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Speech and swallowing rehabilitation in the home: A comparison of two service delivery models for stroke survivors

Katy J. E. Stewart
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**Speech and swallowing rehabilitation in the home: A comparison of
two service delivery models for stroke survivors**

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A thesis submitted in Partial Fulfillment of the Requirements for the Award of
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Abstract

Background and Aims

Speech and swallowing difficulties are common sequelae for people who have suffered a stroke. Recently, there has been an increase in early discharge, community rehabilitation and the use of therapy assistants to support health professionals in stroke rehabilitation. However, the impact of these factors on communication and swallowing outcomes remains under researched.

This research explored Rehabilitation in the Home (RITH) Speech Pathology (SP) services for stroke survivors with dysarthria and dysphagia. More specifically, this research investigated whether traditional speech pathology interventions, supplemented with a home practice program are effective, as well as compare usual treatment to that provided by a therapy assistant. Additionally, the experiences of the key stakeholders were also examined.

Methods and Procedures

Stroke survivors and their carers were recruited from RITH services in Perth, Western Australia into this pilot comparative group study. Stroke survivors with a recent stroke diagnosis and associated dysarthria and/or oral stage dysphagia were randomly allocated to either: a) treatment as usual with a speech pathologist (TAU) or b) intensive treatment with a speech pathologist and a supervised therapy assistant (INT). Evidence-based dysarthria and dysphagia treatment program content was controlled for both groups and all participants were encouraged to complete independent home practice daily. The stroke survivors were assessed at three time points, at baseline, immediately post therapy and at two months post stroke with a range of speech, swallowing and psycho-social outcome measures.

The perceptions, experiences and preferences of the stroke survivors and the carers were collected through questionnaires after therapy had ceased.

The speech and swallowing outcome measures were analysed using a 2x2 mixed model ANOVA and the questionnaires were analysed using qualitative content analysis.

Results

Ten stroke survivors and their carers ($n = 10$) were recruited into TAU ($n=5$) or INT ($n=5$) intervention groups. The stroke survivors had an average time post onset of stroke of 39.6 days. Stroke survivors participated in regular and intensive levels of RITH SP and all completed some degree of home practice. Therapy was provided over a three week period and TAU participants received $M = 470$ mins ($SD=85.22$) and INT participants received $M = 909$ mins ($SD=175.58$) of professionally led therapy. Within groups analyses revealed a statistically significant treatment effect over time for scores on the Dysarthria Impact Profile, oral motor function, speech intelligibility, water swallow test and the chewed cookie test. There was no significant difference over time for speech rate. There were no statistically significant differences between the TAU and the INT groups on any of the measures. Carers and stroke survivors gave positive reports of RITH SP with both groups noting improvements in the stroke survivors' speech and swallowing and commenting on the benefits of receiving rehabilitation in the home. Many stroke survivors valued and desired intensive speech pathology services; with the use of therapy assistants viewed positively by those in the INT group. Stroke survivors reported that they had difficulty practicing independently with most carers being involved with home-based speech pathology intervention.

Conclusions

Stroke survivors in an early phase of recovery were able to participate in RITH SP and benefitted from a speech pathology intervention program targeting dysarthria and dysphagia. Intensive speech pathology and therapy assistant intervention was as effective as usual care by a speech pathologist with improvements made by all stroke survivors across the majority of speech and swallowing measures. Stroke survivors were able to complete home practice and provided positive reports on the program, staff and setting. Home practice may be difficult for stroke survivors in the early stages post stroke, and may require support with its completion. Further investigation into the effectiveness and acceptability of home based therapy, the use of therapy assistants and the role of the carer as well as the ease and impact of home programs is required.

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Introduction

There are approximately 60,000 stroke events per year in Australia with most strokes occurring in people over the age of 75 (National Stroke Foundation, 2010). The current annual cost of stroke is estimated to be \$2.14 billion (National Stroke Foundation, 2010) and this will rise with the ageing Australian population and the predicted increase in the number of strokes per year. To counter ever-increasing health care costs, new cost saving measures are being implemented. These measures include early supported discharge (ESD) with the replacement of hospital rehabilitation with rehabilitation in the home (RITH) services. Assistants are also being used routinely worldwide to provide a solution to the lack of skilled, certified health care professionals and to assist with their work duties (Kumar, Nyland, Young, & Grimmer, 2006) in turn, reducing expensive health care costs.

While there are published studies comparing RITH/ESD services to routine in-patient rehabilitation care in the stroke population (Fjærtøft, Indredavik, & Lydersen, 2003; Ricauda et al., 2005; Rodgers et al., 1997; Rudd, Wolfe, Tilling, & Beech, 1997), there is a distinct lack of published material describing the type of speech pathology (SP) services provided through a RITH model as well as a lack of information on communication and swallowing outcomes of RITH intervention. Additionally, research into the use of therapy assistants to deliver speech pathology intervention has mostly centred on the paediatric population, with the use of assistants in adult speech pathology under researched. With the growing trend of early discharge for stroke patients combined with the use of therapy assistants there is a need to investigate and evaluate these models of speech pathology service delivery.

This study investigated the outcomes of a RITH SP service in the Perth metropolitan area and the use of therapy assistants to provide intensive home-based rehabilitation for stroke survivors who were in the early stage of stroke recovery. More specifically, within the context of RITH SP, this study asked the following questions;

1. Is a speech pathology RITH intervention program, supplemented with a home practice program:
 - a. feasible; and,
 - b. are improvements demonstrated in dysphagia and dysarthria for the combined group of stroke survivors?
2. Is there any difference in outcomes of a speech pathologist-only led treatment program (TAU) vs. an intensive speech pathologist and therapy assistant practice regime (INT)?
3. What are the perceptions, experiences and preferences of:
 - a) the stroke survivors; and,
 - b) the carers involved in RITH speech pathology rehabilitation?

The study was undertaken in a clinical context within the constraints of the current health services. Despite limitations of this study, which include a small sample size with no control group, the data reported here is mostly novel. This study adds to the small amount of published studies supporting dysarthria and dysphagia intervention, home-based speech pathology intervention and the use of therapy assistants.

Literature Review

This literature review is divided into three sections to provide a context for this project. The first section is an overview of stroke rehabilitation in the home and the use of therapy assistants in health care. The middle section of this literature review briefly outlines the issues for the key stakeholders in this project; the stroke survivors and the carers. This section firstly explores the stroke survivors' experiences with RITH and with working with health assistants. Following this, a summary of literature on the impact of caring for a stroke survivor and the role of the carer in therapy is provided. The final section of the literature review considers key issues in stroke rehabilitation namely: treatment intensity, neural plasticity and evidence based interventions in post-stroke dysarthria and dysphagia. This final section includes a summary of the treatments currently used and provides a foundation for the intervention program used within this study.

Stroke and Rehabilitation in the Home

The impact of stroke extends beyond economic issues, with the stroke survivor, their family and community all affected. Stroke can be distressing and disabling; potentially leaving the patient with psycho-social disruption, long-term physical disability or death. Successful rehabilitation improves individual client outcomes while lessening the risk of complications and readmission to hospital (National Stroke Foundation, 2010). It is generally agreed that rehabilitation is a holistic process that encompasses the patient, their family and community, and considers the individual's environment and the way in which they participate within it. Rehabilitation should begin on the "first day after stroke" (p.30) and aim to maximize

the stroke survivor's participation and community reintegration (National Stroke Foundation, 2010).

Post stroke rehabilitation often continues after hospital discharge and can be provided in different settings. Consistent with national practice, rehabilitation in Perth is often provided in a local hospital or community centre, with the patient either remaining in hospital as a rehabilitation inpatient or attending scheduled outpatient appointments with or without a family member. Community-based rehabilitation may also be offered, where the health professional, visits the stroke survivors in their homes.

Early supported discharge (ESD) and rehabilitation in the home (RITH) programs offer an alternative to in-patient or out-patient rehabilitation with ESD models providing rehabilitation in the patient's home rather than inpatient rehabilitation (National Stroke Foundation, 2010). In Australia, the term Rehabilitation in the Home (RITH) is often used interchangeably with ESD. ESD (with RITH) is a planned, coordinated multidisciplinary discharge and home-based rehabilitation service which, if available, "should be offered" to all stroke survivors with a "mild to moderate disability" (p.42) (National Stroke Foundation, 2010). ESD programs are becoming an essential part of stroke services and appear to improve long-term clinical outcomes (Fjærtøft et al., 2003), reduce the length of stay in hospital (Rodgers et al., 1997) and deliver increased patient satisfaction (Rudd et al., 1997) when compared to traditional stroke unit rehabilitation. ESD also provides health services with significant cost savings, with each day of home-based care being approximately half the cost of one day of in-patient hospital based care (Ricauda et al., 2005).

Home based stroke rehabilitation is thought to be more 'contextual' or relevant compared to services provided within the hospital setting (Koch, Wottrich, & Holmqvist, 1998). RITH can provide an optimal rehabilitation environment as rehabilitation is designed to develop home-based skills (National Stroke Foundation, 2010) and maximise the stroke survivor's participation and independence in their home and community. RITH services are different to hospital-based services, with the stroke survivor and the therapist having different and changeable roles in the home environment compared to the hospital, with treatment activities and outcomes changing depending on the home based context (Koch et al., 1998).

Along with these reported, general benefits of RITH, home-based therapy and RITH outcomes have been reported in the areas of physiotherapy and occupational therapy. A UK study (Gilbertson, Langhorne, Walker, Allen, & Murray, 2000) found that a short occupational therapy rehabilitation program, based in the home, enhanced recovery and reduced the risk of decline post stroke. Similarly, physiotherapy studies have found home based physiotherapy programs for stroke survivors are cost effective and should be the treatment of choice (J. Young & Forster, 1993).

RITH Speech Pathology Services

Studies investigating RITH speech pathology are limited in number and in type of disorder. To date, there are no published studies that focus on the outcomes of RITH SP in dysarthria intervention. However, preliminary research suggests RITH SP services are as effective as in-patient SP services (Brunner, Skeat, & Morris, 2008; Holmqvist et al., 1998). One such study examined a RITH multidisciplinary service in Stockholm and included a wide array of rehabilitation outcomes, including

aphasia rehabilitation outcomes. This study included 16 stroke patients with aphasia who were treated by a speech therapist (Holmqvist et al., 1998). The stroke survivors with aphasia who participated in home-based rehabilitation (n=11) were compared to 'routine care' stroke survivors with aphasia (n=5). At three months, there were no statistically significant differences on a generalised assessment of aphasia between the routine care and the home-based rehabilitation groups. Although not exclusively reporting on aphasia rehabilitation outcomes, Holmqvist et al. (1998) concluded that ESD with RITH services provide similar outcomes across disciplines when compared to routine (in or out patient) rehabilitation and can be a preferred service delivery model for stroke survivors.

The first published study that investigated RITH SP outcomes exclusively was published in 2008 by Brunner, Skeat and Morris. This study evaluated routine RITH speech pathology services for stroke survivors with dysphagia and/or aphasia at Southern Health Australia in Melbourne. Stroke survivors were provided with routine speech pathology care either in their home with RITH services; or, in-patient rehabilitation. To examine outcomes the treating speech-language pathologist (n=10) rated the stroke survivor (n=63; 21 in RITH and 42 in in-patient rehabilitation) with the swallowing and language scales within the Australian Therapy Outcome Measures (AusTOMS) (Perry & Skeat, 2004) at admission and at discharge. The study found RITH was as effective as inpatient rehabilitation. A large majority of stroke survivors had improved outcomes after their rehabilitation with swallowing gains being more evident than gains in language.

Although Brunner et al. (2008) demonstrated post RITH outcomes were equivalent to in-patient rehabilitation; there are limitations to this preliminary RITH speech pathology study. This study did not complete a direct assessment of aphasia

or dysphagia, did not provide a description of the treatments used, the interventions were not controlled and a blinded assessor was not used. The AusTOMS are a broad set of therapy outcome measures based on the UK Therapy Outcome Measure (TOMS) (Enderby, John, & Petheram, 1997). They were designed for clinical use; to examine “broad trends across patients and across services” (p.312) and are unable to provide the level of detail that can be obtained with standardised assessments (Brunner et al., 2008). Therefore, conclusions drawn about the effectiveness of RITH SP are limited to the disorders of dysphagia and aphasia and can only be based on the subjective reports of the treating speech pathologists.

A RITH case study (Stewart, 2011a) reported improvements in speech and swallowing outcomes after treatment for a stroke survivor from Africa. The stroke survivor reported RITH services were ‘very helpful’ with improvement noted across a range of articulation and phonation measures. The stroke survivor, her carer and the interpreter also reported improvements in speech intelligibility, with reported improvements to her swallowing and a return to normal diet and fluids. The case study also described some challenges to the provision of home-based treatment including dealing with visitors and the use of interpreters. Some benefits of home-based service delivery were discussed. Providing therapy in the home allowed the speech pathologist to witness the stroke survivor in her own setting, which assisted in establishing rapport and which led to increased cultural sensitivity of the speech pathologist. Although providing novel reports into home-based SP rehabilitation, the experiences of the speech-language pathologist or the outcomes of the stroke survivor cannot be generalised to the larger population. This study was a single case with no blinded assessor and did not describe or analyse the stroke survivor outcomes.

Assistants in Healthcare

The use of allied health assistants (AHAs) to supplement care by trained therapists is becoming increasingly common, with a large increase in the use of therapy assistants reported locally in the Australian rural and remote sector (Lin & Goodale, 2006). In Australia, across states and territories, there are differences in the use and uptake of assistants by speech pathologists (O'Brien, Byrne, Mitchell, & Ferguson, 2013), with some states and areas using discipline specific speech pathology assistants, others having access to generic allied health assistants and some areas and settings unable to access assistants.

There are obvious potential benefits involved from an economic perspective to using assistants. Therapy delivered by a speech pathologist is known to be more expensive than when delivered indirectly by an assistant (Boyle, McCartney, Forbes, & O'Hare, 2007) and the use of assistants to deliver speech-language therapy can be cost effective (K. Dickson et al., 2009). However, there are significant gaps in the evidence base for the effectiveness of such therapy assistant supplementation (Goldberg, Williams, & Paul-Brown, 2002) with the majority of research based on small-scale studies (Lizarondo, Kumar, Hyde, & Skidmore, 2010). The need for future research to address these gaps has been indicated with both small-scale studies and large, multi-centre trials required to provide fundamental knowledge and add to the body of evidence (Lizarondo et al., 2010). Despite this, the Western Australian Health Department initiated a major reform to enable 'remodelling' of the workforce (Chief Health Professions Office, 2008). This has been implemented to allow the assistant workforce to expand their roles with the aim to free up health professionals to deliver more complex services. However, Speech Pathology Australia reported that the role of assistants in speech pathology is not clearly

defined (Speech Pathology Australia, 2005) with further clarification needed in relation to the training of assistants (Speech Pathology Australia, 2007).

Historically, assistants in health care have been aligned with one discipline in the health sector. For example, in the past, physiotherapy assistants (PTAs) have formed 20% of physiotherapy staff in the UK (Ellis, Connell, & Ellis-Hill, 1998). However, more recently, there has been a move to employ generic, multi-disciplinary assistants in health care. The terms 'therapy assistant', 'therapy aide', 'rehabilitation assistant', 'support worker' or 'allied health assistant' (AHA) are sometimes used to describe a trained assistant who can provide treatments across disciplines and potentially across disabilities. In most rural and remote sectors in Western Australia (Lin & Goodale, 2006) and across Perth RITH services, health services employ therapy assistants who work across disciplines.

There are, however, few published papers describing and/or evaluating the role of 'allied health assistants' with only 10 papers discussed in a systematic review of the role of AHAs (Lizarondo et al., 2010). Within this systematic review, some papers described assistants who worked for one discipline, with only six papers describing assistants who work across disciplines. This review reported that the role of the AHA includes both direct patient care and indirect administrative duties, which is limited to "assisting, supporting, monitoring and maintaining" (p. 151). Lizarondo et al. conclude that AHAs make a "valuable contribution" (p. 143) with the potential to improve processes and clinical outcomes. However, ongoing issues were identified, such as the potential for blurred roles between the allied health professional and the AHA.

Within stroke literature, there has been some documentation of the role and effectiveness of multi-disciplinary assistants. Knight, Larner and Waters (2004)

investigated the role of hospital based generic rehabilitation assistants (RAs) who can work across different professions in stroke rehabilitation. In this study, the RAs mostly worked with PT (40.3%) and OT (27.8%) with only 0.7% of time spent completing speech pathology programs (Knight et al., 2004). Another study explored the experiences of 20 patients (11 stroke patients and nine orthopaedic and medical patients) who received supplementary weekend treatment from an RA. The use of RAs was deemed acceptable to patients with reported improvements in functional outcome (Pullenayegum, Fielding, Du Plessis, & Peate, 2005). Weekend therapy sessions on the ward were found to be useful with stroke survivors indicating they wanted more RA sessions (Pullenayegum et al., 2005).

