program.[86] Reasons for this may be that the self-efficacy of participants in the intensive mobility program prior to starting the program was relatively high, with a mean self-efficacy score pre-intervention of 32 out of 40.[86] Another reason for this was the self-management approach embedded in the program was use of the Take Charge After Stroke (TaCAs) program, which previously has been shown to improve independence and quality of life, with no previous studies examining the program's direct effect on self-efficacy.[66] Which aspects facilitate TaCAs as an intervention are still unknown as there is no clear effect of TaCAs on intrinsic motivation or mood of participants completing the program.[94] This makes it difficult to hypothesise which aspects of the participant workbook were facilitatory in the study described in Chapter Three. However, one finding of the study by McNaughton and colleagues (2021) which is consistent our finding in this study, is that while TaCAs has positive effects on quality of life, it did not significantly change health related behaviour, for example ongoing self-monitoring or risk factor management.[94] Findings from the acceptability survey support that while participants enjoyed the TaCAs program, many found it difficult to bridge the self-management techniques of transition to more self-directed practice. The survey also found that although they enjoyed the participant workbook which included TaCAs and perpetuated common self-management techniques such as goal setting, reflection, and monitoring, this was not a compulsory component of the program. Participants were given a choice to use the workbook and there was no direct measure of adherence to use in the study described in Chapter Three after it had been used for TaCAs.[66] Future studies should consider the known effect of TaCAs on independence and quality of life, but should consider further investigation into how these improvements may be translated into improved self-efficacy during a mobility intervention such as the intensive mobility program described in Chapter Three.[66] Given the trend in ESES score of participants and the reporting of difficulty translating TaCAs into the program, future studies may consider pre-surveying barriers to self-efficacy in the cohort and developing a person specific behaviour change plans to exercise specific challenges. Future implementation should also consider education around self-efficacy and self-management strategies for participants to audit participant knowledge on skills prior

to and post engaging in the program. The direct relationship between adherence to more intensive training and self-efficacy measures may also be warranted in future investigations.

4.3 The outcomes of the study and implications for clinical practice

The feasibility of the intensive mobility program demonstrated in Chapter Three has several implications for clinical practice. There were several strategies which facilitated the successful implementation of the intensive mobility program in the study described in Chapter Three. These include effective knowledge translation, using dedicated multidisciplinary teams and resources. These will now be discussed to reflect on their implications for clinical practice. The clinical outcome measures chosen for this intervention including their utility for future studies is also reflected on.

4.3.1 Strategies which facilitated implementation and implications for clinical practice

Several facilitation strategies were used in assisting the implementation of the intensive mobility program described in Chapter Three. Implementation or facilitation strategies are designed to produce a change in people's behaviour and environments at the individual, team, and organisational level.[50, 95] Knowledge on how and what kinds of evidence based activities have been feasibly implemented and should be supported within an organisation may improve clinician adherence to best clinical practice.[96] Current research regarding the most effective implementation strategies in stroke rehabilitation are inconclusive.[96] However recent studies in rehabilitation implementation science have suggested implementation activities which are both active and multifaceted are likely to better facilitate adherence to guidelines by health professionals.[96] Hence, below we have described the strategies which have worked well in the intervention described in Chapter Three, which may help facilitate future research into the field of intensive mobility training after stroke in community settings. The strategies used to facilitate the implementation of the intensive mobility program included the use of knowledge translation through an intervention manual, information sheets, peer leaders, training, and supervision sessions, utilising a dedicated intensive multidisciplinary

teams and multidisciplinary meetings; and participant resources such as participant workbooks. This next section also discusses the current research supporting the use of facilitation strategies and implications on clinical practice.

In the study described in Chapter Three, clinicians delivering the intervention were provided with an intervention manual, information sheets, training, and supervision sessions in which the key aspects of the intervention were aligned with current clinical guidelines. Knowledge translation is a tool to convey the current evidence base to support changes in clinical practice and to support implementation.[48] It is defined as 'a dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically sound application of knowledge to improve health and health services'.[48] Knowledge translation and education is the most used strategy to improve adherence of clinicians to interventions program and convey context specific information.[48, 97] Evidence suggests reference to clinical guidelines by allied health professionals remains routinely low in clinical practice.[48] In clinical practice, physiotherapists are reported to refer to clinical guidelines less than 50% of time, and occupational therapists and exercise physiologist reference to clinical guidelines also remains low.[48] In the study described in Chapter Three of this thesis, facilitation of multiple training sessions may have assisted in supporting clinical practice, as education is not typically an effective implementation strategy when offered without support.[48] Presence of a 'knowledge broker', a more senior clinician who was able to support implementation and the frequency of supportive measures such as audit, feedback and discussion of barriers and enablers appears positive influence implementation.[96] Theoretically the role of a 'knowledge broker' in implementation may be to collaborate and engage with stakeholders, tailor the knowledge to context and build and support the capacity of workers seeking to implement the behaviour change or evidence based practice.[98] Support which is provided by the peer (clinician) leader 'opinion leader' in previous research suggests that the role of 'championing the intervention' may also promote the uptake of evidence based practice within an organisation at a 'grassroots' level.[96] The use of an intervention manual, information sheets, training and supervision sessions also allowed the intervention to be tailored to each study site, a practice which is known to assist overcoming local barriers in implementation science.[48] This finding is also

consistent with recent investigations into the effectiveness of implementation packages by clinicians in rehabilitation settings.[48]

Multidisciplinary meetings within dedicated program teams were another strategy used to support the implementation of the intensive mobility program in Chapter Three. Discussion in meetings was used to identify barriers to the program and identify tailored action plans for successful implementation, strategies which are supported by implementation science practice.[97] Multidisciplinary teams working collaboratively in previous stroke interventions have not typically been well described, but the nature of the teams in stroke rehabilitation is well documented in Chapter One of this thesis.[2, 55-57, 62, 99] Clinicians facilitating the intervention described in Chapter Three informally reported that routine collaborative multidisciplinary meetings had several benefits to implementation. These included facilitating the relay of assessment results, development of goals in consultation with the participant, monitoring therapy progress, troubleshooting barriers to progress and adherence and providing a wholistic approach to context specific training. They also reported that when multidisciplinary meetings did not occur this resulted in difficulty maintaining uniformity in therapy planning, consistency in measuring progress in clinical outcomes and poorer quality and continuity of care across sessions.

Participant resources were used to support the self-management aspect of the intervention and provided a basis for goal setting and therapy planning. A major finding of the study described in Chapter Three, is that it is difficult to identify which components of self-management programs are facilitatory and acceptable in community stroke intervention. The resource developed to support implementation in this thesis was presented in an accessibility designed format created with the assistance of community-based speech pathologists and students and can be found in Appendix 3 of this thesis. Only two participants in the intensive mobility program found the participant resource useful for ongoing self-management compared to 4 which found the TaCAs program useful. Feedback in our study suggested that participants found it difficult to continue self-management using the participant resource on their own as discussed earlier in this chapter. Further comparison to existing programs which provide these elements is limited as resources used in self-

management trials (except for TaCAs) are not readily accessible in the public domain. Future trials should consider the mixed results of using this participant resource as a faciliatory strategy in implementing intensive mobility training to stroke populations. A survey on aspects of the participant resources which were barriers or beneficial may help refine use of the workbook for future interventions. And secondary to this, consider that self-efficacy in implementing skills learnt in intensive therapy sessions remains low, the reasons for which were not within the scope of the program delivered in Chapter Three.

4.3.2 The use of outcome measures used in this study and the implications for clinical practice

The clinical outcomes from the study described in Chapter Three reflect the difficulty in choosing robust and sensitive outcome measures which reflect change in the community dwelling stroke population. Discussion of the use of existing outcome measures recommended for stroke research by round table and consensus studies will not be covered within the scope of this paper. However it is acknowledged that use and implementation of outcome measures is a common problem in development of community interventions due the diversity of participant characteristics, stroke related impairments and comorbidities.[78] This issue is further compounded by the lack of consistently used outcome measures in previous trials investigating the outcomes of community or intensive interventions after stroke.[48, 100] Factors which were considered in the choice of clinical outcomes were participant characteristics, time after stroke and the tested validity, reliability and responsiveness of common outcome measures used in community settings.[101] Given the multifactorial nature of the intervention, outcomes were also chosen on practicality of implementing at multiple time points with minimal equipment. Each outcome measure chosen for the intervention and the rationale for its choice is presented below. The feasibility of the study presented in Chapter Three suggests a randomised control trial is warranted investigating the use of intensive therapy in a community stroke population. The implication for clinical practice and the potential for each outcome's use in a future study is also reflected on.