There are some reports of assistants working in the home environment; however, this is mostly with single discipline assistants. While the challenges, benefits and supervision recommendations for using assistants to deliver rehabilitation in the home are described in occupational therapy (OT) (Glantz & Richman, 1997) and physiotherapy (PT) (Sherry & Walsh, 1996), there is little evidence supporting the effectiveness of generic therapy assistants working in community rehabilitation (Kumar et al., 2006).

In summary, assistants in healthcare are being utilised more frequently, despite a lack of empirical evidence supporting their use. Within in-patient stroke rehabilitation, generic assistants are being used across disciplines, with little time spent delivering speech pathology programs. Stroke survivors have reported that therapy delivered by a therapy assistant was beneficial and acceptable, however, in the community setting, the evidence is less clear. It is unknown how feasible it is for therapy assistants to deliver speech pathology services in the home environment. As assistants have the potential to provide enhanced and/or more cost effective

services, further investigation into the feasibility and effectiveness of using therapy assistants within RITH SP is required.

Assistants in Speech Pathology

The use of assistants within speech pathology may increase the frequency of services, while still uphold the quality of the service delivered (American Speech-Language-Hearing Association, 1996). Additionally, it may allow for an extension of services, which may lead to improved access to speech pathology services (Paul-Brown, 1995). Other authors suggest that there may also be cost benefits to the health service in using speech therapy assistants. Speech therapy assistants within the paediatric setting are less costly than speech pathologists, (Boyle et al., 2007; K. Dickson et al., 2009) and allow “cost-effective ... quality care” (p.42) by supplementing, enhancing and extending services (Paul-Brown, 1995). Also, the use of speech therapy assistants may result in a decrease in speech therapy workload and provide an opportunity for the speech pathologists to work closely with other health professionals and so reduce the professional isolation of speech pathologists (Rothwell, 2009). Speech pathology assistants have been described as being a valued member of the team, who bring expertise, experience and creativity, characteristics that benefit the client and speech pathologist (Rothwell, 2009).

In a recent study in NSW by O'Brien and colleagues, eight rural and remote speech pathologists (who serviced mainly a paediatric clientele) were interviewed to gain insight into working with AHAs. These speech pathologists reported concerns about the introduction of AHAs. O'Brien et al. (2013) recommended that professional, economic and organisational issues related to the use of AHAs in speech pathology be further addressed.

There is little known about the benefits or use of assistants to deliver speech pathology interventions within ESD and RITH services. A paper presented at the Smart Strokes 2011 conference (Stewart, 2011b) reported multi-disciplinary therapy assistants in RITH often work in isolation with irregular speech pathology referrals. In this study, 10 therapy assistants were surveyed on their self-efficacy and self-confidence with working with SP therapy programs. RITH productivity data was also discussed in relation to occasions of service. The therapy assistants spent the bulk of their time completing physiotherapy programs with only 6% of their time working on SP programs. Frequency of referrals, supervision and guidance were identified as factors influencing their self-confidence and self-efficacy when delivering speech pathology interventions.

Effectiveness of assistants in speech pathology. The use of assistants in speech pathology is seen to have a range of benefits; however, there are some concerns over their use, and differences currently exist in the degree of uptake across health services. While there is little literature on their use in stroke rehabilitation, available research describing the effectiveness of therapy assistants providing clinical services has been completed in the context of adult tele-rehabilitation and in nursing homes and in the paediatric education setting (see Appendix A).

McElhone (2011) reported the results of a survey of stroke survivors in an acute stroke in-patient setting which investigated their perceptions of the use of an AHA to assist with conducting a communication group (including stroke education and therapy). McElhone noted that the SP and AHA were both effective facilitators with all stroke survivors being comfortable and reporting positively on the information provided, the support given and knowledge of the staff. The SP was, however,

perceived to be more effective than the AHA in providing specific information pertaining to the participants' particular stroke characteristics.

There have been positive reports of training assistants who conducted adult clinical swallowing examinations via tele-rehabilitation (Sharma, Ward, Burns, Theodoros, & Russell, 2012; Ward, Sharma, Burns, Theodoros, & Russell, 2012). Ward et al. (2012) investigated the use of an allied health assistant to conduct hands-on adult clinical swallowing examinations in tandem with a remotely based speech pathologist. The assessment results were found to be valid and reliable when compared to usual face-to face examinations with a speech pathologist only.

In the aged care field, trained nursing assistants have been used effectively in nursing homes to engage residents in conversation and increasing feeding time for residents with dementia (Chang & Lin, 2005; Hoerster, Hickey, & Bourgeois, 2001). There is also a report of the clinical benefits of using trained AHAs as an adjunct to acute swallowing assessment by observing mealtimes (Kalapac-Trigg, 2013). SPs felt confident or very confident in the AHAs' abilities to assess stroke survivors' swallowing, with the SP making changes to diet and fluid recommendations as a direct result of the AHAs' feedback (Kalapac-Trigg, 2013).

In the paediatric field, there is more robust evidence for the effectiveness of assistants. A systematic review of paediatric service delivery models for speech-language intervention (Cirrin et al., 2010) identified five papers meeting their inclusion criteria, however, they were unable to draw any conclusions about service delivery options, including the use of assistants. A randomized controlled trial in the primary school setting in the United Kingdom showed trained and supervised speech language therapy assistants are as effective as a speech pathologist at delivering interventions for language impairment where the skill of a speech pathologist is not

required (Boyle et al., 2007). Additionally McCartney, Boyle, Ellis, Bannatyne, and Turnbull (2011) found treatment delivered by school staff resulted in children spending less time doing language-learning exercises, with less expressive language improvement, compared to treatment delivered by a speech language pathologist or a supervised speech language therapy assistant.

There are additional reports on the outcomes of using an assistant to deliver speech pathology programs in the paediatric population. Cultbertson and Tanner (1998) give mixed reports on the use of distance education for training school-based speech therapy assistants to service remote schools in Arizona. They reported positively on the use of local staff who were able to economically address professional staff shortages and provide the required practice schedules of a program in a culturally and linguistically appropriate manner.

Additionally, education assistants have been utilised in schools to teach students to use speech-generating devices to improve the rate of production of multi-symbol messages (Binger, Kent-Walsh, Ewing, & Taylor, 2010) and specialist teaching assistants were shown to be effective in delivering intensive speech and language therapy with school aged children (Mecrow, Beckwith, & Klee, 2010).

Research to date has found that there are benefits in using assistants to deliver speech pathology programs, with evidence for their effectiveness mainly drawn from telehealth, aged care and in paediatric settings. However, most of these studies are small, largely descriptive and include a broad range of settings with a lack of evidence for specific speech, language and swallowing outcomes. Research has been largely conducted in the paediatric and education settings with the adult population under researched. There have been no published studies examining the outcomes of generic therapy assistants who deliver speech pathology programs in

RITH. With changes to service delivery models in health, there is a need to research the outcomes of using supervised therapy assistants to deliver speech pathology programmes.

The Stroke Survivor

The perceived effectiveness of an intervention and the experiences of those who receive an intervention is little studied or reported within speech pathology. Often, the participant's 'voice' is overlooked with the prioritization of assessment results over patient perspectives (Mackenzie, Kelly, Paton, Brady, & Muir, 2013). Additionally, for those research participants with communication difficulties, this exploration of the participant's view may be more challenging (Mackenzie et al., 2013). However, these key stakeholders can assist in a treatment's evaluation and provide additional information on the intervention's value and hence may assist in its refinement or future use (Mackenzie et al., 2013). This section summarises the literature available describing stroke survivor's experience with: a) RITH, including within RITH SP; and, b) with the use of therapy assistants.

Stroke survivors in RITH programs are more satisfied with their services, especially with the active planning of their rehabilitation when compared to those in routine rehabilitation (including in-patient, day-hospital and out-patient care) (Holmqvist et al., 1998). However, the specific opinions of stroke survivors who have received RITH SP services have not been reported in the literature. The first published study specifically reporting RITH SP outcomes (Brunner et al., 2008) did not provide details about the opinions of the stroke survivors who received speech pathology services from speech pathologists.

Little is known about how stroke survivors feel about receiving speech pathology services from an assistant. As discussed previously, there are two published reports of the use of Rehabilitation Assistants (RA) to deliver hospital based stroke rehabilitation services for communication and swallowing management (Knight et al., 2004; Pullenayegum et al., 2005). Pullenayegum and colleagues (2005) explored the experiences of 11 stroke survivors who received multi-disciplinary weekend therapy services from a RA. The stroke survivors reported positively on receiving services from the RA with 75% of stroke survivors indicated they would have liked more sessions.

McElhone (2011) investigated the stroke survivors' perspective of receiving group therapy and education from an AHA. The AHA was reported to be an effective facilitator but the SP was deemed to be more effective in regards to the provision of specific information.

In summary, there is some emerging evidence of the stroke survivors' positive experiences and satisfaction with RITH programs, along with some initial positive reports of stroke survivors' experiences of having received treatment from an assistant. However, the specific experiences of stroke survivors who receive RITH SP services including SP services from a therapy assistant are not known.

The Carer

Informal Family Care-giving in the Community

Eighty-seven per cent of disabled stroke survivors who return home receive some kind of assistance with 93% of these receiving some level of informal care, typically from family members (Australian Institute of Health and Welfare, 2013). Family members who are informal carers are at risk of suffering from anxiety,

depression (Greenwood & Mackenzie, 2010) and burnout (van den Heuvel, Witte, Schure, Sanderman, & Jong, 2001). The risk of burnout increases if the stroke survivor has severe cognitive, behavioural, and emotional difficulties post stroke (van den Heuvel et al., 2001). Additionally, spouses who care for a partner with a communication impairment are at greater risk for developing mental health problems and reduced quality of life and need long-term access to support services (Le Dorze & Signori, 2010).

However, there may be an additional strain on carers when the person who is cared for receives an early hospital discharge and/or home-based rehabilitation. Government policies to reduce length of hospital stay by transferring patients back into the community mean that unpaid or 'informal' carers will be relied upon more and more to assist with care and support in the home (Al-Janabi, Coast, & Flynn, 2008).

Furthermore, in the transition home, poor communication with hospital staff can impact negatively on carers and stroke survivors. A longitudinal study (Ski & O'Connell, 2007) of home-based rehabilitation services followed 13 stroke survivors and their carers. The stroke survivor/carer pairs were recruited in the acute setting, prior to receiving in-patient and then home based rehabilitation services. This report found that a prompt and poorly planned hospital discharge negatively impacted on the adjustment and coping skills of the carer and the stroke survivor (Ski & O'Connell, 2007). There is concern in the field that despite ESD and RITH services having a range of benefits, the impact on the carer may be great. As little else is known on the experiences or the roles of carers who have received or participated in RITH stroke rehabilitation, further research is required.

In summary, many stroke survivors require informal assistance from family or friends when they return home. Family members who are carers are at a higher risk for mental health difficulties and poor quality of life, with poor discharge planning and a prompt discharge negatively affecting carers. With such a high carer burden, with an increased risk of burden with early discharge there is a clear need to investigate the role, opinions and preferences of carers who receive RITH services.

The Role and Opinions of the Carer in Home-Based Speech Pathology

Pierce (1999) suggests that when working in the home, therapy starts the moment a speech pathologist enters the house. Therapy is perceived as not something that the speech pathologist does but is something taught to both patient and family with the stroke survivor and family encouraged to actively participate in therapy (Pierce, 1999). The family member who is the main informal caregiver is usually inevitably the key communicative partner who is responsible for supporting the stroke survivor's communication (Booth & Swabey, 1999). Supporting and educating carers is crucial as when the family is supported and is functioning well, the stroke survivor will also function and feel improved (Visser-Meily et al., 2006).

There is a need to research carers' desires and expectations in relation to caring for a stroke survivor (Cecil et al., 2011) with carers experiencing 'uncertainty' about their role and their future (O'Connell & Baker, 2004). One study of 10 carers of stroke survivors who live in the community (Cecil et al., 2011), provided reports of the carers' personal experiences of caring for stroke survivors. Mixed experiences with SP services across different settings were reported across the group of carers. Carers reported positively on a community based aphasia course and home based therapy services. Others stated they were given little assistance from the speech

pathologist, complained of cancelled appointments or that they had to 'fight' for therapy. The role of the carer in SP was variable, with one carer reporting she felt she was more involved in remediating her husband's speech than the SP. Post stroke SP services appeared to be highly valued by carers but access to these services and satisfaction with SP services was variable.

While the importance of involving and educating the carer is known, the impact of the carer on outcomes and the role of the carer within adult SP has not been heavily reported. Sacchett, Byng, Marshall and Pound (1999) report that carer involvement is crucial to the success of aphasia therapy and commented that carer involvement and their role within therapy merits further investigation. There is little information on what carers do to help support the stroke survivor or the role they play to assist the stroke survivor with dysarthria and dysphagia. Carer education and support was a key feature of a Living with Dysarthria intervention program reported by MacKenzie, Paton, Kelly, Brady and Muir (2012). This program recruited 12 people with dysarthria and seven family members. MacKenzie et al. (2012) reported the intervention goal for three family members required the family member to take on a helping or supportive role, which was specific to the improvement of speech or confidence with speech.

In summary, carers for stroke survivors are at significant risk of mental health difficulties and poor quality of life. Within SP, the involvement of the carer may be critical to rehabilitation outcomes, with carers often assisting the stroke survivor in a supportive role. However, the specific role that carers take on and the experiences of carers have not been investigated in home visiting SP.

Stroke Rehabilitation Intensity and Neural Plasticity

After a stroke event, the brain demonstrates neural plasticity, with the potential for adaptation. Disruption to neural pathways may result in maladaptive responses with the learning of new and disabling motor patterns (McCabe, 2010). It is now recognized, that rehabilitation should start as soon as possible post stroke, to capitalize on harnessing adaptive neural plasticity and suppressing maladaptive neural re-wiring (McCabe, 2010).

Although under researched, evidence suggests that increased intensity of stroke rehabilitation services is linked with improved outcomes (Kleim & Jones, 2008; Kwakkel, Wagenaar, Koelman, Lankhorst, & Koetsier, 1997; Langhorne, Wagenaar, & Partridge, 1996). Additionally, there is some emerging evidence that intensive, home-based multi-disciplinary rehabilitation services have added benefit for older stroke survivors when compared to less intensive services (Ryan, Enderby, & Rigby, 2006).

Rehabilitation studies have found most stroke survivors are able to start rehabilitation within hours or days post stroke and this early intervention may assist recovery (National Stroke Foundation, 2010). The UK National Clinical Guidelines for Stroke (2012) recommend a minimum of 45 minutes per day being actively treated by the therapist in either individual, group or supervised therapy for each discipline required. Additionally, the National Stroke Foundation recommends one hour of 'active' practice per day for at least five days per week (National Stroke Foundation, 2010).

Intensive Speech Pathology Services. Within speech pathology, the limited available research indicates that more intensive stroke rehabilitation appears to improve outcomes compared to less intense treatment (Bhogal, Teasell, &

Speechley, 2003; Brunner et al., 2008; Carnaby, Hankey, & Pizzi, 2006). For dysphagia, an increase in patient attributive time was associated with improved swallowing and activity limitation outcomes on the AusTOMS (Brunner et al., 2008) and increased intervention intensity reduced the risk of complications (Carnaby et al., 2006). A systematic review of the intensity of aphasia rehabilitation found that three or more hours of treatment per week was generally required to detect a positive effect of intervention (Bhogal et al., 2003) with at least two hours per week of therapy recommended in the early stages (National Stroke Foundation, 2010).

A recent randomized controlled trial in the UK by Bowen, Hesketh and colleagues (2012 ACT NoW study) compared the outcomes (TOMS) of regular and early speech and language therapy, for aphasia and dysarthria, to home visits by a trained visitor who usually provided general conversation. Both groups improved on the TOM activity scale but with no significant difference between the groups. The authors concluded that there is no added benefit for the subjects who received speech and language therapy. The results and conclusions from this study have been critiqued (Godecke & Worrall, 2012) and some questions have been raised about the measures used, confounding due to the lack of control of the treatment provided and differences in direct face-to-face time between the two groups. Bowen et al. (2012) reported difficulty in staffing intensive SP led intervention in the ACTNoW study. This resulted in the stroke survivors in this study receiving an average of 18 hours over 16 weeks, which is less than recommended in the aphasia literature to show a positive change from an intervention. However, this study does support the benefit of regular contact and the provision of interaction and communication opportunities provided by a trained visitor to 'challenge' the stroke survivor to engage with the 'unfamiliar' (Bowen et al., 2012).

There are additional reports of SPs not being able to provide the recommended levels of therapy intensity. In a recent study of acute stroke speech pathology services for people with moderate to severe aphasia (Godecke, Hird, Lalor, Rai, & Phillips, 2012), only 15% of people in the usual care group received therapy in the study's intervention period. For those participants who received treatment, they received on average, 10.5 minutes of intervention per week. Ciccone, Armstrong and Hersh (2013) reported the analysis of 20 reflective workbooks completed by SPs who provided services for 20 people with aphasia. These accounts were from inpatient and community based settings and at different stages in the recovery period; from the acute stage to when the patient had returned home. The results suggested that for most people with aphasia, SPs did not provide the amount of therapy that they thought was required or that they had initially aimed to provide.

There is little published information investigating the impact of different dosages of repetitions/sets of exercises on dysarthria and dysphagia outcomes (Archer, Wellwood, Smith, & Newham, 2013; Robertson, 2001). For dysarthria, there are no published guidelines or recommendations on within session treatment intensity for stroke but high intensity is considered to be best (Enderby et al., 2009) with the intensive Lee Silverman Voice Therapy (LSVT) program showing promise (Wenke, Theodoros, & Cornwell, 2008). Vickers and colleagues (2013) provide initial data in their descriptive feasibility study which explored the feasibility and intensity of therapeutic exercises (e.g. Shaker exercise) for stroke survivors with dysphagia in the sub-acute in-patient phase. Stroke survivors completed a set of individually tailored dysphagia exercises in either swallowing groups, one-to-one with a SP or AHA or in independent practice. During practice sessions the average dosage (in

terms of the number of repetitions of each exercise) per stroke survivor was 3091 repetitions (363-10,704) over an average of 17 days (range from 4-52 days), which equated to an average of 172 repetitions per day (range 59-446). Stroke survivors, regardless of dysphagia severity, age or perceived cognitive impairment, were able to participate in regular swallowing rehabilitation and make improvements. The dose of practice varied considerably between stroke survivors with a higher total dosage of practice not associated with improved dysphagia outcomes. The dose versus the quality of practice in dysphagia and dysarthria practice is yet to be investigated with further research required

Home practice. With global healthcare costs rising, access to individual therapy may become more difficult. In order to increase the intensity of practice, stroke survivors should be encouraged to continue to practise outside of treatment sessions, with help from staff, family and friends if appropriate (National Stroke Foundation, 2010). Within adult SP, there are few published reports on the outcomes or experiences with home practice programs. Robertson (2001) investigated the use of clinic-based dysarthria treatment supplemented with a home practice program. Both clinic-based therapy and home practice focused on “oro-facial muscle” and articulation exercises. Robertson provided stroke survivors with a home practice program and encouraged them to complete it three times a day. All eight of her participants completed home practice, however, the frequency of practice varied across participants from an average of 0.6 – 2.7 practice sessions per day. Stroke survivors who practised at home, for an average two-three times a day, made greater gains compared to those who practised less than once per day. Robertson also reported that for those subjects who had difficulty completing home practice, many had little family support or reduced opportunities to communicate.

A study by Manheim, Halper, and Cherney (2009) described positive outcomes from using a home-practice computer program for post-stroke aphasia rehabilitation with weekly checks by a SP to ensure compliance. This study reported an average 44.0 (SD=30.3) hours of home practice over nine weeks of intervention (range 11.3-66.1 hours). Although only 65% of the stroke survivors were able to complete a minimum of 30 minutes of practice per day, participants reported a statistically significant improvement in their communication levels after therapy.

Interestingly, there are differences in the amount of practice completed independently compared to that with a therapist. An observational study of 16 stroke survivors with hemiplegia who were in a rehabilitation unit found stroke survivors were most active with a greater amount of practice completed when with a therapist (Ada, Mackey, Heard, & Adams, 1999). Ada and colleagues also suggest therapists worry that unsupervised practice may reduce the quality of that practice. Stroke survivors found it difficult to go from supervised to un-supervised practice but that reducing barriers and providing “structure, feedback and social reinforcers” (p. 37) may facilitate practice. As financial constraints may not allow more one-to-one time, strategies to increase semi-supervised practice were discussed. Ada and colleagues suggested that to “bridge the gap” (p. 37) between supervised and unsupervised practice, that group sessions be used and family members be trained to be assistants to help supervise the stroke survivor’s practice.

Within RITH SP, there are no reports in the literature into the feasibility of home practice. Further investigation is required to establish the amounts and types of home practice that stroke survivors are able to do in the RITH environment and how much is needed to show positive impact. Additionally, further research is

needed investigating the availability of carers and the need for carer support when completing practice in the early days post stroke.

In summary, immediately after a stroke event, the brain demonstrates neural plasticity, which should be harnessed by early and intensive rehabilitation. While there are general guidelines for the intensity of stroke rehabilitation, the guidelines for dosage and repetitions is not clear with higher doses not necessarily linked with better outcomes. Although the SP literature is lacking in information about the feasibility, suitability and outcomes from completing home practice, there is emerging evidence to show that opportunities to communicate and regular home practice may enhance the effectiveness of SP treatment programs. Additionally, stroke survivors appear to practise more when supervised. Although the speech pathology profession may have difficulty providing recommended levels of therapy, trained volunteers and home practice programs have been used to provide communication and practice opportunities to good effect.

Dysarthria, Dysphagia and Associated Interventions

Dysarthria and dysphagia are prevalent among the stroke population and were chosen for investigation in this study as they are both disorders of oral motor function, commonly co-exist (Nishio & Niimi, 2004; Ropper, 1987) and are often treated with similar interventions (Mackenzie, Muir, & Allen, 2010). Dysarthria and dysphagia interventions are also both under researched, with the management of dysarthria specifically highlighted by the National Stroke Foundation as a priority area for research (National Stroke Foundation, 2010). As indicated below, these difficulties can affect interpersonal relationships, self-image and community reintegration.

The prevalence of dysarthria following stroke is common with a sudden-onset of dysarthria in 8.7% of patients with ischemic stroke (Kumral, Çelebisoy, Çelebisoy, Canbaz, & Çallı, 2007) and dysarthria in 53% of patients after an acute first stroke event (Mann, Hankey, & Cameron, 1999). Dysarthria can lead to changes in “self-identity, relationships, social and emotional disruptions, and feelings of stigmatization or perceived stigmatization” with participants continually attempting to “get their speech back to ‘normal’” (p. 135-136) (S. Dickson, Barbour, Brady, Clark, & Paton, 2008). Recovery from dysarthria varies considerably with site of lesion and extent of stroke influencing recovery rates. A study of dysarthric stroke patients with a single brain lesion revealed that 53% of patients were ‘normal’ at three months post-stroke (Canbaz, Celebisoy, Ozdemirkiran, & Tokucoglu, 2010). Despite this, descriptive and intervention studies report stroke patients suffering from persistent dysarthria many months or years after stroke (Mackenzie, 2011).

Dysphagia is known to negatively affect “self-esteem, socialization, and enjoyment of life” (p.139) (Ekberg, Hamdy, Woisard, Wuttge–Hannig, & Ortega, 2002). Difficulties in swallowing occur in up to half of the people experiencing a non-fatal stroke (Bath, Bath-Hextall, & Smithard, 1999) with recovery varying significantly. While many recover within the first week, some continue to have persistent swallowing difficulties in the medium and long-term (Smithard et al., 1997). Additionally, even mild swallowing difficulties are associated with poorer functional outcomes (Barer, 1989) and some stroke survivors suffer significant swallowing disability with a need for long-term alternative feeding.

Dysarthria interventions. A Cochrane (Sellars et al. 2005) review into speech therapy for stable dysarthria secondary to brain damage revealed that there is insufficient quality research to support or refute the use of dysarthria interventions

with no un-confounded randomized controlled trials identified. The review highlighted dysarthria intervention as a priority research area and recommended that clinicians consider expert opinion and case studies to guide clinical practice. Since then, reviews of stable dysarthria intervention (Palmer & Enderby, 2007) and intervention outcomes post-stroke (Mackenzie, 2011) have reported that little has changed in this time, with only small studies adding to the literature. Many published dysarthria intervention studies have mixed participant aetiologies with few studies including only post-stroke dysarthria. These post-stroke dysarthria studies until recently have only included very small numbers of participants. To date, the largest group of participants in a published study that reports exclusively on post-stroke dysarthria is 12, from the Living with Dysarthria study (Mackenzie, Paton, et al., 2012). An unpublished study (the NONSPEX study) into the effectiveness of lip and tongue exercises by Mackenzie, Muir, Allen, and Jensen (2012) appears to be the largest group of stroke survivors with dysarthria (n=39).

Bowen and colleagues (2012) included 17 participants with dysarthria in the ACTNoW study; an RCT which included other participants with aphasia. While therapy content was not tightly controlled, at six months, there were improvements in functional communication but with no difference between therapy provided by a SP or from general social contact received from an employed visitor.

In a systematic review of interventions for stable dysarthria Palmer and Enderby (2007) described published interventions which included;

- i) techniques that target compensatory strategies,
- ii) treatments for 'single' speech parameters such as speech rate, resonance, oro-motor treatment, articulation, prosody (including pitch, volume, stress and intonation) and

- iii) the provision of 'multi-system' intervention programs, which address more than one speech parameter.

Multi-system dysarthria treatment programs are common practice in speech pathology (Palmer & Enderby, 2007) with some small published studies supporting this approach (Mackenzie & Lowit, 2007, 2012; Mackenzie, Paton, et al., 2012; Robertson, 2001; Tamplin, 2008). With this approach, a multi-system dysarthria treatment program may, for example, target phonation, prosody, alternative and augmentative communication and behavioural techniques concurrently.

The most common approach in dysarthria management is behavioural intervention (Duffy, 2005) involving the direct treatment of symptoms and the use of compensatory strategies to enhance communication efficiency, naturalness and intelligibility (Yorkston, Beukelman, Strand, & Bell, 1999). Small scale studies demonstrate that some stroke survivors with dysarthria can respond positively to behavioural intervention, even months after the stroke event (Lee & McCann, 2009; Mackenzie & Lowit, 2007, 2012; Mackenzie, Paton, et al., 2012; Mahler & Ramig, 2012; Robertson, 2001; Tamplin, 2008; Wenke et al., 2008; Wenke, Theodoros, & Cornwell, 2010). A large Japanese study (Nishio, Tanaka, Abe, Shimano, & Yamaji, 2007) was conducted which followed 187 participants with dysarthria from a range of aetiologies. Nishio and colleagues (2007) found that patients with dysarthria who received speech therapy (n=187) demonstrated significant improvements in articulation compared to a control group (n=76).

Additionally, there is some emerging evidence that traditional dysarthria interventions may have a positive effect on the psycho-social impact of dysarthria. The original version of the Dysarthria Impact Profile (DIP) (which doesn't contain section E), created by Walshe (2003), was used as an outcome measure with a

group of eight people with post-stroke dysarthria in a study by Mackenzie and Lowit (2007). They reported that these stroke survivors received individually tailored dysarthria intervention twice a week for eight weeks. The impact of dysarthria was reduced after treatment, with specific improvements in the *Accepting My Dysarthria* section, indicating some improvement in the stroke survivors' adjustment (Mackenzie & Lowit, 2007). The authors suggest that apart from the main treatment effect, factors such as the support and skills of the speech therapists and natural adjustment over time may have contributed to this change.

However, there can be some variability with dysarthria outcomes. Mackenzie and Lowit (2007) used a single word intelligibility test, ratings of conversational effectiveness, and speech intelligibility ratings to measure change to participants with post-stroke dysarthria. Mackenzie and Lowit reported high variability in their participants with improvements in intelligibility and/or communication effectiveness noted only for some participants with post-stroke dysarthria.

Oral motor exercises in dysarthria. Some interventions, such as non-speech oral motor exercises (NSOMExs) are used across disorders such as dysarthria and dysphagia to target similar motor functions (Archer et al., 2013; Clark, 2003; Mackenzie et al., 2010). These traditional interventions are widely implemented (Mackenzie et al., 2010) despite a scarcity of robust evidence to support their use (Mackenzie, 2011; Sellars, Hughes, & Langhorne, 2005). The use of oral motor exercises as a treatment for speech and swallowing can be controversial, with some arguing that the treatment of separate parts may not influence the whole and that a holistic, integrative approach must be adopted. This has lead some therapists to avoid using these exercises or to use with caution.

Clinically, NSOMExs and oral motor exercises with speech are often used as the building blocks of developing skills in an integrated intervention program, which builds on these small, separate skills, moving gradually up a hierarchy of skills, which incorporate functional speech and/or swallowing practice.

An audit into the use of these exercises in the UK revealed 81% of respondents used non-speech oral motor exercises in dysarthria rehabilitation (Mackenzie et al., 2010). There is some low-level evidence suggesting these NSOMExs are beneficial. A study into the effectiveness of oro-facial myo-functional therapy by Ray (2002) found positive changes in speech intelligibility in single words for 12 participants with mild-moderate dysarthria following right-hemisphere brain damage. Robertson (2001) also found positive changes after a program of oral-motor exercises and speech practice.

Mackenzie, Muir, et al. (2012) have provided initial reports from the NONSPEX study of the use of NSOMExs in dysarthria. Thirty-nine participants were randomly allocated to two groups and were invited to participate after a minimum of three months post-stroke. The intervention program was introduced after a non-intervention period (eight weeks) with once weekly SP sessions in the participant's home and a home program. Group A and B received a similar dosage of individually targeted intervention focusing on articulatory precision and included speech practice (words and sentences) and conversational practice. Group B also received non-speech oral motor exercises. There were no statistically significant differences between groups but there were positive changes across time for listener and self-rated communication effectiveness and the tongue and lip measures (FDA-II). The authors conclude that an additional regime of NSOMExs have no added impact on dysarthria outcomes in post-stroke dysarthria therapy.

Of interest, over the eight-week intervention period, the only measure to show statistically significant change was for listener and self-rated communication effectiveness. Additionally there was no statistically significant change in speech intelligibility over time. The intervention included regular home practice, with the compliance and total amount of home practice completed for the groups not reported. This coupled with so little known about the effectiveness of home practice in dysarthria could lead to the argument that the intervention provided was not intensive enough. Potentially, for the intervention to be effective, a greater frequency and intensity of direct speech pathology contact may be required.

Stroke survivor experiences with dysarthria rehabilitation. There has been some recent exploration into the rehabilitation experiences and preferences of people who have post-stroke dysarthria. Brady, Clark, Dickson, Paton, and Barbour (2011) reported on the experiences of 24 people with post-stroke dysarthria who participated in semi-structured interviews. Many reported that they felt a sense of responsibility for their own rehabilitation with “functionally relevant, patient-focused activities” (p.935) and treatment resources perceived as relevant and worthwhile. Exercises that challenged the stroke survivor were appreciated with some reporting that they stopped practising their exercises once they became too easy. Some exercises were deemed ‘embarrassing’ or ‘ridiculous’ by stroke survivors, which posed a subsequent risk for a lack of engagement with intervention. The authors recommended that dysarthria rehabilitation exercises are relevant, challenging and functional. Additionally, they recommend SPs provide clear explanations and rationales for assessment and treatment and be aware of the potential for further stigmatization.

A paper reporting the experiences of people with post-stroke dysarthria and/or aphasia was published as part of the ACTNoW study (A. Young, Gomersall, & Bowen, 2013) in which clients were provided therapy by a trained visitor or by a speech pathologist. Participants were interviewed, however, the data for those affected by dysarthria were not separated from those with aphasia. Post intervention improvements in confidence were reported for participants. The trained visitor group reported that their improved confidence was accredited to the “normalizing effects of regular contact with a stranger” and practicing “everyday tasks” such as answering the door (p. 178). The group treated by the SP reported improvements in confidence as “direct consequences of specific tasks and newly acquired strategies” (p. 178). Regular and intensive intervention was valued.

Mackenzie et al. (2013) reported the experiences of nine stroke survivors with dysarthria who participated in the Living with Dysarthria group intervention program, which was conducted in a community setting. The program ran for eight weeks and comprised of once weekly group sessions with the speech-language therapist. The group sessions went for two hours and included education, peer and professional support and communication practice. Home practice was also provided but not an essential part of the program. Not all stroke survivors were interested in home practice and difficulty in completing home practice was reported for those who lived alone or with limited support. Many desired more frequent intervention sessions and a resource folder of exercises and handouts was valued by some. Mackenzie and colleagues suggest that for those participants who are socially isolated or have limited support, the option to have a trained volunteer may be valuable. This echoes previous studies that mention the reduced availability of communication opportunities in post-stroke dysarthria. Brady and colleagues (2011) report that stroke survivors

with dysarthria often report social isolation with limited communication opportunities. Bowen and colleagues (2012) and Robertson (2001) both comment on the potential impact of reduced informal communication opportunities on dysarthria outcomes.