The 2 Minute Walk Test (2MWT) is a measure of self-paced walking that was developed as a redacted version of the 6 Minute Walk Test (6MWT).[84] The 2 Minute Walk Test was chosen as an outcome measure for the study in Chapter 3 due to its high reliability, responsiveness, and correlation with walking ability in stroke in inpatient settings after stroke.[85, 92, 102] It does not have the same evidence for minimal detectable change in community populations such as the 6MWT. But compared to the longer walk tests, the 2MWT is time efficient, practical to perform at multiple time points in smaller settings and reduces the effect of fatigue on performers.[92] The limitation of using the 2MWT as an indicator of walking speed and ability was that it is limited in assessing other aspects of gait such other as spatiotemporal parameters, quality of movement, use of assistive devices or physical assistance required.[85] A small change of between 0.21m/s and 0.27m/s in 3 participants was observed in the study described in Chapter Three, suggesting the 2MWT or a walking speed outcome measure would be an outcome of interest in community stroke populations in a future randomised control trial.

The Motor Assessment Scale (MAS) developed by Carr and Shepherd (1984) was chosen as a general mobility measure as it a comprehensive and commonly used measure of motor performance over eight items including walking.[79] Items 3 (Balanced Sitting) and 4 (Sitting to Standing) are known to have a ceiling effect in stroke rehabilitation and were used for screening participants eligibility due to the nature of semi supervised and self-directed practice embedded in the program.[102] As the most responsive item to change of the MAS is walking it was anticipated in a mobility program this may reflect any positive changes in participant performance.[102] This was only the case for one participant (Participant 4) who was in the subacute stage of rehabilitation. Future studies should consider the findings that for participants in the much later stages of recovery, the MAS was not as responsive to changes in walking ability in the intensive mobility program described in Chapter Three. As a result, the MAS will likely not be a useful outcome measure for a larger trial based on the findings in Chapter Three.

The Short Physical Performance Battery (SPPB) is a series of short physical performance tests which include a timed short distance walk, repeated chair stands

and a short balance test developed by Guralnik and colleagues (1994).[83] It is a reliable and validated tool for assessment of lower limb function and while typically used to determine general walking abilities in older populations, was used as it is predictive of disability in diverse populations.[103] It was chosen as an outcome as it has been shown to be associated with changes in walking ability after stroke and changes in 6MWT performance and as a possible reflection of community mobility.[104] The results from the study described in Chapter Three suggest that it does reflect some change in physical performance in lower functioning and subacute persons (for example the results of participant 1 and participant 4), but is not as responsive in more able persons (such as participants 2 or 3). Given the findings of this study, walking speed is likely to be a more useful outcome measure, either obtained from the 2MWT or the walking component of the SPPB for a future randomised control trial.

The Exercise Self Efficacy Scale (ESES) is a 10-item self-administered scale used to determine an individual's exercise related self-efficacy.[86] While not validated in community stroke populations, the tool has shown to be reliable in community dwelling stroke populations.[105] A recent study by Ogwymike and colleagues (2021) found a significant association between exercise related self-efficacy and self-reported quality of life (using the Stroke Specific Quality of Life Scale) in community dwelling stroke survivors.[105] The same study also indicated that exercise relate self-efficacy using the ESES was a predictor of quality of life and associated with independence in community dwelling populations. The ESES was implemented in this study to reflect changes which may have resulted in self efficacy in a practical method which could be completed in a timely manner by participants in the study described in Chapter Three. A finding from the study in Chapter Three was that the intensive mobility program resulted in maintaining exercise self-efficacy post intervention. A larger randomised control trial should ascertain whether a positive change in ESES may be reflected in a positive change in quality of life measures as the study was not statistically powered to comment on a clear association in the study described in Chapter Three.[105]

The Short Form Survey 12 (SF-12) was chosen as the quality of life outcome measure in this trial described in Chapter Three.[106] The SF-12 is a self-reported quality of life survey which a shorter version of the Short Form-36 survey and reports mental and physical quality of life across eight domains in general populations. [106] A quality of life measure was utilised because of the known association between walking ability and mobility, independence, adherence to physical activity in community dwelling stroke populations. [66, 70, 94, 106] While not as reliable or valid as the SF-36, the SF-12 was a practical, short and easy to access survey which had previously been shown to be responsive change in stroke populations.[66, 106] Further to this the SF-12 was recently used in the TaCAs trials implemented by Fu and colleagues (2020), which did not implement a physical intervention in community stroke populations.[66] The findings from the study described in Chapter Three showed that the intensive mobility program did result in a small change in physical related quality of life in participants. However as there was no clinically significant change which has been used in stroke populations the SF-12 would likely not be useful in a larger trial.[66, 106]

4.4 Strengths and limitations of the study

The study described in Chapter Three demonstrated that community rehabilitation can deliver very high intensity of practice when implementing an intensive mobility program but also presented several strengths and limitations. Strengths of the study included the application and uptake of best available evidence by the organisation and clinicians, low number of adverse events and strong methodology and implementation. Limitations of the study included the small sample size and the impact of COVID-19 on implementation. These factors will be discussed in more detail below.

4.4.1 The community setting and amount of practice

A strength of the study described in Chapter Three was that community rehabilitation was able to feasibly implement an intensive mobility program with an exceptionally high intensity of practice. As discussed earlier in this thesis, the amount of practice delivered was much higher than typically delivered in community settings, and very high even by more acute or intensive standards. The chosen setting for this

intervention was a private community rehabilitation organisation. In this organisation, adherence to clinical guidelines and acceptability of more novel interventions was typically high. This allowed the program to be implemented with a strong adherence to the methodology, an issue which is commonly raised in the delivery of more resource intensive interventions.[12, 24]

4.4.2 Context and organisational factors

A strength of the study described in Chapter Three was that the intensive mobility program was able to be implemented at an acceptable cost for private rehabilitation and had a high program acceptability at the organisational level. Acceptability of the program at an organisational level was of importance due to the nature of setting being private. All the five participants who completed the program were financially supported by government agencies such as the National Disability and Insurance Scheme (NDIS). The NDIS was introduced in Australia in 2013, providing support to people living with cognitive, physical, and psychological disabilities.[107] In the current community health climate, the scheme allows for people living with disability to make their own choices on models of care which suit their needs in a goal directed manner.[107] The cost of the intervention was determined by cost per clinician hour per participant. Provision of allied health care in community settings are different to inpatient or acute settings where services are provided on a 'as per need basis', meaning community-based therapy provision is tied to hours of service under government agencies.[107] Thus, the estimated cost of the program was determined by the number of participants enrolled in the program with a minimum of two participants and maximum of three participants enrolled in each cohort to be financially feasible. The high acceptability of the program to recipients of the NDIS, suggests this type of therapy model aligns with current NDIS service delivery. [107] A limitation of this study was that it was unable to further investigate the aspects of NDIS based service delivery. Future developments in community-based therapy should consider the aspects of NDIS based service delivery which may determine organisational acceptability outcomes which were outside the scope of the study described in Chapter Three. Goal-oriented services, access to multidisciplinary teams and self-management may be key to delivering services to this population.[107]