In summary, stroke survivors who have participated in dysarthria rehabilitation value exercises that are relevant, functional and challenging and accompanied by opportunities to communicate. SP intervention, which may include personally supporting the individual with dysarthria, may result in improved confidence. Although valued highly by some, home practice was not desired by some and was difficult for those who lived alone.

Dysphagia interventions. A systematic review of dysphagia treatments post-stroke identified 15 randomized controlled trials which met the reviewers' criteria, with two of the trials based on swallowing therapy programs (Foley, Teasell, Salter, Kruger, & Martino, 2008). A more recent Cochrane review (Geeganage, Beavan, Ellender, & Bath, 2012) of post-stroke dysphagia intervention included five papers and it concluded that behavioural swallowing intervention showed a clinical reduction in length of stay in hospital and reduced incidence of complications. Dysphagia interventions are based on limited evidence and clinical experience, with confusion over which components of therapy are beneficial (Geeganage et al., 2012). Despite this, their continued use is not to be discouraged (Foley et al., 2008).

Dysphagia treatment has traditionally included diet modification, use of compensatory strategies and swallowing exercises or manoeuvres (Logemann, 1983). A survey of speech language therapists working in the UK revealed the most commonly used dysphagia exercise was direct supervised bolus swallows (73%), with oral range and strength exercises frequently prescribed (Archer et al., 2013). Oral motor exercises and other behavioural techniques can reduce the degree of

oral dysfunction in dysphagic stroke patients (Elmståhl, Bülow, Ekberg, Petersson, & Tegner, 1999) with a favourable trend towards early behavioural swallowing intervention (Carnaby et al., 2006). The idea of functional swallowing practice is discussed in The McNeill Dysphagia Therapy Program (Carnaby-Mann & Crary, 2010; Crary, Carnaby, LaGorio, & Carvajal, 2012). The act of swallowing is treated as a rehabilitative exercise with the systematic use of exercise principles which progress through a hierarchy of “increasingly resistive materials to swallow” (p.744) (Carnaby-Mann & Crary, 2010). This small, preliminary intervention study (Crary et al., 2012), without the use of a control group, demonstrated significant post-treatment improvements in swallowing function for a small group of people with chronic and stable dysphagia.

Oral motor exercises in dysphagia. An audit of speech and language therapists in the United Kingdom revealed 87% of them used non-speech oral motor exercises in dysphagia rehabilitation (Mackenzie et al., 2010). This echoes the results of an unpublished audit of speech pathologists in the Perth metropolitan area (Dunkin & Langdin, 2008), which found 83% of speech pathologists used oral motor exercises for the rehabilitation of dysphagia.

Some small studies provide evidence to support the use of oral motor exercises. Ray (2002) reports positive improvements in swallowing function after oro-facial myo-functional therapy for 12 subjects with mild-moderate dysarthria. A lingual exercise program without functional swallowing practice, showed improvements in lingual strength and swallowing function for 10 stroke survivors (Robbins et al., 2007). Tongue strength may also be increased in healthy adults, with a variety of exercise regimes, but they exhibit detraining effects when the exercises are discontinued with lingual musculature showing less obvious training specificity

than is indicated in the skeletal muscle literature (Clark, O'Brien, Calleja, & Newcomb Corrie, 2009) .

Lip strength training is reported to improve swallowing function for dysphagic stroke patients, with or without facial paresis (Hägg & Anniko, 2008, 2010). Hägg and Anniko (2010) suggest that a lip strength-training program may be helpful for all dysphagic stroke patients, with or without facial paresis, as all may suffer from a subclinical facial paresis. In lip strengthening exercises, the “buccinator mechanism” (p. 1205) is stimulated with a sensori-motor chain of events involving cranial nerves V, VII, IX, X and XII (Hägg & Anniko, 2010), which are all critical in the oral and pharyngeal stages of swallowing.

The dysarthria and dysphagia interventions discussed in this literature review have some emerging evidence for their effectiveness in the stroke population but require further investigation. The clinical management of dysarthria and dysphagia is based on current practice, expert opinion and this emerging body of evidence. The interventions chosen in this project (see Appendix B) are based on interventions commonly used in current clinical practice together with the research evidence outlined above. The effectiveness and feasibility of delivering these commonly used interventions in the RITH environment is not known nor is the perspectives of the carer and stroke survivor when receiving these treatments.

Rationale, Research Questions and Hypotheses

Rationale

The literature review above provides some evidence that early and intensive intervention may be a key factor to capturing positive neural plasticity changes post-stroke. This intensive practice, provided in the early stages post-stroke, has the potential to provide an optimal chance of neural reorganization and reduce the risk of mal-adaptive behaviours (McCabe, 2010). ESD with RITH can enhance the provision of early rehabilitation by providing seamless and immediate therapy services on discharge.

In this study, a multi-system intervention program was created (see Appendix B), based on evidence based practice interventions, with progressively more challenging tasks used to address the principles of motor-learning. Stroke survivors are most active and complete the most practice when with a therapist (Ada et al., 1999), however, there are known difficulties with staffing intensive speech pathology rehabilitation services (Bowen et al., 2012; Ciccone et al., 2013). There is a need to investigate alternative models of service delivery to increase practice and provide recommended levels of intervention. Supervised therapy assistants were used in this study to provide an intensive, supplementary service for regular guided speech and swallowing practice. This study introduces the therapy assistant as part of the intervention staff triad, within the RITH context (see Appendix C).

An independent practice home program was also used to incorporate the principles of repeated practice with reduced feedback, which is a feature of motor learning theory. This regular practice may be a key factor in determining good

outcomes post dysarthria intervention (Bowen et al., 2012; Robertson, 2001) and may encourage the habitual practice required for motor learning. The establishment of a regular exercise regime may also encourage the stroke survivor to continue with the exercise regime when treatment finishes, reducing the risk of any de-training effects (Clark et al., 2009).

Changes in health policy are encouraging community based rehabilitation with RITH services introduced to decrease length of stay in hospital. With the provision of home-based intervention, the carer may become an integral part in the context of the rehabilitation process (Koch et al., 1998). Within this project, stroke survivors were viewed holistically and carers (who may include the spouse, children, friends or relatives) were considered integral in the treatment process and part of the RITH context (see Appendix C).

This project was relevant to the local community and represented commonly used and currently available treatments. The choice of using a therapy assistant to supplement speech pathology services and provide intensive intervention reflects the current economic climate with competing demands, strong accountability and budget constraints in the health sector. The use of traditional speech and swallowing interventions with easily accessible assessments means that the design of the study is highly replicable and relevant to the majority of practising speech pathologists.

Research Questions

This pilot study compared the outcomes of two RITH service delivery models for a small group of stroke survivors with dysarthria and dysphagia. It also provides insight into whether home-based speech pathology interventions, including the use

of a supervised therapy assistant, are effective and acceptable to stroke survivors and their carers.

Within the context of a RITH setting, this study addressed the following research questions;

1. Is a speech pathology RITH intervention program, supplemented with a home practice program:
 - a. feasible; and,
 - b. are improvements demonstrated in dysphagia and dysarthria for the combined group of stroke survivors?
2. Is there any difference in outcomes of a speech pathologist-only led treatment program (TAU) vs. an intensive speech pathologist and therapy assistant practice regime (INT)?
3. What are the perceptions, experiences and preferences of:
 - c) the stroke survivors; and,
 - d) the carers involved in RITH speech pathology rehabilitation?

Hypotheses

This study aimed to compare the outcomes of two RITH service delivery models for a small group of stroke survivors with speech and swallowing impairments. Hypotheses are stated below.

1. Stroke survivors will:
 - a) be able to complete regular and intensive speech pathology intervention with either a speech pathologist and/or a therapy assistant and complete regular home practice; and,

- b) show improved speech and swallowing outcomes and a reduced psycho-social impact of dysarthria when comparing baseline measures (A1) and post treatment measures (A2) and that those improvements will be maintained at two months post intervention (A3).
- 2. Stroke survivors who receive intensive home-visiting speech pathology services supplemented by a therapy assistant (INT) will have similar or greater improvement when compared to usual treatment (TAU) immediately post treatment (A2) and maintain this level of improvement at two months post treatment (A3) compared to treatment as usual.
- 3. Key stakeholders (carers and stroke survivors) will report positively on home-based speech pathology services and speech and swallowing outcomes (for both group TAU and group INT).

Methods

Research Approach

This study compared outcomes of two independent groups of stroke survivors in early post-stroke recovery. Treatment outcomes were collected after three weeks of therapy. A mixed methods approach involving the analysis of qualitative data and between groups analysis of quantitative data was used to describe and compare two models of service delivery.

Context – RITH Perth

Participants received services through the South-Metro Area Health Service Rehabilitation in the Home team (SMAHS RITH), which is a government-funded early discharge multi-disciplinary allied health service in Perth. SMAHS RITH promotes early discharge from hospital, substitutes hospital based care with home based care, reduces length of stay (LOS) and aims to prevent re-admission to hospital. RITH aims to promote patient flow and provide additional capacity in the health system. Home based delivery of rehabilitation services lessens demand on inpatient resources and is a key component of WA Health's strategy to manage demand on inpatient services.

SMAHS RITH provides the following health services: physiotherapy, occupational therapy, speech pathology, dietetics, social work and clinical psychology under the medical supervision of a consultant geriatrician. SMAHS RITH provides services across a range of aetiologies, which include stroke. To be eligible for RITH, clients must be medically stable with adequate home support, have an accessible and safe home environment and be able to actively participate in a goal

orientated rehabilitation program. Perth RITH services employ therapy assistants who work across disciplines. There is at least one therapy assistant at each site who works as part of the multi-disciplinary team to deliver interventions. SMAHS RITH services use therapy assistants predominantly for physiotherapy interventions (75%), followed by occupational therapy (19%) and speech pathology (6%) (SMAHS RITH, 2011). Usually SMAHS RITH speech pathologists use therapy assistants on an *ad hoc* basis to assist in supervised delivery of selective speech pathology interventions.

Participants

The data reported here were collected from 2010-2011 and involved both the stroke survivors and their carers.

The stroke survivors. As stated previously all participants were recruited from SMAHS RITH. All referrals into the SMAHS RITH program are screened prior to acceptance into the program. All patients must be able to participate in a goal orientated rehabilitation program, be discharged home to a safe environment and have the presence of a carer as required. During the recruitment phase of this study all SMAHS Royal Perth Hospital RITH referrals were screened and participants who met the following inclusion criteria were invited to participate in the study:

- new acute stroke diagnosis with direct referral to SMAHS Royal Perth Hospital RITH from hospital; and,
- a speech pathology in-patient diagnosis of dysarthria and/or oral stage dysphagia resulting from the stroke.

Participants were excluded if they met the following criteria:

- a diagnosis of dementia;

- severe oral/verbal dyspraxia and unable to vocalise;
- severe aphasia;
- aphasia as a higher treatment priority than speech/swallowing, as determined by an initial interview; or,
- previous history of communication or swallowing disorder.

Over a 10-month recruitment period, 10 stroke survivors met the selection criteria and were recruited to the study. Refer to Figure 1, which depicts the participants' progression through the study.

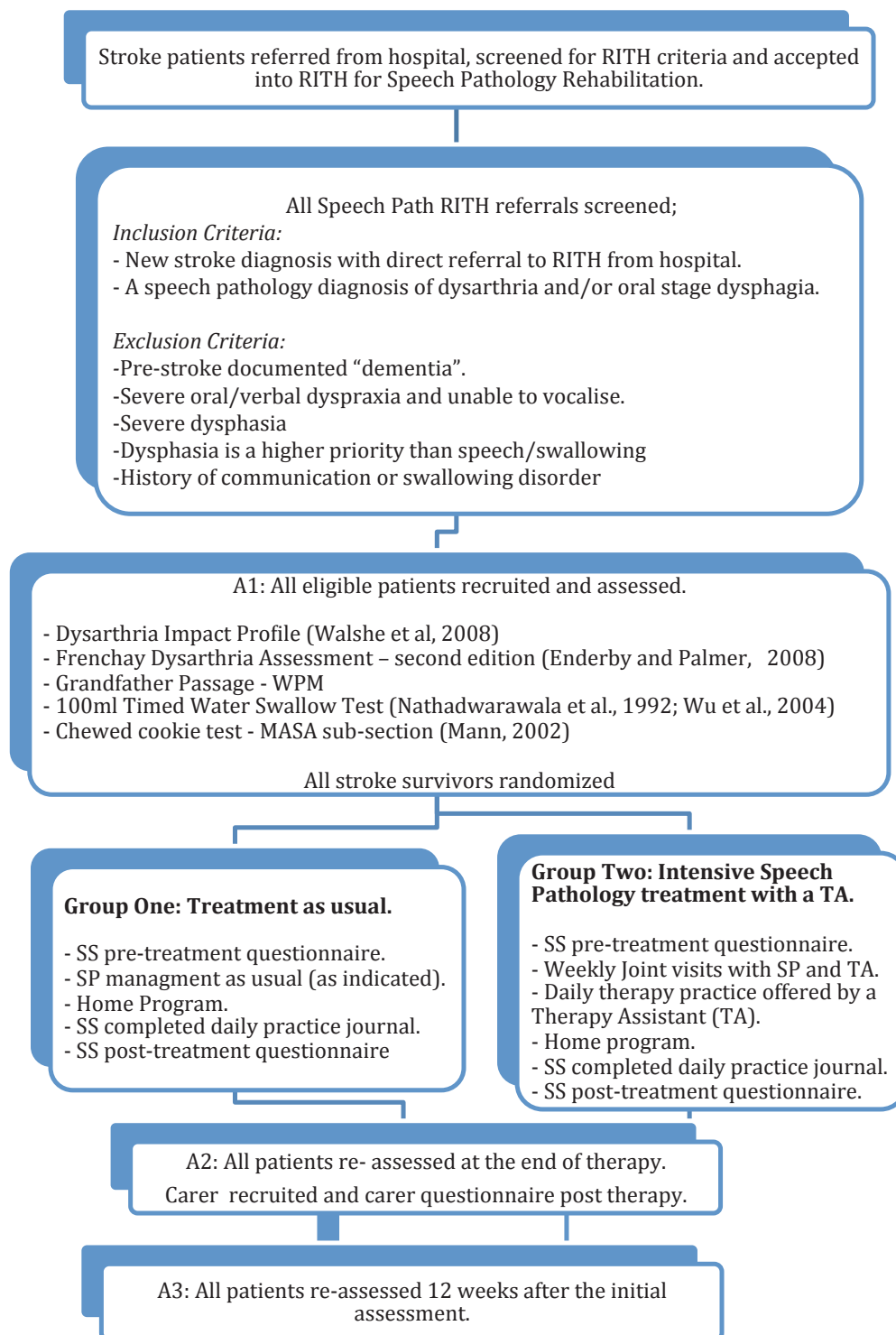


Figure 1. Research Flowchart.

Baseline characteristics. The stroke survivors' age, medical history and family support were gathered from the medical notes and through discussion with the stroke survivor and their family (see Table 1). The Lawton Instrumental Activities of Daily Living Scale (Lawton's IADL) (Lawton & Brody, 1969) was administered by an experienced RITH Senior Occupational Therapist on discharge from hospital. The Lawton's is a functional assessment of independent living skills (Lawton & Brody, 1969) and was used to provide baseline data on the functional skills and level of independence of the stroke survivor.

As self-reported within the initial interview, six out of the 10 stroke survivors came from an Australian, English speaking background, while one participant was African with limited English proficiency (LEP), two were Asian, (one with LEP and one with fluent English as a second language), and one was European (spoke fluent English as a second language). These participants were purposefully included in this project as non-English speaking and LEP participants are under represented in research (Frayne, Burns, Hardt, & Moskowitz, 1996). Additionally, the inclusion of these participants provides a realistic clinical sample that reflected the clinical caseload under consideration. The stroke survivors with LEP were offered professional interpreting services for all sessions, questionnaires and assessments. Stroke Survivor 1 (SS1) used professional interpreting services for all sessions with the SP and when family members were present, family members occasionally were used to assist as and when required. SS10 accepted professional interpreting services for assessments, choosing to use the interpreter for clarification with complex questions such as in the Dysarthria Impact Profile (DIP)(Walshe, Peach, &

Miller, 2009). SS10 refused professional interpreting services for therapy sessions with the SP, preferring to converse in English.

Of the stroke survivors, three (SS4, SS8 and SS9) had an initial mild or moderate aphasia but chose speech and/or swallowing rehabilitation over aphasia. In the initial assessment, all stroke survivors, including those with aphasia, followed instructions accurately with or without an interpreter.

The demographic details of the stroke survivors are outlined in Table 1.

Table 1

Stroke Survivor Individual Demographics

Stroke Survivor or ID ^a	Sex	Age	Intervention Group ^b	Ethnicity ^c	English Language Status ^c	SP Diagnoses with TOMS ratings ^{de}
SS1	F	56	TAU	African	ESL with LEP	Dysarthria – 2 Dysphagia – 4 Dysphonia – 2
SS2	F	56	INT	Australian	Fluent	Dysarthria – 3 Dysphagia – 3 Dysphonia – 3
SS3	M	62	TAU	Australian	Fluent	Dysarthria – 3 Dysphagia – 3 Dysphonia – 3
SS4	M	76	INT	Australian	Fluent	Dysarthria – 2 Dysphagia – 4 Dysphonia – 2 Dyspraxia – 2 Aphasia – 4
SS5	F	82	INT	Australian	Fluent	Dysarthria – 2 Dysphagia – 2.5 Dysphonia – 2.5
SS6	M	51	TAU	Australian	Fluent	Dysarthria – 3.5 Dysphonia – 3
SS7	M	48	TAU	Australian	Fluent	Dysarthria – 2.5 Dysphagia – 4.5 Dysphonia – 3
SS8	F	68	INT	Asian	ESL; Fluent	Dysarthria – 3 Dysphagia – 3 Dysphonia – 3 Dyspraxia – 3 Aphasia – 3
SS9	F	84	TAU	European	ESL; Fluent	Dysarthria – 3 Dysphagia – 3 Dysphonia – 3 Aphasia – 4
SS10	M	47	INT	Asian	ESL with LEP	Dysarthria – 3 Dysphagia – 4 Dysphonia – 3

Note. ^a Each stroke survivor was given a unique identification code (ie stroke survivor one → SS1) to allow for tracking of responses throughout this study. Each stroke survivor code ties with their carer code, ie SS1 relates to C1. ^b (TAU) treatment as usual with a speech pathologist; (INT) intensive treatment with a speech pathologist and a supervised therapy assistant. ^c (ESL) English second language; (LEP) limited English proficiency. English proficiency as identified/self-reported through initial interview. ^d As rated by the RITH speech pathologist at A1. ^e TOMS (Enderby et al., 1997) ratings range from 0 (no impairment) to 5 (severe impairment).

Stroke survivors were randomly allocated to either group TAU or group INT with group demographics summarized in Table 2.

Table 2

Stroke Survivor Group Demographics Pre-Therapy (A1)

Characteristic	TAU Treatment as usual (n=5)	INT SP and TA Intervention (n=5)	TOTAL (n=10)
Sex	3 male 2 female	2 male 3 female	5 male 5 female
Age (Years)	Mean: 60.2 Range 48-84	Mean: 65.8 Range: 47 – 82	Mean: 63 years Range: 48 – 84
Lawton IADL Scale ^a	Mean: 17.4 Range: 15 - 20	Mean: 14.2 Range: 9 -17	Mean: 15.8 Range: 9 - 20
CVA Classification	LACS 1 PACS 3 TACS 0 POCS 1	LACS 2 PACS 1 TACS 0 POCS 2	LACS 3 PACS 4 TACS 0 POCS 3
Site of CVA	3 right hemisphere 2 left hemisphere	2 right hemisphere 2 left hemisphere 1 bilateral	5 right hemisphere 4 left hemisphere 1 bilateral
Time since CVA	Mean: 38 days Range: 15-55	Mean: 41.2 days Range: 13 -115	Mean: 39.6 Range: 13-115
Presence of Aphasia	1/5	2/5	3/10
Presence of Dysarthria	5/5	5/5	10/10
Presence of Dysphagia	4/5	5/5	9/10
Swallowing status	1/5 on modified diet	2/5 on modified diet	3/10 on modified diets.
Visits by other (non SP) RITH Allied Health Professionals in the intervention period.	Total visits= 54 Mean visits= 10.8	Total visits= 59 Mean visits= 11.8	Total visits = 113 Mean visits = 11.3
Number of other RITH professions who visited in the intervention period	Range: 1 - 4	Range: 1-3	Range: 1- 4

Note.^a The Lawton Instrumental Activities of Daily Living Scale (Lawton & Brody, 1969) ^b CVA classification (Bamford, Sandercock, Dennis, Warlow, & Burn, 1991) and site of CVA as determined through examination of patient's notes and CT and/or MRI report.

The carers. For each stroke survivor, the main person who provided informal care (the ‘carer’) for the stroke survivor was invited to participate in the study. All carers in this study were family members. The carers were actively encouraged to be involved in therapy with opportunities for observation, questions and education provided throughout therapy for both intervention groups. All 10 carers consented to participate in the research program.

Of the 10 carers surveyed, 8/10 were female and 7/10 carers lived with the stroke survivor. The mean age of the carers was 51.2 years (range 16-85 years).

Table 3 provides demographic information on each of the carers.

Table 3

Carer Demographics and Relationship to the Stroke Survivor

Carer ID^a	Carer relationship	Carer status	Carer age	Carer Ethnicity^b	Lives with SS	Carer English Proficiency^b
C1	Grand-daughter	Studying	16	African	Yes	ESL; LEP
C2	Daughter	Working	33	Australian	No	Fluent
C3	Wife	Working	62	Australian	Yes	Fluent
C4	Wife	Retired	67	Australian	Yes	Fluent
C5	Daughter	Working	59	Australian	No	Fluent
C6	Wife	Working	54	Australian	Yes	Fluent
C7	Wife	Working	51	Australian	Yes	Fluent
C8	Son	Working	39	Asian	No	ESL; Fluent
C9	Husband	Retired	85	European	Yes	ESL; LEP
C10	Wife	Working	46	Asian	Yes	ESL; LEP

Note. ^a Each carer has been given a unique identification code (ie carer one → C1) to allow for tracking of responses throughout this study. Each carer code ties with the stroke survivor that they cared for, i.e. C1 relates to SS1. ^b as identified/self-reported by carer.

Research Procedures

Recruitment. RITH referrals were screened and participants who met the inclusion criteria were invited to participate in the study (see Figure 1 for research flow chart). Over a 10-month recruitment period 10 stroke survivors and their carer met the selection criteria and were recruited to the study.

Randomisation. Participants were randomly allocated to groups via a computer-generated list. The list was created with an online computer program and hidden from the speech pathologist. Once the stroke survivor was recruited, the group allocation for that participant was revealed to the speech pathologist and the stroke survivor was then allocated to a group. Stroke survivors were randomly allocated to either group TAU or group INT with group demographics summarized in Table 2. The treating speech pathologist, an experienced RITH clinician, recruited, assessed, and treated each stroke survivor and provided training and support for the therapy assistant.

Group TAU. The treatment as usual group received treatment as usual with a speech pathologist. In an attempt to control dosage across this group, the frequency of sessions was designed to be two sessions per week, which is, on average, the minimum desired frequency of SMAHS RITH SP home visits for a stroke survivor in the post-acute stage. The frequency of visits for the TAU group was also at the discretion of the speech pathologist and in negotiation with the individual. Each visit was to be from 30 minutes to 60 minutes depending on the availability and fatigue levels of the stroke survivor.

Group INT. This group received treatment from a speech pathologist plus a therapy assistant. In an attempt to control dosage across this group, it was planned that each stroke survivor receive one speech pathology appointment for one hour

per week, plus five therapy assistant visits per week. The therapy assistant visits were designed to be between 30-60 minutes per visit; depending on the stroke survivor's fatigue and availability. Group INT participants were under the full management of the RITH speech pathologist at all times. The therapy assistant and speech pathologist liaised regularly with each other and the stroke survivor, with the multi-system intervention program changing and progressing with the needs and goals of the stroke survivor within their context (see Appendix C). The speech pathologist and therapy assistant conducted a joint visit once per week where the speech pathologist would review the stroke survivor and trial and demonstrate new treatments and strategies to the therapy assistant. The therapy assistant would stay behind after the joint visit to continue practising with the stroke survivor. The therapy assistant was supervised remotely by the speech pathologist who was available by phone or face-to-face for advice and direction.

The therapy assistant offered the INT group participants daily home visits (Monday-Friday) to practise the interventions. The therapy assistant's role was to direct practice sessions, provide feedback to the speech pathologist and stroke survivor and ensure tasks progressed in complexity and varied in structure.

Three therapy assistants were involved in the treatment of five stroke survivors and all three assistants had completed their Certificate IV in Allied Health Assistance while employed in RITH. The SMAHS and North Metro Area Health Service RITH speech pathologists have developed workshops, competencies and tests in conjunction with the Certificate IV assessors. All three therapy assistants involved in this project had attended a half-day dysphagia training workshop, a three-hour dysarthria training workshop and had successfully completed RITH developed dysarthria and dysphagia tests. In order to pass each module and to be deemed

competent in delivering treatment, the therapy assistant also had to complete a written assignment, which demonstrated their understanding of each disorder.

Interventions. Intervention commenced on the first working day after the initial assessment. All stroke survivors received treatment over 15 working days/three weeks. This time frame was designed to approximate the average length of admission of speech pathology patients in SMAHS RITH at the time of the study (average length of stay in SMAHS RITH was 23 days in 2010). In both groups, participants were able to decline treatment sessions with all reasons for refusal recorded.

The stroke survivors, in both groups, received a combination of ongoing education (for the stroke survivor and any involved carer) and direct speech and swallowing intervention. The evidenced based intervention was designed to be a 'multi-system' program (Palmer & Enderby, 2007) and address the main speech parameters which affected the stroke survivors' speech intelligibility and naturalness (including prosody, rate and resonance) and target areas of swallowing difficulties (see Appendix B). The starting point for therapy was determined from the results of the initial assessment session.

The dysarthria and dysphagia treatment tasks were based on the principles of motor learning. Pre-practice (preparation and introduction for treatment (Maas et al., 2008)) and practice phases (drill like repetition in a hierarchy of tasks (McIlwaine, Madill, & McCabe, 2010)) were used within all motor based tasks. These exercises targeted weakness, endurance, rate and range of movement and the principles of strength training (overload, progression, recovery, specificity) (Clark, 2005). Participants were prescribed sets of exercises with a specified number of repetitions of exercises with rest periods included throughout based on their fatigue levels and

impairment profile. Tasks progressed through a hierarchy of difficulty with varied targets, to incorporate the concept of disseminated practice, that is, practice should occur on “multiple, related, randomised production targets” (p.3) i.e. in various positions across varied targets (McCabe, 2010).

Each stroke survivor, in the beginning stages of RITH SP treatment, received the ‘building blocks’ of the intervention. These were a set of written speech and non-speech oral motor exercises to target both speech and swallowing, which formed the basis for the home practice program. All stroke survivors received some degree of oro-motor therapy, which targeted improving the strength, range and rate of movement. For example, lip seal was targeted for those who identified problems with oral leakage, lip retraction for those with facial asymmetry and repetitive bilabial sounds and syllables for those with dysarthria and poor plosives. Articulation drills became progressively challenging with targets such as complex words and phrases, loaded sentences, paragraphs. As appropriate, stroke survivors received intervention targeting phonation, respiration and the coordination of the two.

Some participants received direct chewing and swallowing practice to focus on oral stage skills such as chewing, lip seal, bolus control and transfer to the pharynx. While the selection criteria for entry into this project included participants with oral stage dysphagia, participants with additional pharyngeal stage dysphagia were not excluded. While reportedly ‘safe’ pharyngeal stage dysphagia treatments such as the Shaker head lift (Shaker et al., 1997) were provided to participants who demonstrated pharyngeal stage dysphagia, the main focus of the intervention program was on promoting oral stage skills.

The exercises progressed into functional speech and/or swallowing practice. The speech tasks included conversational practice and role-plays. Individually

tailored compensatory and behavioural strategies were also provided, promoted and practised. Education was provided informally to stroke survivors in written and verbal format. Education included; defining dysarthria and dysphagia, safe swallowing strategies, modified diet advice, potential factors influencing recovery and the benefits of regular practice.

Prior to recruitment, a folder was created with a variety of commonly used dysarthria and dysphagia interventions and educational handouts for stroke survivors and their carers. All treatments and handouts were taken from the folder to maintain consistency in the intervention provided across patients. Using the treatment principles outlined above, the information gained from the assessments at A1 and the hierarchy of targets, the speech pathologist created an individualised program for each stroke survivor. The programs were modified to cater for the varying profile of impairment, literacy skills, visual acuity and English language skills of each participant. Progress was monitored by the speech pathologist and the programme modified over the course of the treatment.

Any additional language interventions for the subjects with aphasia were given on separate visits or after the research intervention was provided in the same visit. The three stroke survivors (SS4, SS8 and SS9) with an initial mild or moderate aphasia were offered the option of additional language intervention (in keeping with usual treatment). Only one subject (SS9) chose to have additional language therapy intervention, which resulted in a maximum of one extra session per week.

Independent practice home program. Each stroke survivor was given an individually tailored therapy home practice program in order to enhance treatment effectiveness for dysarthria (Robertson, 2001) by consolidating learning and increasing the amount of practice completed. The exercises completed in therapy

with the speech pathologist and/or therapy assistant were reiterated in independent practice. Handouts given for home practice were taken from the resource folder described above. Stroke survivors were actively encouraged to complete daily practice outside of the speech pathology/therapy assistant treatment session. In this study, stroke survivors were encouraged to practice for at least 15 minutes per day, but all were encouraged to practice 'little and often'. The stroke survivor was given a daily diary (see Appendix D) and asked to record the following details of their practice: the exercises practiced; the length of the practice session in minutes; or, if they could not practice, a reason why practice was not completed. The carer, if available at appointments, was also asked to remind and encourage the stroke survivor to practice and if required, assist with recording the amount and type of home practice.

Assessment time points. Each stroke survivor was assessed at three points in time. The baseline assessment (assessment one) (A1) occurred one working day prior to the commencement of the intervention program. Assessment two (A2) occurred one working day after the last treatment session or 16 working days after treatment commenced. Assessment three (A3) took place 12 weeks after A1 (approximately two months post treatment). Each assessment was conducted over a maximum of two working days and took place in the individual's home.

Stroke survivor speech and swallowing assessments. The speech and swallowing outcome measures are outlined below and summarised in Appendix E.

Dysarthria Impact Profile (DIP) (Walshe et al., 2009). The psychosocial impact of dysarthria was measured with the DIP which has good internal consistency and reliability (Walshe et al., 2009). Scores were calculated by adding up the subtotal from each of the five sections and providing a total score. Both repeated

questions in sections A-D were scored. Scores on the DIP range from 49 to 245 with lower scores indicating a strong negative impact and higher scores indicating a minor negative impact of dysarthria.

The Frenchay Dysarthria Assessment – 2nd edition (FDA-II)(Enderby & Palmer, 2008). The FDA-II (Enderby & Palmer, 2008) is the only available published diagnostic test which identifies the presence of dysarthria and assists with the classification of dysarthria type (Duffy, 2005). The FDA-II consists of rating scales and information provided by the patient. For the analysis of results, within this study, the FDA-II was divided into two parts: section 1-6 (Oral Motor Function) and section 7 (Speech Intelligibility).

Oral Motor Function. Oral motor function (OMF) was assessed through completion of parts 1-6 of the FDA-II. OMF includes scores of reflexes, respiration, lips, palate, laryngeal and tongue ratings. Possible OMF scores range from 0 (no difficulty) to 92 (severe difficulty).

Speech Intelligibility. Word, sentence and conversation speech intelligibility (SPINT) was assessed through completion of part 7 of the FDA-II. SPINT involves intelligibility ratings for words, sentences and conversation. Possible SPINT scores ranged from 0-12 with 0 indicating no difficulty and 12 indicating a severe difficulty.

Speech Rate. Speech rate was measured in words per minute (WPM) when reading aloud. The overall functioning and efficiency of the motor speech system was assessed through a sample of speech production. The sample was gathered from the stroke survivor reading aloud the Grandfather Passage (Van Riper, 1963). Oral reading has been suggested to be a useful screening tool (Duchin & Mysak, 1987) and the passage is commonly used in clinical practice as it provides a representative phonetic sample (Duffy, 2005). If the stroke survivor could not read

(illiteracy or non-English speaking), the sample was not collected. The Grandfather Passage used in this study contained 133 words (where the number '93' is counted as two words); however, due to the omission, repetition, and/or insertion of words by the stroke survivors, the actual number of words may vary between participants. The connected speech sample was analysed with words per minute (WPM), which was obtained by dividing the total number of words produced by the participant's total speaking time.