4.4.3 Stakeholders and clinicians

The study described in Chapter Three was limited to reporting only participant adherence and acceptability not clinician's adherence and acceptability beliefs about the intensive mobility program. However, a strength of the study was feedback from multidisciplinary meetings, training sessions and informal conversations provided valuable informal feedback within the program. While the adherence to the implementation of the intensive mobility program was generally good, this was due in part to the dedication of clinicians at each intervention site who took the responsibility for driving the program. A recent study reported clinician adherence to both a facilitator mediated and participant self-directed rehabilitative program through audit and feedback processes (including standardised survey and focus groups), a methodology which could be considered in future studies to report on clinician experience more formally.[96] In the study presented in Chapter Three, challenges expressed by clinicians in these sessions included concerns around how to initiate the program, staffing across multiple locations and implementing novel aspects such as the self-directed training sessions. These concerns are consistent with reported concerns in another more intensive programs such as the Graded Repetitive Arm Supplementary Program (GRASP) program for intensive upper limb training.[12] In their study evaluating clinician's opinions the intervention, implementation was most often dependent on key change makers or peer leaders and on the enthusiasm of individual clinicians. [12] The implementation fidelity of the GRASP program was also dependent on the fidelity of individuals to the components described in the guideline manual. [12] The study reports that although implementation was good, fidelity to key components of the intervention manual was lower than expected and dependent on t clinicians' concerns. An example of this in the study described in Chapter Three, was most clinicians more consistently reporting RPE rather than number of repetitions in the first week of the intervention. Concerns over tolerability in terms of difficulty was a known moderating factor implementing higher intensity interventions previously such as the DOSE and GRASP trials described in Chapter Two of this thesis.[12, 24, 46] While not within the scope of this thesis, future research should consider the receptibility of clinician stakeholders in implementing intensive practice in the community and consider that while controversial, adaptability and acceptability of the intervention to clinician concerns is likely to facilitate adherence and

implementation.[12] Future studies should also consider the use of standardised survey and focus group of key stakeholders and map barriers and enablers to clinician hesitancy. For example, surveying time taken to complete assessment tasks and providing the TaCAs program by clinicians. This may help determine which facilitation strategies may best assist a common barrier such as clinician hesitancy.[98] Survey may also address the feasibility of the intervention for clinicians including their feedback on the acceptability of time demanding tasks (such as the time taken to complete assessments and programs such as the Take Charge (TaCas) program).[108]

4.4.4 Safety

Safety was a factor of interest in delivering the intensive mobility program to community dwelling stroke survivors. A strength of the study described in Chapter Three, was that the number of adverse events which occurred from intensive mobility training was low. There were two adverse events which occurred during the intensive mobility program described in Chapter Three of this thesis. The two adverse events which occurred during the intervention were both controlled falls during semi-supervised practice sessions. Both events occurred to the same individual, who was a known faller, experiencing multiple falls in the previous 12 months and in both incidents the participant caught themselves, lowering themselves to the floor. Future studies should consider investigating the potential risks of mixed direct, semi supervised, circuit and independent practice within intensive mobility programs to determine the absolute risk of this type of mixed intervention. From our findings, overall risk of intensive mobility programs appears low, however participants would benefit from supervision as closely as possible during the intervention when known fallers.

4.4.5 Participant characteristics and sample size limitations

The study described in Chapter Three was not without limitations. The size of the study was small, with only five participants completing the intensive mobility program across two rehabilitation sites. The smaller sample size reflected the difficulty recruiting participants during the COVID-19 period who met the inclusion criteria for the study and the timeframes in which to complete the research. The inclusion

criteria included mobility measures to benchmark functional abilities due to the nature of including semi supervised and self-directed sessions within the program and the COVID-19 restrictions on assistance by family members or others. This restriction also influenced how many people were able to enter the rehabilitation gym at a given time. This may have disproportionately skewed the sample to higher mobility functioning candidates who were recruited or enrolled in the program. As discussed earlier in this thesis, in addition to being small, the participants who completed the program had diverse characteristics, and future studies should consider that community dwelling stroke survivors are wide-ranging in their presentation and abilities. Larger sample sizes would help to determine the effect size of clinical outcomes and provide the statistical power to make more definitive conclusions about the effect of intensive training on mobility outcomes.

4.4.6 COVID-19

The COVID-19 pandemic was a major external factor which may have influenced the implementation of the intensive mobility program described in Chapter Three of this thesis. Recruitment of participants was impacted by COVID-19, with the period of recruitment occurring during government restrictions and lockdown policies delaying logistical operations such as booking in appointments. This resulted in some participants deferring their enrolment into the program to a later date, restricting the total number of participants who were enrolled in the program. Also, due to changing government restrictions, elements of the program were facilitated via telehealth, such as the multidisciplinary case conferences. One participant became unwell during the intervention period due to COVID and subsequently completed only one week of the intervention.

4.5 Key implications for future research based on the findings of the intensive mobility program

Based on the findings from the study described in Chapter Three, there are number of key implications for future research into intensive mobility programs to community dwelling stroke survivors. The study described in Chapter Three demonstrated that higher dosages of training can be successfully implemented in private rehabilitation community settings after stroke. A larger and statistically powered trial with a control

group should be considered to examine the replicability of this program. A success of the study described in Chapter Three was that adherence to higher dosages of training can be facilitated by monitoring and progressing training which is clearly articulated in content and dosage. At the clinical level, future studies would be warranted to determine the relationship between different dosages of training and functional outcomes in community stroke populations as the relationship between dosage and chronic stroke outcomes has not been determined. Consistent with previous findings, the study showed mixed direct supervision, semi supervised practice, circuit training and self-directed training can all be feasibly implemented in a community setting.[26, 35, 37, 109] A future trial examining the direct effect of additional self-directed sessions could be considered given the high adherence to these sessions in our study when delivered consecutively with other training methods.

At a participation level, a novel finding in our study was that collaborative relationships with a multidisciplinary team and use of self-management strategies such as Take Charge or a participant workbook facilitated implementation of the program. However, future studies should consider the known effect of Take Charge on independence and quality of life, but also how these resources may be better translated into improvements into exercise self-efficacy in stroke populations. At an organisational level, future developments in community-based implementation should consider the social-political impacts of service delivery. Previously, successful implementation and upscaling of multidisciplinary stroke care units had a significant impact in Australia on lowering deaths and disability and subsequently health associated costs.[110] Future research should consider the impact of an organisation such as the NDIS on delivering longer-term rehabilitation in people accessing the scheme. Determining the feasibility of other novel rehabilitative models on goal directed outcomes for both stroke and other neurological community dwelling populations who access longer term supports is also warranted. Potentially this could compare uptake or receptivity, cost effectiveness and quality adjusted life years (QALYs) measures of participants with NDIS support and without.[110]

4.6 Conclusion

In conclusion, the findings from the study described in Chapter Three of this thesis support that an intensive mobility program delivered to community stroke survivors is

feasible to implement. The program was delivered with a high adherence, acceptably and safely. A novel finding from this study was that very high dosages of training can be delivered to stroke survivors in a community setting. The program implemented the largest dosage of training ever delivered (at the time of writing) to exclusively community dwelling stroke survivors in a private rehabilitation setting and was well received by this population. This suggests that progressive training which promotes improvement in mobility in community settings after stroke is an area of interest. Another key finding from our study was that intensive or potentially more 'gruelling' therapy interventions may be mediated by collaborative and multidisciplinary therapeutic relationships which foster motivation in participants. More intensive rehabilitation is well facilitated using a multidisciplinary team and successfully embedded self-management strategies.

From the presented study, an intensive mobility program shows promise in improving mobility, physical related quality of life and self-efficacy in community dwelling stroke survivors. The direct effect of this program these outcomes warrants further investigation via a randomised controlled trial. The use of clinical measures in this study should be considered in the planning of future trials to determine the effect of intensive mobility training on functional outcomes. This is especially given the diversity of function of community stroke populations as identified in this and previous studies. Future research should also consider the strategies implemented in this study which facilitated implementation such as the use of the multidisciplinary team meetings and the mixed reception of intervention resources such as the participant workbook to facilitate self-management. The findings from the study reported in this thesis show there is potential for community rehabilitation to provide the means to progress mobility much later after stroke, and that models of intensive mobility training are feasible for this population.

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Appendix 1: Summary of community interventions after stroke

Table 1: Comparing the randomised controlled trials of community programs previously offered to community-dwelling stroke survivors.