Timed Water Swallow Test. Water swallow speed (WSS, ml/sec) was assessed using the the 100mL Timed Water Swallow Test (TWST) (Nathadwarawala, Nicklin, & Wiles, 1992). The TWST is a reliable, valid and sensitive measure for identifying patients at risk of swallowing dysfunction, provides a simple interval measure, (Nathadwarawala et al., 1992; Wu, Chang, Wang, & Lin, 2004) and is suited to home based research. The protocol was followed as outlined by Nathadwarawala, et al. (1992) with scores calculated by dividing the number of millilitres drunk by the length of time taken to drink the 100mL (in seconds). Scores above 10mL/sec indicate a normal swallowing speed.

Chewed Cookie Test. The chewed cookie test (CCT) uses a subjective rating scale taken from a section of the Mann Assessment of Swallowing Ability (MASA) (Mann, 2002). The MASA is a quick, efficient 'bedside' screening tool, which is standardized for use in neurologic populations (Mann, 2002). The CCT uses the oral preparation, bolus clearance and oral transit sections from the MASA. This measure provides a standard rating of chewing and oral transfer skills without the use of videofluoroscopy, and so, is useful within the home-based clinical context. Possible scores range from 6 (severe difficulty) to 30 (no abnormality detected). Subjects

were provided with the same type of cookie and not given water to assist in chewing unless they requested it.

Stroke survivor and carer questionnaires. Qualitative and quantitative data was gathered from the stroke survivors and carers through questionnaires (see Appendices F-H). Questionnaires were designed by this author and were used to gather data from the key stakeholders on their perceptions, experiences and preferences of RITH SP. Questionnaires can be used as a social validation procedure and are commonly used to obtain feedback on the implementation of community interventions to determine if these interventions are socially acceptable (Francisco & Butterfoss, 2007). Social validity can be assumed through high ratings and the continued use of an intervention (Francisco & Butterfoss, 2007).

Both questionnaires were developed to include a mixture of open field, dichotomous, trichotomous and Likert scale questions to provide a combination of detailed, authentic comments with quantitative measures and ratings of opinions and behaviours (Creswell, 2013). Dichotomous questions included yes/no responses. Trichotomous responses were used to rate reported levels of improvement from small to large. Likert scale questions were used to provide a scale measure of reported confidence. Additionally, other scale questions were used to measure the frequency of preferred intervention.

Stroke survivor questionnaire. The questionnaire explored the stroke survivor's perceptions, experiences and preferences for RITH SP. The post-therapy stroke survivor questionnaire (SSQ) was delivered at A2 in a structured verbal interview. Originally, the stroke survivor questionnaires were planned to be completed in a written format but the majority of candidates were unable to complete in this format, due to post assessment fatigue, variation in literacy and English

fluency levels, writing abilities and hemiparesis. The speech pathologist decided to complete all questionnaires in a structured interview format to attempt to maintain uniformity of delivery.

The post-therapy questionnaires (see Appendix F and G) were tailored to each group, either TAU or INT. While the majority of questions were the same for all participants, the stroke survivors who received TAU were asked about their experiences with practising with a SP and their thoughts on potentially practising with a TA. In comparison, the stroke survivors who received INT therapy were asked about their experiences, preferences and opinions for practising with a therapy assistant and a speech pathologist.

Carer questionnaire. Carers completed a post-treatment questionnaire (CQ) at A2 (see appendix H), which comprised a set of eight questions. The carer questionnaire explored the perceptions, experiences and preferences of the carers in relation to RITH SP, including their role in therapy. To cater for variations in English abilities and carer availability, the questionnaire was completed in the person's home (five in written mode by the carer; one in a structured interview with the SP) or as a structured phone interview with the SP (n=4). The carers with limited English proficiency (LEP) were offered professional interpreting services but none accepted preferring to converse in English (C1 and C9) or use a family member to interpret for them (C10). The aims of the questionnaire were discussed verbally with the carer prior to completion and carers were asked to be specific about the RITH SP services they had received.

Instrumentation. Equipment: digital voice recorder (Sony ICD-UX200F), stopwatch (Sportline 240 Econosport), glass vial for swallow trials with one millimetre

demarcations, calculator (Canon LS-100TS), sound level meter (Dick Smith Electronics – model Q1362) and SPSS version 21.

Data Analysis

Analysis of speech and swallowing outcome measures. The quantitative data were analysed descriptively using summary statistics and through statistical analysis with SPSS. Baseline age and scores for the Lawton's, OMF, WPM, DIP, SPINT, TWST and CCT for the two groups were compared. The data for age, Lawton's, OMF and WPM were normally distributed and therefore independent samples t-tests were used. Mann-Whitney U tests were conducted for baseline DIP, SPINT, TWST and CCT scores.

Therapy compliance was compared between groups. Minutes of professionally led therapy time (total time accumulated during direct SP sessions delivered in the home by either a SP or a TA) were normally distributed and assessed with independent samples t-tests. Independent home practice minutes were not normally distributed and were compared between groups with a Mann-Whitney U test.

Evaluation of treatment effects were analysed with a 2x2 mixed model ANOVA for DIP, OMF, SPINT, WPM and TWST. As the tests for normality and sphericity were violated for the CCT; the CCT was analysed with a 2x2 mixed model ANOVA with the degrees of freedom adjusted with a Huynh-Feldt Epsilon. An alpha level of 0.05 was used to denote statistical significance with a confidence interval of 95%.

Analysis of questionnaires. The data were analysed using qualitative content analysis (Sandelowski, 2000). Analysis of responses varied depending on

the format of the question. Tallies were calculated for the dichotomous and scaled responses to provide summary descriptive data. Responses to open-ended questions were analysed for recurring content using a descriptive analysis approach (Sandelowski, 2000). Such responses were analysed broadly through thorough reading by the researcher (KS). Categories were created and responses grouped into each category by frequency. For the carer questionnaire, two external speech pathologists reviewed the raw data from the questionnaires, looked for emerging categories and then independently created categories and sorted responses into these categories. All three speech pathologists then met together to go through the results, with the subsequent consensus of categories and groupings.

Ethical Issues

Ethical approval for the collection of data was granted by Royal Perth Hospital Ethics Committee (EC 2010/023) with subsequent reciprocal ethical approval from the South Metro Area Health Service Human Research Ethics Committee (Armadale, Bentley and Fremantle Hospitals), Swan Kalamunda Executive Committee Swan Kalamunda Health Service (Swan District Hospital) and Sir Charles Gairdner Group Human Research Ethics Committee. Edith Cowan University Human Research Ethics Committee approved the use of the data for the completion of this thesis (Code 9329). There has been no departure from the approved requirements on maintenance and security of records or compliance with the consent procedures and documentation.

Results

This chapter reports the analysis of quantitative and qualitative data and is written in three parts: stroke survivor speech and swallowing outcome measures; stroke survivor perceptions, experiences and preferences of their SP therapy program; and, carer perceptions, experiences and preferences for RITH SP.

Stroke Survivor Dysarthria and Dysphagia Outcomes

Baseline between group comparisons. Baseline between group comparisons for stroke severity and age were made using independent samples t tests. Stroke severity was measured by the Lawton Instrumental Activities of Daily Living Scale (Lawton's (Lawton & Brody, 1969)) and age was the age of each participant at A1, immediately prior to therapy. Neither Shapiro-Wilk nor Levene's test were significant, thus normality and equal variances for the two groups could be assumed.

On average, the participants within the TAU group had a higher score on Lawton's (M=17.4, SD=1.82) than participants in the INT group (M=14.20, SD=3.27), however this difference was not significant ($t(8) = 1.912$, $p=0.092$). Additionally the TAU group (M=60.2, SD=14.32) was 5.6 years younger than the INT group (M = 65.8, SD = 14.32), however this difference was not significant ($t(8) = -.618$, $p > .05$).

To determine if there were between group differences in baseline dysarthria and dysphagia severity, the six A1 speech and swallowing outcome measures were analysed (see Table 4).

Table 4

Summary of TAU and INT Group Outcome Measures

	A1 Mean (SD)		A2 Mean (SD)		A3 Mean (SD)	
	TAU	INT	TAU	INT	TAU	INT
DIP	165.00	152.40	182.00	181.20	182.00	185.60
TAU=4 ^a	(22.04)	(25.97)	(19.51)	(19.33)	(28.19)	(36.12)
INT=5						
OMF	31.40	33.80	15.00	13.60	13.00	10.40
	(10.53)	(8.29)	(8.09)	(4.62)	(7.11)	(5.77)
SPINT	4.50	5.8	1.50	3.00	1.25	2.8
TAU=4 ^a	(2.38)	(1.79)	(1.00)	(2.55)	(1.26)	(2.78)
INT=5						
WPM	126.75	69.25	113.50	69.75	130.50	84.50
TAU=4 ^a	(40.63)	(19.62)	(23.01)	(19.67)	(28.90)	(19.84)
INT=4 ^b						
TWST	10.86	5.97	13.10	7.59	16.44	8.63
	(7.43)	(7.39)	(9.86)	(6.80)	(10.54)	(8.62)
CCT	26.20	21.60	29.60	28.40	28.60	28.00
	(3.63)	(8.99)	(0.89)	(1.67)	(2.19)	(2.83)

Note. Dysarthria Impact Profile (DIP), Oral Motor Function (OMF), Speech Intelligibility (SPINT), Speech rate in words per minute (WPM), Timed Water Swallow Test (TWST) and Chewed Cookie Test (CCT). ^a One stroke survivor (SS1) was unable to complete DIP, SPINT, or WPM due to ESL. ^b One stroke survivor (SS2) was unable to complete the WPM assessment in A1 due to fatigue.

Neither the Shapiro-Wilk test for normality nor Levene's test for variance were significant for OMF and WPM. However both tests were significant for the remainder of the measures. Therefore independent samples t-tests were used to compare the mean baseline OMF and WPM scores and non-parametric measure analyses were used for the remainder of the measures.

At baseline (A1), OMF in the TAU group (M=31.40, SD=10.53) was not significantly different to the INT group (M = 33.80, SD = 8.29), ($t(8) = .401$, $p > .05$). At A1, WPM in the TAU group (M=126.75, SD=40.63) was significantly higher than the

INT group ($M = 69.25$, $SD = 19.62$), $t(6) =$, $p < .05$, two-tailed $d = 1.80$ (considered to be a large effect size) (Cohen, 1988). The participants in the TAU group read aloud 57.5 words per minute faster, 95% CI $[-112.703, -2.297]$ than those in the INT group.

A Mann-Whitney U test was completed for baseline (A1) DIP, SPINT, TWST and CCT scores with the following findings:

- DIP in the TAU group (Mean Rank = 5.25, $n = 4$) was not statistically significantly different to the INT group (Mean Rank = 4.80, $n = 5$), $U = 9.000$, $z = -.25$, $p = .905$, two-tailed.
- SPINT in the TAU group (Mean Rank = 3.88, $n = 4$) was not statistically significantly different to the INT group (Mean Rank = 5.90, $n = 5$), $U = 5.50$, $z = -1.13$, $p = .286$, two-tailed.
- TWST in the TAU group (Mean Rank = 7.00, $n = 5$) was not statistically significantly different to the INT group (Mean Rank = 4.00, $n = 5$), $U = 5.00$, $z = -1.57$, $p = .151$, two-tailed.
- CCT in the TAU group (Mean Rank = 6.40, $n = 5$) was not statistically significantly different to the INT group (Mean Rank = 4.60, $n = 5$), $U = 8.000$, $z = -.95$, $p = .421$, two-tailed.

In summary, at baseline (A1), the two groups were not significantly different on the measures: DIP, OMF, SPINT TWST and CCT, however, there was a statistically significant difference between groups for WPM. The speech rate of the TAU group was significantly faster than that of the INT group.

Amount of therapy. All participants completed the treatment program involving professionally led therapy (therapy provided by a speech pathologist or a therapy assistant) and home practice.

Professionally led therapy. Independent samples t-tests were used to compare the group averages for a) total SP time (total 1:1 time accumulated with a speech pathologist) and b) professionally led therapy time (total 1:1 time accumulated during SP sessions conducted by either a SP or a TA). Neither the Shapiro-Wilk test for normality or Levene's test for variance were significant.

- a) Total SP time. Stroke survivors participated in therapy delivered by a speech pathologist, with an average of 369 (SD=121.83) minutes of therapy, ranging from 235 to 605 minutes from A1 to end of the intervention period. A statistically significant difference was found between the TAU group (M= 470.00, SD= 85.22) who received 202 minutes more time of therapy, 95% CI[-293.63, -110.37], and the INT group (M=268.00, SD=11.25), $t(8) = -5.08$, $p = .001$, $d = -3.66$ (considered to be a large effect size) (Cohen, 1988)).
- b) Professionally led therapy time. Stroke survivors participated in professionally led therapy, with an average of 689.50 (SD=265.45) minutes of therapy, ranging from 375 minutes to 1140 minutes from A1 to end of the intervention period. A statistically significant difference was found between the TAU group (M= 470, SD =85.22) who received 439 minutes less time of therapy, 95% CI[-640.28, -237.72], and the INT group (M=909, SD=175.58), $t(8) = -5.03$, $p = .001$, $d = -3.18$ (considered to be a large effect size) (Cohen, 1988) (see Table 5).

Table 5

Treatment Regime Intensity Summary from A1 to End of Therapy

Therapist Type	Total Number of Home Visits. (including A1; not including A2) ^a	Total SP Time ^b (mins)	Total TA Time (mins)	Total Professionally Led Therapy Time ^c (mins)
TAU Group	SP ~ 8 Range: 7-9	2350 ^d M=470 (SD=85.22) Range: 375-605	N/A	2350 ^e M = 470 (SD=85.22) Range: 375-605
INT Group	SP 4 (A1 plus three weekly joint visits with TA)	1340 ^d M = 268 (SD = 25.15) Range: 235-305	N/A	4545 ^e M=909; (SD=175.58) Range: 695-1140
TA	~ 13 Range: 13-15 (Once weekly joint SP visit plus 4 other visits per week offered.)	N/A	3205 M = 641 (SD = 158.56) Range: 435-835	

Note. ^a A1 visit included as therapeutic benefit and increased awareness/feedback may have been attained through; the assessment process, especially the FDA-2 and in goal-setting in the DIP and the provision of education, strategies and some initial intervention exercises were often given at the end of the A1 visit. ^b The term "Total SP Time" is the total amount of direct (1:1) therapeutic time delivered by a SP from A1 up until and including the final therapeutic visit. ^c The term "Professionally Led Therapy Time" is the amount of total direct 1:1 therapeutic time delivered by either a SP or TA from A1 up until and including the final therapeutic visit. ^d The INT group received statistically significantly more minutes of total SP time than the TAU group ($t(8) = -5.08$, $p = .001$, $d = -3.66$ (considered to be a large effect size) (Cohen, 1988)). ^e The INT group received statistically significantly more minutes of professionally led therapy time (with a SP and TA) than the TAU group ($t(8) = -5.03$, $p = .001$, $d = -3.37$).

Independent home practice. Stroke survivors completed an average of 321 (SD= 274.02; range: 140-1070) minutes of independent home practice over three weeks, with an average of 15.3 minutes per day (calculated over 21 days) (see Table 6). Participants were encouraged to practice ‘little and often’ with the home practice protocol suggesting stroke survivors should practice for at least 15 minutes per day, which would result in 315 minutes of practise over 21 days. However, despite the mean, which was influenced by the large variation in the amount of home practice completed, only two stroke survivors were able to achieve this target.

The Shapiro-Wilk statistic was significant for the TAU group therefore a Mann-Whitney U test was used to compare the mean minutes of home practice of the TAU group (M=380.6, SE=174.08) to the INT group (M=262.2, SE= 41.65). The difference between the TAU group (Mean Rank = 5.20) and the INT group (Mean Rank = 5.80), U =11.00, z=-.31, p> .05, two-tailed was not statistically significant.

Table 6

Total Minutes of Stroke Survivor Home Practice Reported in Diary

	TAU (n=5)	INT (n=5)	Both (n=10)
Total	Total= 1903	Total = 1311	Total = 3214
Minutes of	Range= 155 - 1070	Range = 140 - 391	Range = 140-1070
Home	M=380.6 ^a	M = 262.2 ^a	M = 321.4
Practice	SD = 389.25	SD = 93.12	SD = 274.03

Note. ^a A Mann-Whitney U test indicated that the mean total minutes of home practice was not statistically significantly different between groups, p>.05.

In summary, the stroke survivors in the INT group received significantly more professionally led therapy time than the TAU group. The stroke survivors in the TAU group received significantly more total SP time than the INT group. There were no statistically significant differences in amount of home practice completed between groups.

Evaluation of treatment effects: Dysarthria and dysphagia outcomes.

Analysis of the speech and swallowing outcome measures as well as the psychosocial impact of dysarthria was undertaken for the 10 stroke survivors.

The assessments were administered pre- (A1), immediately post (A2), and two months post-therapy (A3). Descriptive statistics for these measures are summarised in Table 4.

A 2x2 mixed model ANOVA was used to analyse the performance of the participants across the assessment time points. The Shapiro-Wilk, Fmax, Levene's and Mauchly's test statistics indicated that the assumptions of normality, homogeneity of variance and sphericity were not violated for the following outcome measures;

- a) Dysarthria Impact Profile (DIP)
- b) Oral motor function (OMF)
- c) Speech intelligibility (SPINT)
- d) Speech rate when reading aloud "The Grandfather Passage" measured in words per minute (WPM).
- e) Water swallow speed in ml/sec (TWST)

Assumptions of normality, homogeneity of variance and the assumption of sphericity were violated for the Chewed Cookie Test (CCT).

Dysarthria Impact Profile. There was a significant main effect for time ($n=9$), $F(2,14)= 8.582$, $p=0.005$, partial $\eta^2 = 0.551$ (time accounts for 55.1% of the variance in DIP) with scores at A2 ($M=181.56$, $SD=18.16$), and A3 ($M=184.00$, $SD=30.89$), significantly higher than A1 ($M=158.00$, $SD=23.74$) (see Figure 2). The difference between DIP scores at A2 to A3 was not significant. The main effect for intervention type (TAU $n=4$; INT $n=5$) was not significant $F(1, 7)= 0.043$, $p=0.842$, partial $\eta^2=$

.006. The interaction effect between time and intervention, $F(2, 14) = 0.779$, $p = 0.478$, partial $\eta^2 = 0.1$, was not significant.

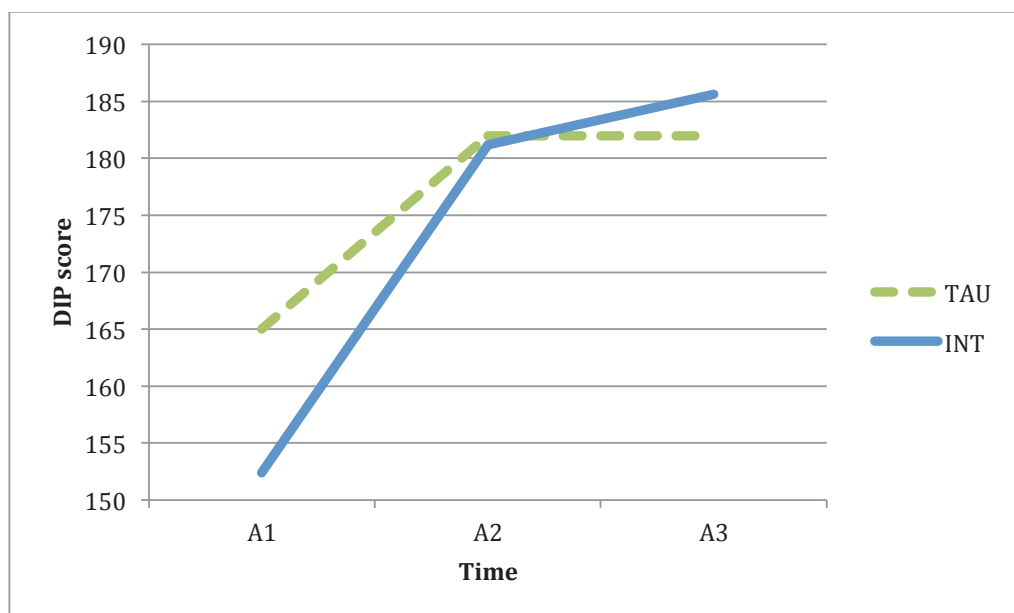


Figure 2. Dysarthria Impact Profile (DIP) scores across time.

As shown in Figure 2, a general treatment effect was found for the psycho-social impact of dysarthria, as measured on the DIP, immediately after treatment with no between group difference.

Oral motor function. There was a significant main effect for time ($n=10$), $F(2,16)=75.652$, $p=.000$, partial $\eta^2 = .904$ with scores at A2 ($M= 14.30$, $SD= 6.255$) and A3 ($M= 11.70$, $SD=6.255$) significantly lower than A1($M= 32.60$, $SD=9.021$) (see Figure 3), indicating an improvement in oral motor function. The difference between A2 and A3 was not significantly different. The main effect for type of intervention (TAU $n=5$; INT $n=5$) was not statistically significant $F(1,8)=81.325$, $p=.905$, partial $\eta^2=.002$. The interaction effect between time and intervention, $F(2, 16)=0.993$, $p=0.392$, partial $\eta^2=.110$ was also not-significant

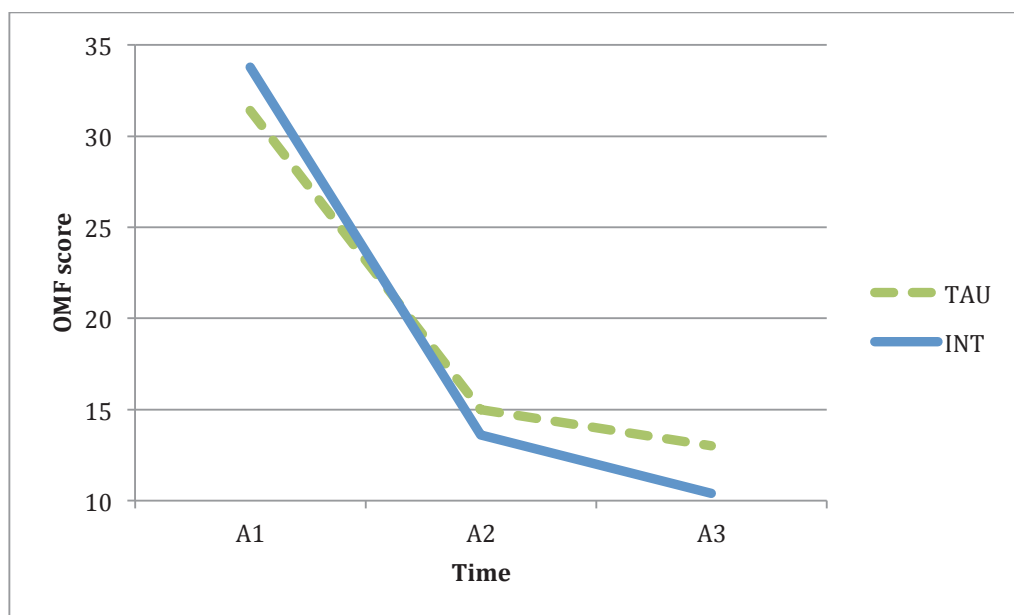


Figure 3. Oral Motor Function (OMF) scores across time.

As shown in Figure 3, a general treatment effect was found for oral motor function immediately after treatment with no difference found between INT and TAU groups.

Speech intelligibility. There was a significant main effect for time ($n=9$) $F(2,14)=27.593$, $p=0.00$, partial $\eta^2 = 0.798$ with SPINT at A2 ($M=2.33$, $SD= 2.06$) and A3 ($M=2.11$, $SD=2.26$) significantly higher than A1 ($M= 5.22$, $SD=2.05$) (see Figure 4). The difference between the SPINT scores at A2 and A3 was not statistically significant. The main effect for type of intervention (TAU $n=4$; INT $n=5$) was not statistically significant $F(1, 7)= 1.217$, $p=0.307$, partial $\eta^2=1.48$. The interaction effect between time and intervention was not statistically significant, $F(2,14)= 0.04$, $p= 0.961$, partial $\eta^2=0.006$.

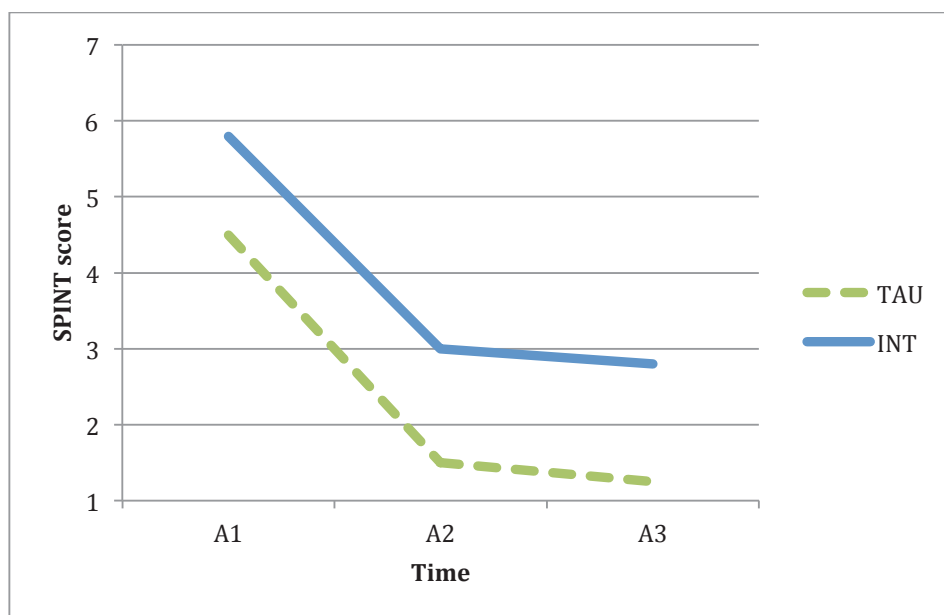


Figure 4. Speech intelligibility (SPINT) scores across time.

As shown in Figure 4, a general treatment effect was found for speech intelligibility immediately after treatment with no difference found between INT and TAU groups.

Speech rate in words per minute (WPM). The main effect for time ($n=8$) was not significant $F(2,12)=2.608$, $p=0.115$, partial $\eta^2 = 0.303$ (see Figure 5 and 6). The difference between WPM at A1 ($M=98.00$, $SD=42.63$), A2 ($M=91.63$, $SD=30.65$) and A3 ($M=107.50$, $SD=33.63$) was not statistically significant. The main effect for type of intervention (TAU $n=4$; INT $n=4$) was significant $F(1,6)=8.508$, $p=.027$, partial $\eta^2=0.586$. The interaction effect between time and intervention type was not statistically significant $F(2,12)=0.556$, $p=.588$, partial $\eta^2=0.085$. At baseline, there was a statistically significant difference in speech rate with TAU group (Mean=126.75, $SD=40.63$) speaking 57.5 words per minute faster than INT group (Mean=69.25, $SD=19.62$). This would appear to account for the significant effect for type of intervention.

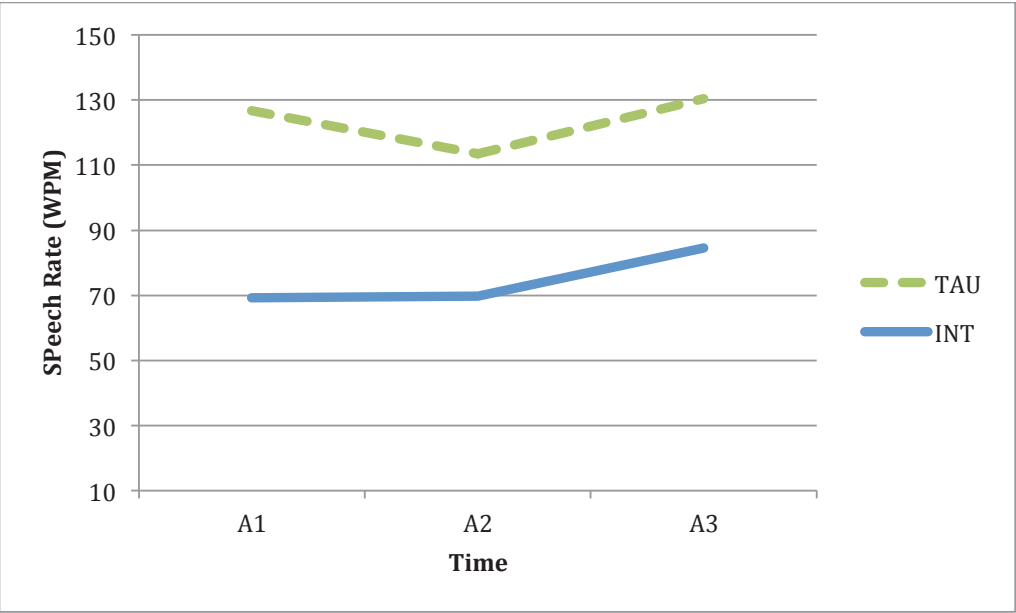


Figure 5. Speech rate (WPM) scores across time.

As shown in Figure 5, a general treatment effect was not found for speech rate immediately after treatment. A statistically significant difference was found between groups with the TAU group speaking faster than the INT group prior to therapy.

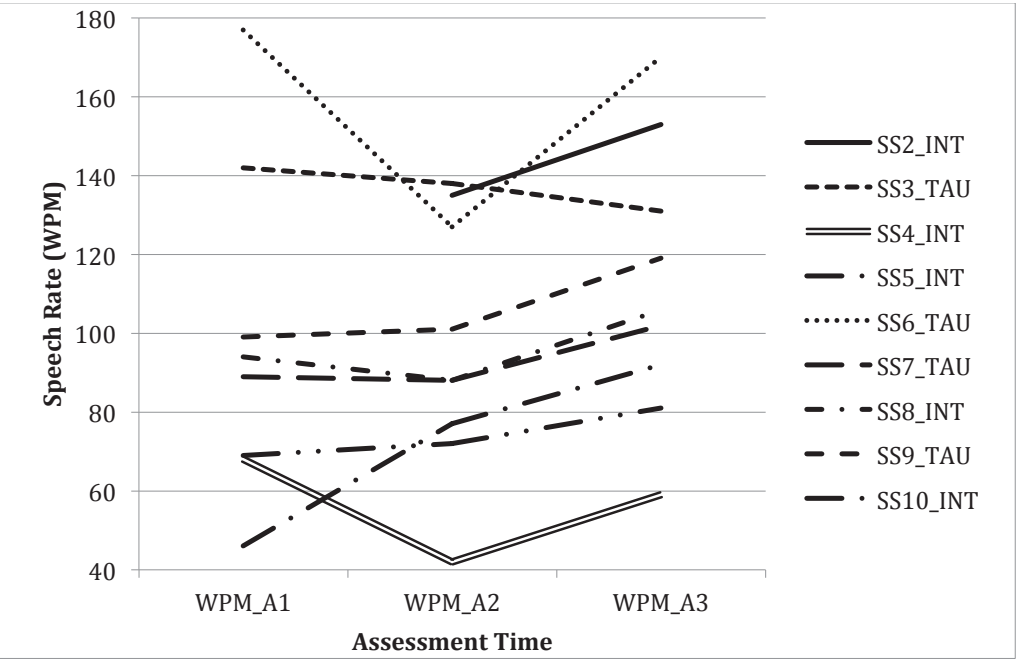


Figure 6. Individual stroke survivor speech rate (WPM) scores across time.

As shown in Figure 6, variation between stroke survivors was noted, with some stroke survivors demonstrating an increase or a decrease in speech rate over time.

Timed Water Swallow Test. The main effect for time ($n=10$) was significant $F(2,16)= 12.654$, $p=0.01$, partial $\eta^2 = 0.613$ with water swallow speed levels at A3 ($M=12.53$, $SD=9.97$) significantly higher than at A1 ($M=8.41$, $SD=7.44$) (see Figure 7). The difference between scores at A1 and A2 ($M= 10.35$, $SD=8.50$), and from A2 to A3 was not statistically significant. The main effect for type of intervention (TAU $n=5$; INT $n=5$) was not significant, $F(1, 8)= 1.299$, $p= 0.287$, partial $\eta^2=0.140$. The interaction effect between time and intervention was not significant, $F(2, 16)= 1.757$, $p=0.204$, partial $\eta^2=0.180$.