Randomised control trials	**Pang et al. (2005)**[11]	**Mudge et al. (2009)**(27)	**Langhammer et al. (2009)**(7)	**Marsden et al. (2010)**[2]	**Dean et al. (2012)**(4)	**Takatori et al. (2012)**(9)
Participants (Intervention/Control)	63 (32/31)	58 (31/27)	75 (35/40)	31 (12/13)	151 (76/75)	44 (22/22)
Demographic						
Age (years)	65	71.5	74	71.55	67	68.55
Sex	59% Male	55% Male	57% Male	61% Male	51% Male	72% Male
Time since stroke (TSS) (years)	TSS: >1	TSS: 3.9	TSS: At discharge from acute	TSS: 3.1	TSS: 5.9	TSS: >1
Baseline mobility status	Walks more than 10m independently with/without an aid	Walks independently with/without an aid	Mobility not reported	Mobility not reported	Walks more than 10m independently with/without an aid	Walks more than 10m independently with/without an aid
Intervention	Fitness and mobility exercise (FAME) program	Circuit stations were specified in the study and included general functional strength, balance and walking practice.	'Intensive' training (minimum 80 hours in 12 months): Endurance, strength, balance exercises + additional individualised/unspecified therapy	Community Living After Stroke for Survivors and Carers (CLASSiC) program. 1 hour physical activity and 1 hour education delivered by a multidisciplinary team	Weight bearing exercises for better balance (WEBB) program	Strength, Balance, Whole body Vibration, Aerobic training
Control	Seated upper limb program	8 x 90 minute occupational therapy social and education group	Self-initiated exercise group	No intervention	Upper limb and cognitive training	Stretching and Gait Training (40 minutes)
Duration of program	19 weeks	4 weeks	12 months	7 weeks	12 months	12 weeks
Frequency (number of sessions per week)	3x weekly circuit class, 3 workstations	3x weekly circuit group, 15 stations for 5 minutes each	2 x weekly	1x weekly group session	1x weekly circuit group, home exercise program	2x weekly

Randomised control trials	**Pang et al. (2005)**[11]	**Mudge et al. (2009)**(27)	**Langhammer et al. (2009)**(7)	**Marsden et al. (2010)**[2]	**Dean et al. (2012)**(4)	**Takatori et al. (2012)**(9)
Session Length (time)	60 minutes	50-60 minutes	60 -120 minutes	150 minutes	45-60 minutes	120 minutes
Table 1: Comparing the randomised controlled trials of community programs previously offered to community-dwelling stroke survivors.						
Intensity (Reps, RPE, %HRR)	Started at 40-50% HRR and increased by 10% HRR every 4 weeks as tolerated	Not reported	Endurance: 70-80% HR max Strength: 50-60% 1RM Balance: 15-17 RPE	Not reported	Not reported	Strength: 10 RM Max Aerobic: 'Light' RPE (Borg Scale)
Adherence rate to intervention	81.4%	90%	80% intensive group 78% self-initiated group	88%	63%	No adherence reported
Difficulty/ Progression	Increasing intensity by 10% HRR each week and increasing repetitions	Increasing difficulty in each task was specified in study	No progression reported	No progression reported	Progression tailored to individuals	No progression reported
Follow up	No follow up	3 months	12 months	5-10 weeks	12 months	No follow up
Outcome	The FAME program can be is feasibly implemented for older community dwelling stroke survivors. The program can improve cardiorespiratory fitness (VO2 Max), walking capacity (6MWT) and maintain bone mineral density (BMD) in this population.	Circuit based classes can be used to improve walking endurance (6MWT) performance in chronic stroke populations. In this trial, circuit classes did not improve physical activity levels. Gains in endurance (6MWT) were not retained at 3 months follow up post circuit classes.	Using a more 'intensive' program, both self-directed and intensive groups improved in frequency of practice, ADLs, motor function, gait and balance and grip strength. Both groups had similar physical performances at 12 months follow up indicating that increased practice rather than structure may have a role in maintaining physical function.	Using group task training and combined self-management using the CLASSiC program, can improve physical performance in stroke survivors, health related quality of life and reduced carer burden.	Circuit group training using the WEBB program may increase walking capacity increased walking speed in community stroke populations. However, the WEBB intervention had did not reduce the number of falls of participants compared to control groups.	Intensive training can make a small improve arterial occlusion but not improvements in physical function or ADLs.

Table 2: Comparing other studies on programs previously offered to community-dwelling stroke survivors.

Study	**Eng et al.(2003)**[6] *(Single group, repeated measures)*	**Song et al. (2015)**[8] *(Three arm control trial)*
Participants (Intervention/Control)	25	30 (10/10/10)
Demographic		
Age (years)	63.16 (SD=8.5)	62.05 (SD= 7.9)
Sex	76% Male	Sex not reported
Time since stroke (TSS)	TSS: 4.24 years (SD=2.86)	TSS: 2.64 years (SD=1.4)
Baseline mobility status	Walks 10m independently with/without an aid	Mobility not reported
Intervention	Functional exercise program including aerobic warm up, functional lower leg strength and balance, walking circuit and warm down with stretching	Individual task orientated circuit training (ITCT) 30 minutes + conventional therapy 30 minutes per day Circuit training was based on 5 stations involving functional task orientated exercises and mobility training.
Control	No control	Conventional Therapy or Class based task orientated circuit training (CTCT)
Duration of program	8 weeks	4 weeks
Frequency (number of sessions per week)	3x weekly group	3x sessions per week
Session Length (time)	60 minutes	30 minutes
Intensity (Reps, RPE, %HRR)	11-13/16 Borg Rating of Perceived Exertion (RPE)	Not reported
Adherence rate to intervention	94%	No adherence reported
Difficulty/ Progression	Progression maintained at same level of moderate intensity RPE	Increasing task difficulty, but not specified how in the study
Follow up	1 month	No follow up

Study	**Eng et al.(2003)**[6] *(Single group, repeated measures)*	**Song et al. (2015)**[8] *(Three arm control trial)*
Outcome	Improvements and retention in mobility (gait speed), functional capacity (12MWT), balance (Berg Balance Scale) and COPM related goals	Task orientated circuit training performed individually or within a group improves gait velocity and cadence compared to conventional therapy

Appendix 2: Stroke Research and Treatment Manuscript Submission Guidelines

Stroke Research and Treatment Manuscript Submission Guidelines available at https://www.hindawi.com/journals/srt/guidelines/ Accessed 20 June 2022.

Article Types

The journal will consider the following article types:

Research articles

Research articles should present the results of an original research study. These manuscripts should describe how the research project was conducted and provide a thorough analysis of the results of the project. Systematic reviews may be submitted as research articles.

Reviews

A review article provides an overview of the published literature in a particular subject area.

Formatting

Title and authorship information

The following information should be included:

- Manuscript title
- Full author names
- Full institutional mailing addresses
- Email addresses

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Abstract

The manuscript should contain an abstract. The abstract should be self-contained, citation-free, and should not exceed 300 words.

Introduction

This section should be succinct, with no subheadings.

Materials and methods

The methods section should provide enough detail for others to be able to replicate the study. If you have more than one method, use subsections with relevant headings, e.g. different models, in vitro and in vivo studies, statistics, materials and reagents, etc.

Hindawi journals have no space restriction on methods. Detailed descriptions of the methods (including protocols or project descriptions) and algorithms may also be uploaded as supplementary information or a previous publication that gives more details may be cited. If the method from a previous article is used, then this article must be cited and discussed. If wording is reused from a published article, then this must be noted, e.g. This study uses the method of Smith et al. and the methods description partly reproduces their wording [1].

If a method or tool is introduced in the study, including software, questionnaires, and scales, the license this is available under and any requirement for permission for use should be stated. If an existing method or tool is used in the research, the authors are responsible for checking the license and obtaining any necessary permission. If permission was required, a statement confirming permission was granted should be included in the materials and methods section.

Publishing protocols. We encourage authors describing any methodology, in particular laboratory-based experiments in the life sciences but also computational and bioinformatics protocols, to upload details of their methods to protocols.io. This is an open access website that allows researchers to record their methods in a structured way, obtain a DOI to allow easy citation of the protocol, collaborate with selected colleagues, share their protocol privately for journal peer review, and

choose to make it publicly available. Once published, the protocol can be updated and cited in other articles.

You can make your protocol public before publication of your article if you choose, which will not harm the peer review process of your article and may allow you to get comments about your methods to adapt or improve them before you submit your article (see also the protocols.io FAQ page).

Results and discussion

This section may be divided into subsections or may be combined.

Main text (review only)

This section may be divided into subsections or may be combined.

Conclusions

This should clearly explain the main conclusions of the article, highlighting its importance and relevance.

Data availability

This statement should describe how readers can access the data supporting the conclusions of the study and clearly outline the reasons why unavailable data cannot be released.

Conflicts of interest

Authors must declare all relevant interests that could be perceived as conflicting. Authors should explain why each interest may represent a conflict. If no conflicts exist, the authors should state this. Submitting authors are responsible for co-authors declaring their interests.

Conflicts of interest (COIs, also known as ‘competing interests’) occur when issues outside research could be reasonably perceived to affect the neutrality or objectivity of the work or its assessment. For more information, see our publication ethics policy. Authors must declare all potential interests – whether or not they actually had an influence – in the conflicts of interest section, which should explain why the interest may be a conflict. If there are none, the authors should state: “The author(s)

declare(s) that there is no conflict of interest regarding the publication of this article". Submitting authors are responsible for co-authors declaring their interests. Declared conflicts of interest will be considered by the editor and reviewers and included in the published article.

Authors must declare current or recent funding (including for article processing charges) and other payments, goods or services that might influence the work. All funding, whether a conflict or not, must be declared in the funding statement. The involvement of anyone other than the authors who: i) has an interest in the outcome of the work; ii) is affiliated to an organization with such an interest; or iii) was employed or paid by a funder, in the commissioning, conception, planning, design, conduct, or analysis of the work, the preparation or editing of the manuscript, or the decision to publish must be declared.

You may be asked to make certain changes to your manuscript as a result of your declaration. These requests are not an accusation of impropriety. The editor or reviewer is helping you to protect your work against potential criticisms.

If you are in any doubt about declaring a potential conflict, remember that if it is revealed later – especially after publication – it could cause more problems than simply declaring it at the time of submission. Undeclared conflicts of interest could lead to a corrigendum or, in the most serious cases, a retraction.

Funding statement

Authors must state how the research and publication of their article was funded, by naming financially supporting body(s) (written out in full) followed by associated grant number(s) in square brackets (if applicable), for example: "This work was supported by the Engineering and Physical Sciences Research Council [grant numbers xxxx, yyyy]; the National Science Foundation [grant number zzzz]; and a Leverhulme Trust Research Project Grant".

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Acknowledgments

All acknowledgments (if any) should be included at the very end of the manuscript before the references. Anyone who made a contribution to the research or manuscript, but who is not a listed author, should be acknowledged (with their permission).

References

Authors may submit their references in any style. If accepted, these will be reformatted in Chicago style by Hindawi. Authors are responsible for ensuring that the information in each reference is complete and accurate. All references should be numbered consecutively in the order of their first citation. Citations of references in the text should be identified using numbers in square brackets e.g., “as discussed by Smith [9]”; “as discussed elsewhere [9, 10]”. All references should be cited within the text and uncited references will be removed.

Citation standards. All data, program code, and other methods should be appropriately cited. Such materials should be recognized as original intellectual contributions and afforded recognition through citation.

Appendix 3: Intensive Mobility Program Participant Workbook

PARTICIPANT TRAINING WORKBOOK

ACCELERATE YOUR POTENTIAL

CONCENTRIC
REHABILITATION CENTRE
Award Winning Allied Healthcare

Intensive training

Congratulations on commencing this intensive program!
We are very excited to work with you to help you reach your potential!

WHAT IS AN INTENSIVE PROGRAM?

An intensive program is a when you do a lot of therapy each day.
It helps you reach your goals in a shorter time.

THE PROGRAM INCLUDES:

3-week program
3 hours per day

Multidisciplinary team

Rehabilitation for stroke recovery

The latest rehabilitation equipment

What will it involve?

Every day you will have:

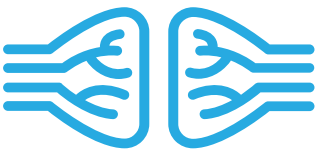
- Sessions with therapists
- Group sessions

It will teach you how to practice at home
It will be in the clinic or in the community with the choice of training at home

Who will join me?

Therapy shouldn't be lonely or boring, so you will do the program with two other stroke survivors.
It will help you organise training programs, build a therapy community & encourage each other.

WHY INTENSIVE PROGRAM?



Neuroplasticity: the ability of the brain to make and change the things you know & do

Self-determination: the ability of a person to control their own life

Both of these things are important and each person should be given the support to get the right practice to have the best chance at recovery

It is best to have 1000s of repetitions everyday to train the brain

Sessions will include strength, task and mobility training to help neuroplasticity

BEFORE THE INTENSIVE PROGRAM?

To get you ready for active training, you will be doing a program called ‘Taking Charge’. It will help you figure out your big picture goals, and then support you to reach them.
Before you start the program, you will have an assessment and discussion with your therapist by yourself.

WHAT TO EXPECT

E

Engage your Motivation, Skills and Abilities!
The ‘Taking Charge’ program will help you discover what is important & motivating for you.
Based on analysis of your movement and any underlying problems, your therapist will identify key areas which may make the biggest difference to your goals.

P

Purposeful & Goal Directed training!
Based on your key areas, you will select an BIG intensive goal which will be your main area of training for the next 3 weeks.
Our multidisciplinary team will help you create a treatment plan which is individualised, and goal directed.

I

Intensity! Repetition is key!
Sessions will also be individualised for your goals & abilities.
Including:
Strength Training: Learning to switch muscles on & restore muscle-brain connections
Task Specific Training: Learning to use those muscles in everyday tasks such as standing or walking
Mobility Training: Completing walking tasks in environments which challenge your current abilities

C

Continual and Structured Feedback!
Ultimately you are driving your own recovery.
Use your team to find the best set up to practice good technique, use your affected limb and reduce compensations. Use this workbook to record your goals & progress!

Program structure

INDIVIDUAL ASSESSMENT

TAKING CHARGE PROGRAM

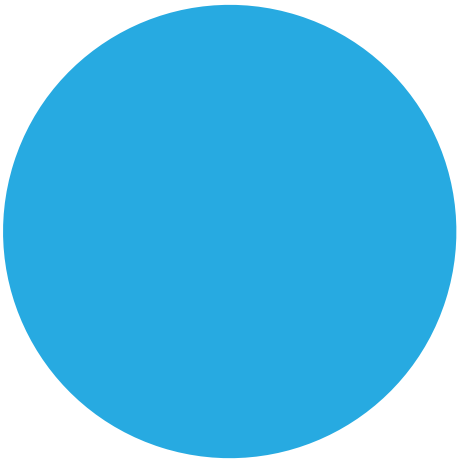
BIG PICTURE GOAL SETTING AND TREATMENT PLAN

45 HOUR INTENSIVE PROGRAM

BIG PICTURE GOAL REVIEW

REFLECTIONS AND NEXT STEPS

Intensive workbook contents



My outcome measures

Summary of performance measures

Indicators	Outcome measure	Pre-intensive performance	Mid-point review *(Only 2.2-2.3)*	Post-intensive performance
Mobility	2.1 Motor assessment scale stroke (MAS)			
Balance and mobility	2.2 Short physical performance battery (SPPB)			
Mobility and walking speed	2.3 2 Minute walk test (2MWT)			
Self-reported function	2.4 Patient specific functional scale (PSFS)			
Exercise self efficacy	2.5 Exercise self efficacy scale (ESES)			
Impact of health on quality of living	2.6 Short form survey (SF-12)			

AREAS OF DIFFICULTY IDENTIFIED

Taking charge after stroke

'Taking Charge' after stroke is a community program to help the person recovering from stroke to take charge of their recovery.

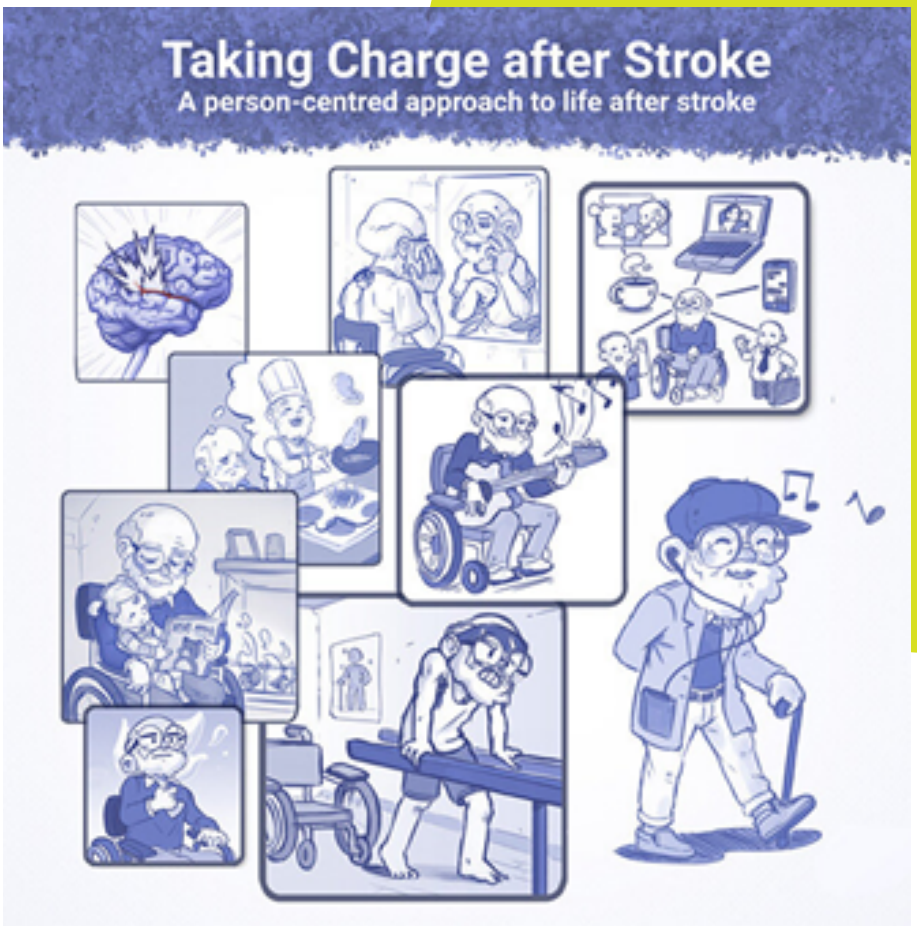
Taking Charge has already helped many people after stroke improve:

Independance

Quality of life

Purpose

THE ROLE OF YOUR FACILITATOR IS TO LISTEN & REFLECT YOUR THOUGHTS BUT YOU ARE IN CHARGE!



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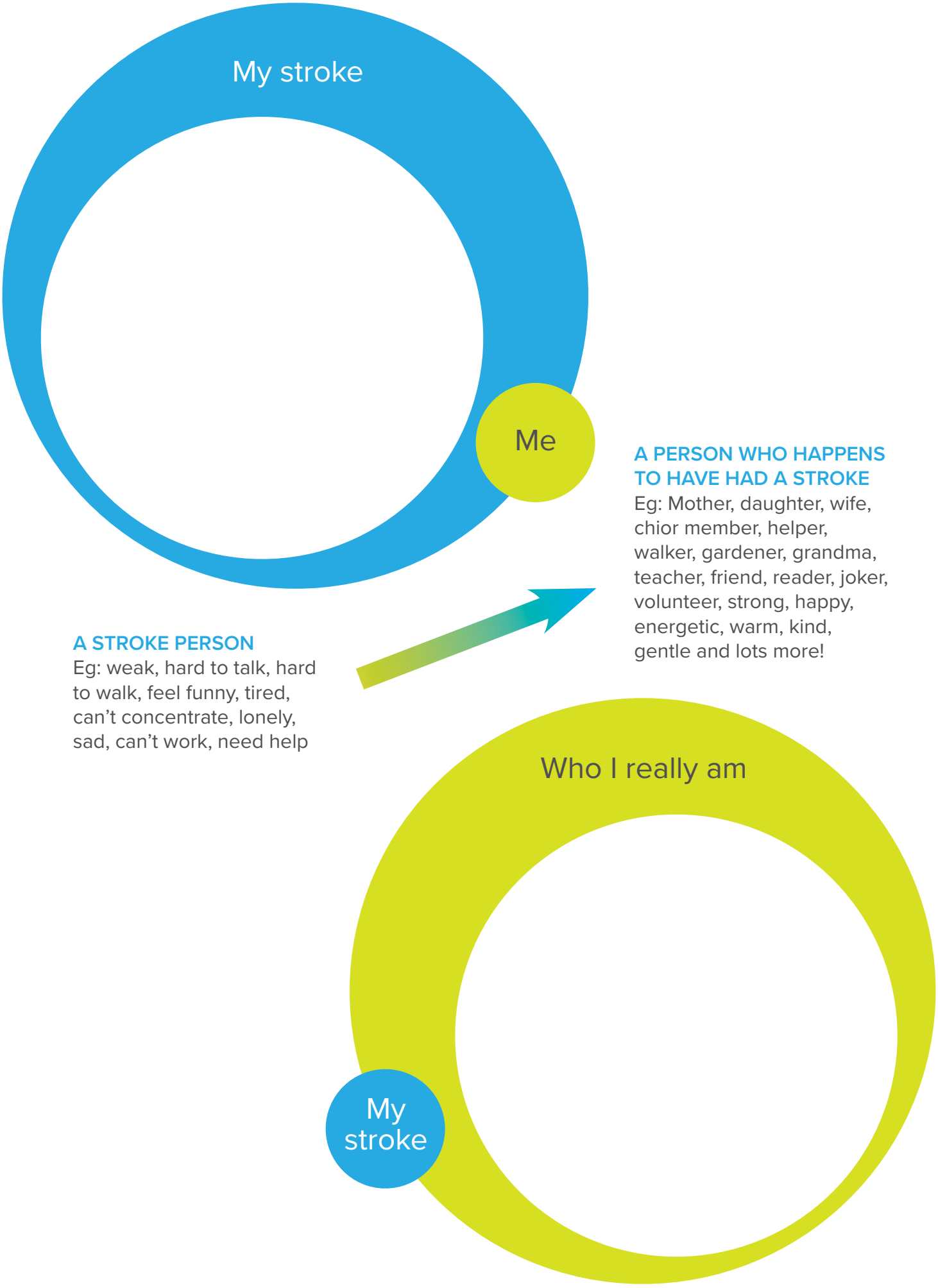

My stroke
Me
A PERSON WHO HAPPENS TO HAVE HAD A STROKE
Eg: Mother, daughter, wife, chior member, helper, walker, gardener, grandma, teacher, friend, reader, joker, volunteer, strong, happy, energetic, warm, kind, gentle and lots more!
A STROKE PERSON
Eg: weak, hard to talk, hard to walk, feel funny, tired, can't concentrate, lonely, sad, can't work, need help
Who I really am
My stroke

WHAT DO I WANT TO DO WITH MY LIFE?

Overall hopes, aims, aspirations for the next 12 months:

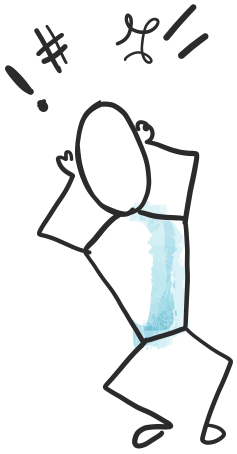
1.

2.

3.

4.

WHAT AM I AFRAID OF?



Main fears:

1.

2.

3.

4.

REMEMBER! You can draw your responses!

WHAT WOULD MY BEST DAY LOOK LIKE?

Draw a picture of your best day here.

Friends and family may also want to draw something.

For people who don't feel like drawing, an alternate strategy is to ask the person to close their eyes and visualise their best day to describe it. (A support person or the facilitator might draw what is described or write a verbatim description.)

PHYSICAL THINGS

Like getting around, washing and dressing, doing the housework.

Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*To walk to the shops on my own*	*1. Walk unaided - 1 month* *2. Walk unaided 200m - 3 months* *3. Walk to the shop - 6 months*	*1. Walking practice with support person present 5 times a week* *2. Physio advice about stick and walking frame*

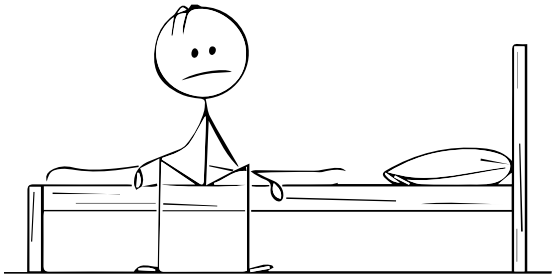
COMMUNICATION

Including speech, undertanding, reading, writing and using a computer.

Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*To be able to answer the telephone*	*1. To be confident talking to someone I know - 2 months* *2. To be confident talking on the telephone to someone I know - 4 months*	*1. Lots of practice with people I know* *2. Use answerphone until confident answering phone myself*

EMOTIONAL ISSUES

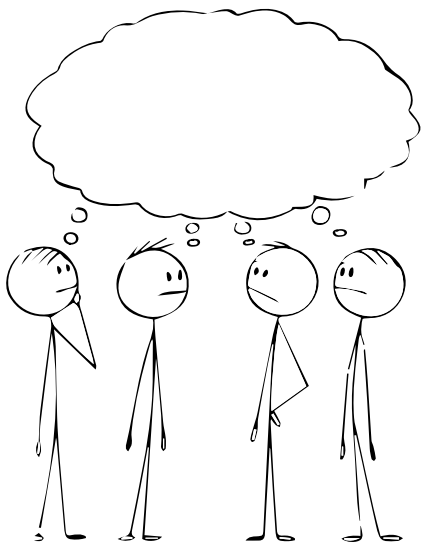
Like feeling anxious, worried, stressed, depressed, helpless.



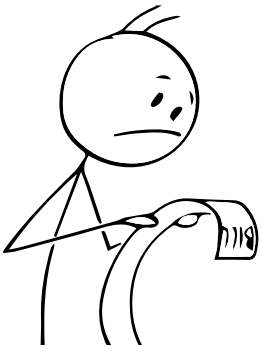
Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*To feel in control/ charge*	*1. Look at my main hopes for next 12 months every week* *2. Sleep 6 hours/night + nap 1 hour*	*1. Put my 'main hopes' sheet on the fridge door where I can see it* *2. Join a support group?*

INFORMATION NEEDS

Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*Understand what happened and why*	*1. Understand what a stroke is* *2. Understand why a stroke occurred* *3. Understand rehabilitation*	*1. Talk to other people, including Stroke Foundation, doctor, inernet (www.stroke.org.nz)*



FINANCIAL ISSUES

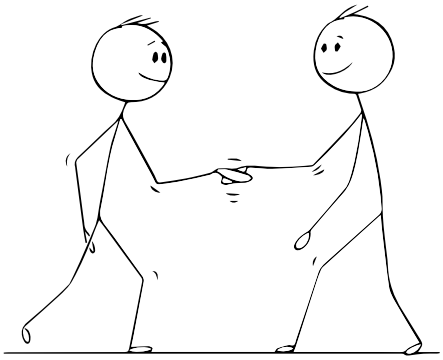


Like paying bills, returning to work, using a budget, knowing about available supports.

Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*To reduce travel costs*	*1. Mobility car sticker* *2. Taxi chits and other supports* *3. Informed about WINZ/NDIS support*	*1. GP to provide* *2. Stroke foundation, local providers* *3. WINZ/NDIS information*

MY SUPPORT NETWORK

Where I go for help, support, having a good time.



Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*To get more of my support team involved*	*1. TSupport team understand my main hopes for the future* *2. Enough help for me and my carers*	*1. Information/support group* *2. Meet with supports needs assessor (GP can arrange)*

PREVENTING STROKES AND HEART ATTACKS IN THE FUTURE

Blood pressure, smoking, diet, exercise, diabetes.

Date	Goals in own words	Specific objectives & time frame	How to achieve these
Example	*To reduce my risk of stroke (my poblems are high blood pressure, diabetes and cigarettes!)*	*1. BP < 135/80* *2. HbA1C <50* *3. Quit smoking*	*1. Reduce salt, take medicines, measure myself at home* *2. Nutrition and exercise* *3. Enrol in quit programme*

My goal setting & program

You have chosen to start an intensive therapy program to help you be your best!

You will have completed your Take Charge program and your Intensive assessment with a therapist before starting this program. We hope that you will think of 1-2 main goals to work on over the next three weeks.

GOAL SETTING

My BIG goal is: (This is a BIG picture vision or purpose)

WHAT ARE THE STEPS TO REACH MY GOAL

My main goal for this intensive is: (1 or 2 of these may be your intensive goal)

This goal's importance to me:

1 2 3 4 5 6 7 8 9 10

Your therapist may help you complete the following table about your current performance at this activity:

GAS GOAL SCALE	VERBAL RATING		DESCRIPTION OF PERFORMANCE	NUMERICAL CONVERSION
AT BASELINE	With respect to this goal do you have...	Some function (please describe)		-1
		No function (please describe)		-1
		A lot more (please describe)		+2
AT OUTCOME REVIEW: WAS THIS GOAL ACHIEVED?	Yes	A little bit more (please describe)		+1
		Performs as expected (please describe)		0
	No	Partially achieved (please describe)		-1
		No change		-1 or -2
		Got worse (please describe)		-2

My second goal for this intensive is:

This goal's importance to me:

1 2 3 4 5 6 7 8 9 10

Your therapist may help you complete the following table about your current performance at this activity:

GAS GOAL SCALE	VERBAL RATING		DESCRIPTION OF PERFORMANCE	NUMERICAL CONVERSION
AT BASELINE	With respect to this goal do you have...	Some function (please describe)		-1
		No function (please describe)		-1
		A lot more (please describe)		+2
AT OUTCOME REVIEW: WAS THIS GOAL ACHIEVED?	Yes	A little bit more (please describe)		+1
		Performs as expected (please describe)		0
	No	Partially achieved (please describe)		-1
		No change		-1 or -2
		Got worse (please describe)		-2

My personal goal for this intensive is:

This goal's importance to me:

1 2 3 4 5 6 7 8 9 10

Your therapist may help you complete the following table about your current performance at this activity:

GAS GOAL SCALE	VERBAL RATING		DESCRIPTION OF PERFORMANCE	NUMERICAL CONVERSION
AT BASELINE	With respect to this goal do you have...	Some function (please describe)		-1
		No function (please describe)		-1
		A lot more (please describe)		+2
AT OUTCOME REVIEW: WAS THIS GOAL ACHIEVED?	Yes	A little bit more (please describe)		+1
		Performs as expected (please describe)		0
	No	Partially achieved (please describe)		-1
		No change		-1 or -2
		Got worse (please describe)		-2

How do I want to feel when I achieve this goal/s?

What will achieving this goal mean to me?

SELF-MONITORING

How will I know when I have achieved a success each day?

How will I measure how well I am working toward my goal?

- Number of repetitions
- Perceived effort (RPE scale)
- Number of 'wow' moments
- Other (please specify): .....

MY ROTUINE

How will I set myself up for success in this program?

What routines will I set/ self-care strategies will I use?

(This could be a priming strategy you do before you start for the day (ie; listen to music you love) or making sure you have a set number of hours of sleep, or a certain snack you enjoy for when you need a break)

When I am having an 'off day', what do I want to remind my future self?

MY INTENSIVE SCHEDULE

Your current intensive program includes:

- 1:1 Physiotherapy / Exercise Physiology / Occupational Therapy
- Gladiators Group (Strength training) Group
- Stroke Superheroes (Task/Mobility/Strength) Training Group
- Maverick Session (Self-directed practice)
- Walk Warriors (Mobility Training Sessions) (including Outdoor mobility)
- Community Champions Group (Community Participation)

Note: Each session will have an active break between each exercise. An active break period is about 1-2 minutes. Every hour there will be 10 minutes of rest.

Changes you can make to the program

- You will need to do a total number of 45 hours of training over 3 weeks to finish the program. You can change these things as long as you talk to your therapist.
- You can do a Maverick Session instead of doing group classes. A Maverick Session is practice you do by yourself. You must record your exercises to show your therapist the next day.
- You can do up to two hours of your Maverick Sessions on the weekend. The practice needs to be the same that you would have done during the week. You must record your exercises to show your therapist the next week.

My intensive program

DAILIES

Dailies track your progress in the program and record what you have achieved/ your achievements.

Reflecting is when we look back on what we have already done. It helps to keep you in the driving seat of your rehabilitation journey. This keeps you focused and helps you record your progress.

Each person has different skills, strengths and experiences! They have shaped you. You can use them to support your health and wellbeing.

Please use the reflections and recording sheets as much as you can. This will help you get the most out of the program.

DAY 1

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 2

TODAY IS A NEW DAY!

My goal/s for today is ...

☐

☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 3

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

What will you focus on tomorrow?

DAY 4

TODAY IS A NEW DAY!

My goal/s for today is ...

☐

☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

What will you focus on tomorrow?

DAY 5

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 6

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 7

TODAY IS A NEW DAY!

My goal/s for today is ...

☐

☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

What will you focus on tomorrow?

DAY 8

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 9

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 10

TODAY IS A NEW DAY!

My goal/s for today is ...

☐

☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 11

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 12

TODAY IS A NEW DAY!

My goal/s for today is ...

☐

☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 13

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

What will you focus on tomorrow?

DAY 14

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

No hurt | Hurts little bit | Hurts little more | Hurts even more | Hurts whole more | Hurts worst

What will you focus on tomorrow?

DAY 15

TODAY IS A NEW DAY!

My goal/s for today is ...

- ☐
- ☐

Tick off the goals you completed today

What are the things you need to do to achieve this goal today?

How do you want to feel when you've achieved this goal/s today?

Reflect on your performance today - what was your highlight or WOW moment?

Reflect on section 3: self-monitoring. What is your progress towards your goal? What number would you give your 'success' today?

1 2 3 4 5 6 7 8 9 10

How are you feeling?

What will you focus on tomorrow?

BIG goal review & reflection

TIME TO REFLECT!

Congratulations on completing your intensive! What an achievement! Now is the time to go back and look at your intensive goals and reflect on your performance!

My Main Goal for this intensive was:

What can you now do?

This goal's importance to me:

1 2 3 4 5 6 7 8 9 10

Your therapist may help you complete the following table about your current performance at this activity:

GAS GOAL SCALE	VERBAL RATING		DESCRIPTION OF PERFORMANCE	NUMERICAL CONVERSION
AT BASELINE	With respect to this goal do you have...	Some function (please describe)		-1
		No function (please describe)		-1
		A lot more (please describe)		+2
AT OUTCOME REVIEW: WAS THIS GOAL ACHIEVED?	Yes	A little bit more (please describe)		+1
		Performs as expected (please describe)		0
	No	Partially achieved (please describe)		-1
		No change		-1 or -2
		Got worse (please describe)		-2

How will you incorporate your new ability into your week?

My second goal for this intensive was:

What can you now do?

This goal's importance to me:

1 2 3 4 5 6 7 8 9 10

Your therapist may help you complete the following table about your current performance at this activity:

GAS GOAL SCALE	VERBAL RATING		DESCRIPTION OF PERFORMANCE	NUMERICAL CONVERSION
AT BASELINE	With respect to this goal do you have...	Some function (please describe)		-1
		No function (please describe)		-1
		A lot more (please describe)		+2
AT OUTCOME REVIEW: WAS THIS GOAL ACHIEVED?	Yes	A little bit more (please describe)		+1
		Performs as expected (please describe)		0
	No	Partially achieved (please describe)		-1
		No change		-1 or -2
		Got worse (please describe)		-2

How will you incorporate your new ability into your week?

My personal goal for this intensive was:

What can you now do?

This goal's importance to me:

1 2 3 4 5 6 7 8 9 10

Your therapist may help you complete the following table about your current performance at this activity:

GAS GOAL SCALE	VERBAL RATING		DESCRIPTION OF PERFORMANCE	NUMERICAL CONVERSION
AT BASELINE	With respect to this goal do you have...	Some function (please describe)		-1
		No function (please describe)		-1
		A lot more (please describe)		+2
AT OUTCOME REVIEW: WAS THIS GOAL ACHIEVED?	Yes	A little bit more (please describe)		+1
		Performs as expected (please describe)		0
	No	Partially achieved (please describe)		-1
		No change		-1 or -2
		Got worse (please describe)		-2

How will you incorporate your new ability into your week?

MY BIG MOMENT

In three weeks, you will be able to show your new skill to your therapy team and to the people you did therapy with.

What would you like your BIG moment to look like?

Post intensive reflections & next steps

REFLECT ON YOUR ACHIEVEMENT!

How do you feel about the goals you have reached?

How will you celebrate?

Do you have your own way to check how you are going with your goals in training?

REFLECT ON YOUR ACHIEVEMENT!

Have another look at your BIG goal, is there something stopping you from reaching this goal?

Who is the best person to help you solve this?

- Physiotherapy
- Occupational Therapy
- Speech Pathology
- Exercise Physiology
- Psychology
- Podiatry
- Dietetics

What is your next step?

- Review treatment plan with key therapist
- Attend initial assessment with new discipline: .....
- Attend group class: .....
- Start self-directed training with ..... reviews monthly/yearly
- Other .....

EXERCISE RECORDING SHEETS

Name: ..... Therapist: .....

Week starting: ..... Today's date: .....

Weekly goal:

Exercise	Set up/ equipment	Effort (RPE) *0-10*	Mon	Tue	Wed	Thu	Fri	Session code *(Therapist to fill)*
1.								
2.								
3.								
4.								
5.								

Exercise	Set up/ equipment	Effort (RPE) *0-10*	Mon	Tue	Wed	Thu	Fri	Session code *(Therapist to fill)*
6.								
7.								
8.								
9.								
10.								

Comments/feedback:

Exercise	Set up/ equipment	Effort (RPE) *0-10*	Mon	Tue	Wed	Thu	Fri	Session code *(Therapist to fill)*
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Comments/feedback:

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ABN 90 952 801 237
CRICOS Provider No 00002J

MACQUARIE University
SYDNEY·AUSTRALIA

21/01/2022

Dear Dr Katharine Scrivener,

Reference No: 520211072635749

Title: 10726 The feasibility of a short duration, intensive, multidisciplinary, self-managed approach to improve mobility for community stroke survivors

Thank you for submitting the above application for ethical and scientific review. Macquarie University Human Research Ethics Committee HREC EXEC Medical Sciences Committee considered your application.

I am pleased to advise that ethical and scientific approval has been granted for this project to be conducted by Dr Katharine Scrivener and other personnel: Ms Avanthi Elisha Ball, Dr Joanne Glinsky

Approval Date: 20/01/2022

This research meets the requirements set out in the *National Statement on Ethical Conduct in Human Research* (2007, updated July 2018) (the *National Statement*).

Standard Conditions of Approval:

1. Continuing compliance with the requirements of the *National Statement,* which is available at the following website: http://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research

2. This approval is valid for five (5) years, subject to the submission of annual reports. Please submit your reports on the anniversary of the approval for this protocol.

3. All significant safety issues, that adversely affect the safety of participants or materially impact on the continued ethical and scientific acceptability of the project, must be reported to the HREC within 72 hours.

4. Proposed changes to the protocol and associated documents must be submitted to the Committee for approval before implementation.

It is the responsibility of the Chief investigator to retain a copy of all documentation related to this project and to forward a copy of this approval letter to all personnel listed on the project.

Should you have any queries regarding your project, please contact the Ethics Secretariat on 9850 4194 or by email ethics.secretariat@mq.edu.au

The HREC EXEC Medical Sciences Committee Terms of Reference and Standard Operating Procedures are available from the Research Office website at: https://www.mq.edu.au/research/ethics-integrity-and-policies/ethics/human-ethics

The HREC EXEC Medical Sciences Committee wishes you every success in your research.

Yours sincerely,

Professor Anthony Eyers
Chair, HREC EXEC Medical Sciences Committee

This HREC is constituted and operates in accordance with the National Health and *Medical Research Council's (NHMRC)National Statement on Ethical Conduct in Human Research (2007, updated July 2018)* and the *CPMP/ICH Note for Guidance on Good Clinical Practice*