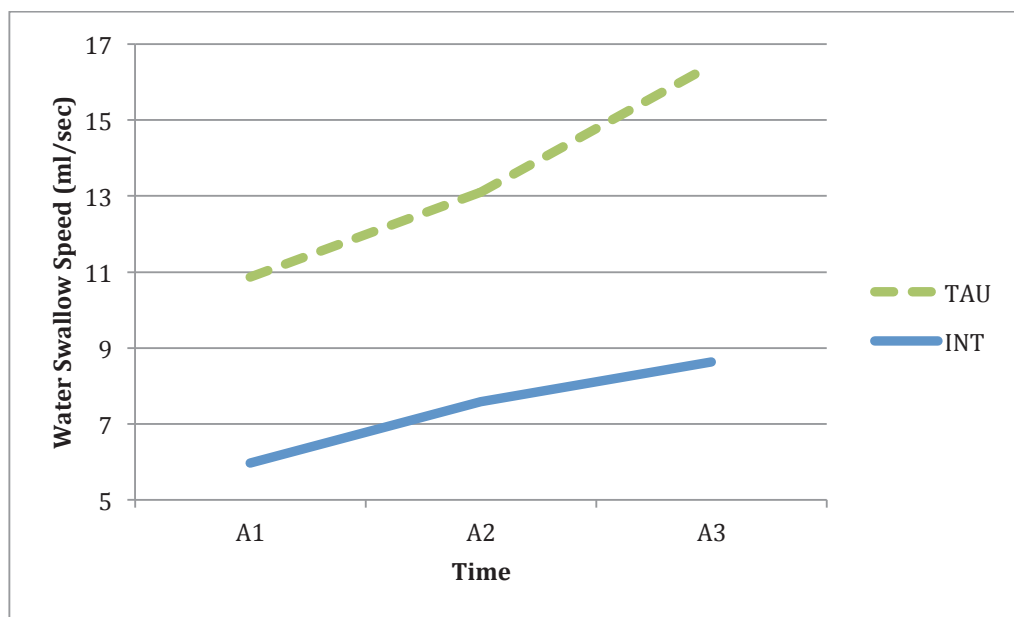


Figure 7. Timed water swallow test (TWST) scores (ml/sec) across time.

As shown in Figure 7, a general treatment effect was found for water swallow speeds from before treatment to two months after treatment but with no difference found between INT and TAU groups.

Chewed Cookie Test. For the CCT, the Shapiro-Wilk, Fmax and Mauchly's test assumptions were violated. Therefore, the CCT was analysed with a 2x2 mixed model ANOVA with the degrees of freedom adjusted by multiplying with the Huynh-Feldt Epsilon.

The main effect for time (n=10) was significant $F(1.30, 10.41)=6.510$, $p=.022$, partial $\eta^2=.449$ (see Figure 8). Using a Bonferroni adjustment, follow-up pairwise comparisons did not find a significant effect between assessment points. A Fisher's Least Significant Difference (LSD) comparison detected an effect with CCT at A2 (M=29.00, SD= 1.41) and A3 (M=28.30, SD=2.41) significantly higher than A1 (M=23.90, SD=6.90). The difference between the CCT scores at A2 and A3 was not statistically significant. The main effect for type of intervention (TAU n=5; INT n=5) [$F(1,8)=1.076$, $p=.330$, partial $\eta^2=.119$] and interaction effect between time and intervention [$F(1.30, 10.41)=.991$, $p=.367$, partial $\eta^2=.110$] were not significant.

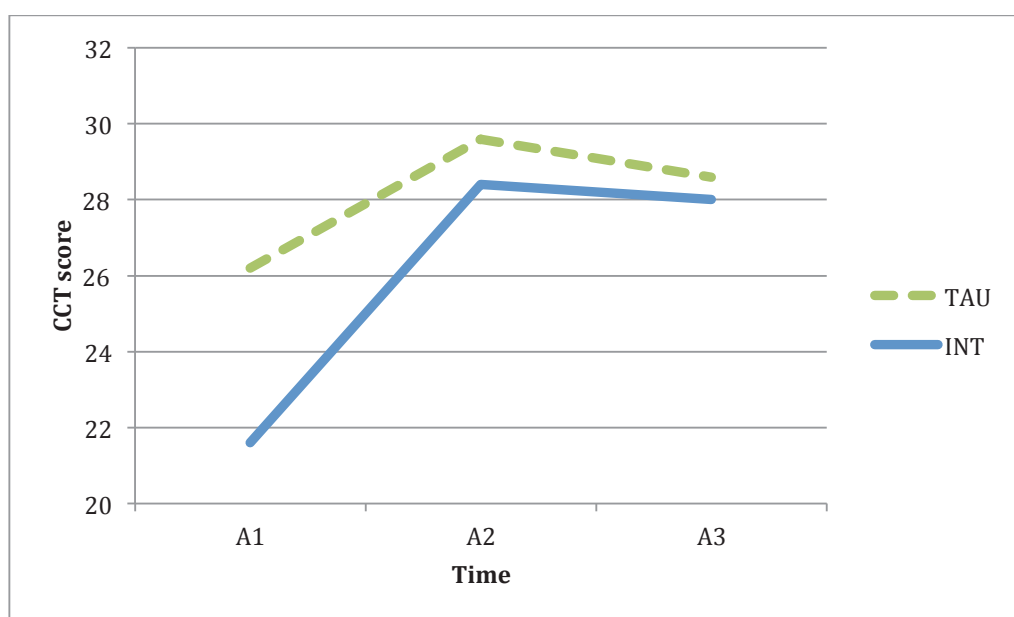


Figure 8. Chewed cookie test (CCT) scores across time.

As shown in Figure 8, a general treatment effect was found for the chewed cookie

test immediately after treatment but with no difference found between INT and TAU groups.

In summary, there was a statistically significant change in DIP, OMF, SPINT, TWST and CCT scores over time but the change in WPM was not statistically significant. Other than speech rate (WPM), the differences in speech and swallowing scores for the INT and TAU groups were not significant. This between-group difference in speech rate, without any interaction in speech rate and time, is accounted for by the initial difference between groups at baseline, as the TAU group spoke at a faster rate than the INT group prior to therapy.

Perceptions, Experiences and Preferences of the Stroke Survivors

The stroke survivor questionnaires were used to gather information on the perceptions, experiences and preferences of the stroke survivors as they related to RITH SP. This data are reported below with the responses from the questionnaire grouped to address the research questions. As such the responses do not follow the order of the questionnaire.

Perceptions of speech and swallowing outcomes. Stroke survivors were asked specifically if their speech and/or swallowing had improved and to what extent in Questions 4a and 4b. However, other questions spontaneously elicited responses that were relevant to this area and so these are also noted below.

Speech outcomes. All stroke survivors reported the treatment program had helped their speech and reported an improvement in their speech, categorising their speech post treatment as “better”, “clearer” and “improved”. Stroke survivors were then asked to rate the level of improvement of their speech on a trichotomous scale comprising a choice of small, medium or large change (see Figure 9). From the INT

group, 2/5 reported a medium level of change and 3/5 reported a large level of change in their speech. In contrast, the TAU group had 1/5 report a small change, 3/5 a medium level of change and 1/5 a large level of change.

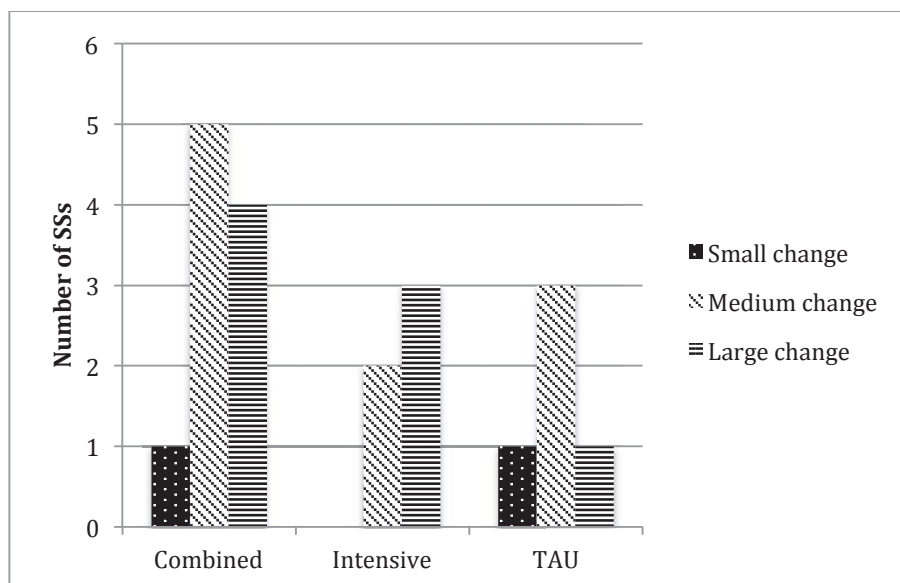


Figure 9. Stroke survivor reported level of speech improvement.

As shown in Figure 9, the INT group had more positive perceptions of the magnitude of speech improvement than the TAU group.

One SS implied that post-treatment improvements in her speech had led to improvements in her confidence. SS2 (INT) stated “I was only about 2 (rating of confidence out of 10) at the start of the program. I wasn't confident because I couldn't speak properly. I was quite confident at the end of the program”. SS10 valued the feedback from a family member when answering Question 2 “My wife says it has worked”.

One stroke survivor reported his changing priorities over the course of treatment, which were linked to the noticeable changes in his speech:

SS3 (TAU): at the start I wanted to work on my arm. Now I am frustrated with my arm and have been quite keen to do the speech. It has been better than OT because I am making gains. Improvement can be seen (in the speech).

Swallowing outcomes. Half of the stroke survivors reported their swallowing had improved (SS2, SS5, SS7, SS8, SS9) and two reported (SS3, SS6) their swallowing had not improved. SS10 reported that his swallowing remained unchanged as it was “normal” to begin with, despite the speech pathologist diagnosing dysphagia at A1. One stroke survivor (SS4) was unsure if swallowing had improved and SS1 did not comment on swallowing. For those five stroke survivors who reported an improvement in their swallowing, three were from the intensive group and two were from the TAU group. When asked to rate the level of improvement in their swallowing from a choice of small, medium or large change, four of the five provided a rating. As shown in Figure 10, four stroke survivors rated their swallowing to have had a small or medium change. No stroke survivor reported a large improvement in swallowing and two stroke survivors indicated that their swallowing was not back to normal and that their “swallowing needs more work” (SS2). One stroke survivor (SS8) indicated that improvements in her swallowing had occurred “towards the end” of the program.

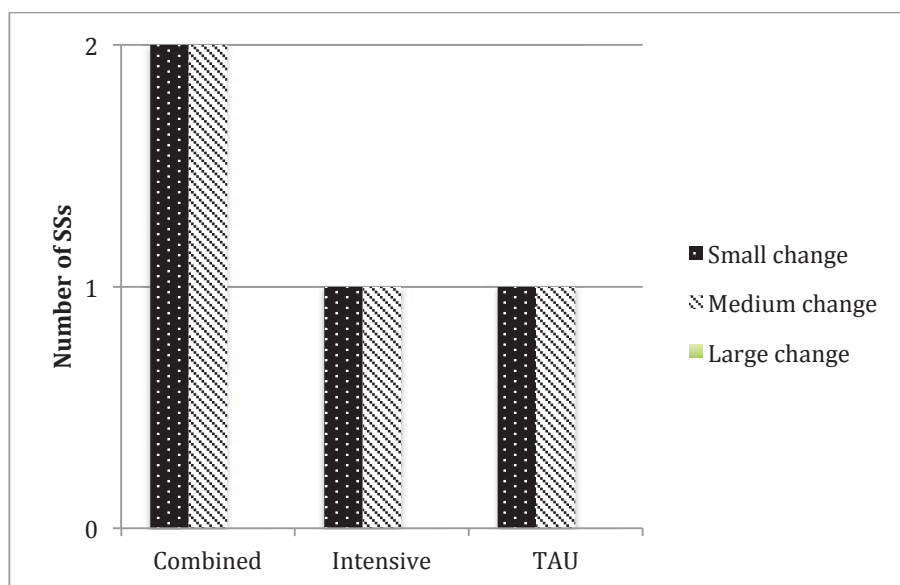


Figure 10. Stroke survivor reported level of swallowing improvement.

In summary, all stroke survivors reported positively on speech related outcomes but only half reported improvements in swallowing. Stroke survivors from the INT group more frequently reported a large magnitude of change in their speech and the TAU group more frequently reported a medium magnitude of change to their speech.

Confidence with RITH SP. Stroke survivors were asked to rate their confidence when participating in the speech pathology treatment program. Stroke survivors were asked to provide a rating on a Likert scale with demarcations from 0-10 indicating a rating of “No Confidence” to “Highly Confident”. Overall, the combined stroke survivors (N=10) were confident with mean score of 8.8 (0= No confidence, 10= Highly confident) with a range of scores from 8-10. For the stroke survivors (N=5) who participated in the TAU group, the mean score was 8.6 (range 8-10) and the most frequently reported response was 8. For the stroke survivors (N=5) who participated in the INT group, the mean score was 9 (range 8-10) and the most frequently reported responses were 8 and 10.

Experiences with RITH SP. Questions 2 and 3 asked stroke survivors to discuss the elements of the RITH SP program they found helpful and unhelpful. Stroke survivors who received therapy from a therapy assistant additionally reported on working with therapy assistants through Questions 9 and 10.

Responses were grouped into three categories, reflecting the individuals' attitudes towards the: speech pathology intervention program (including home practice), staff and setting of therapy. These categories are summarised in Figure 11 and the results are outlined below.

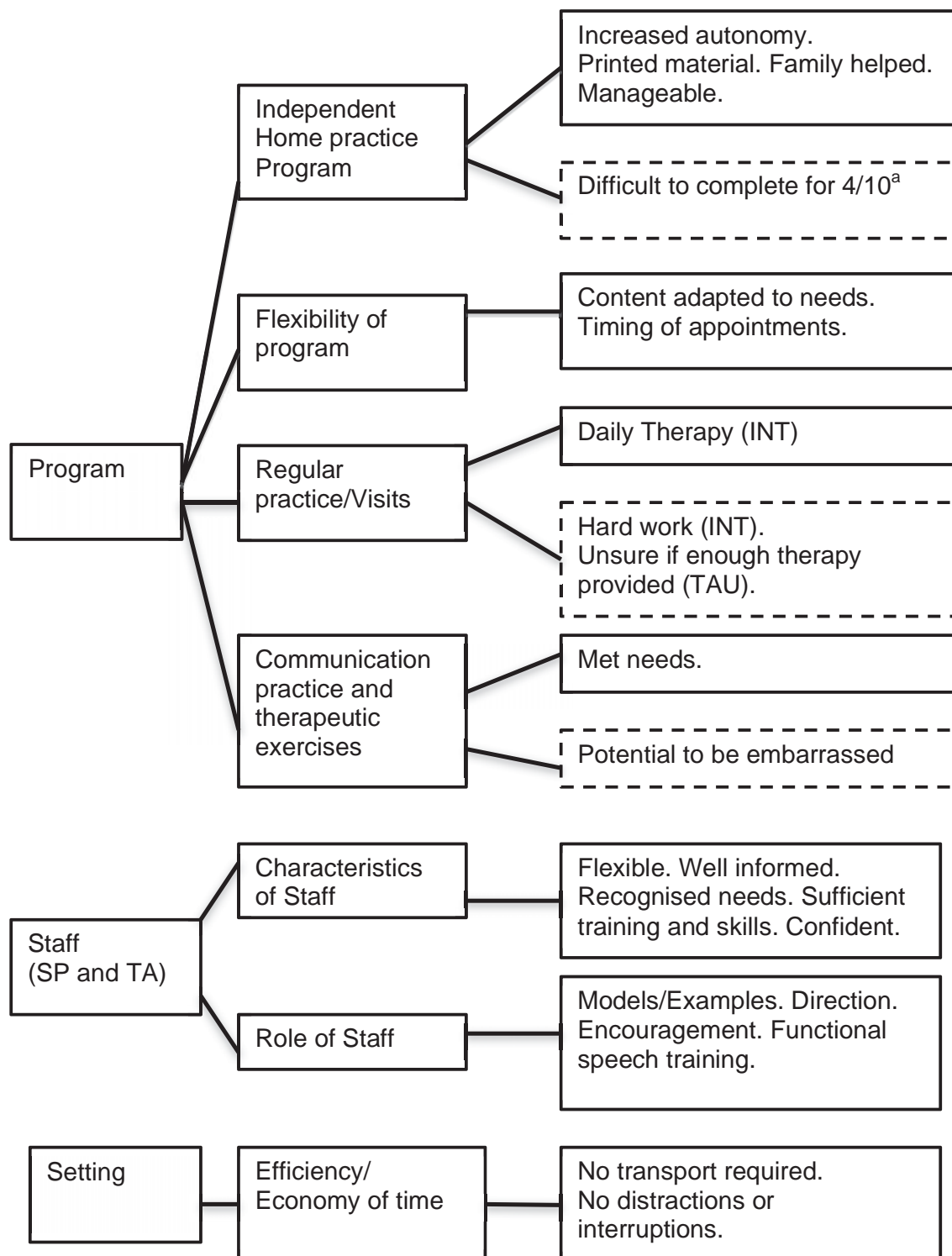


Figure 11. Stroke Survivor Experiences with RITH SP.

Note. ^a Negative aspects reported have a dashed line.

Attitudes towards the program. Communication practice and therapeutic exercises were the most mentioned benefits of the program (Question 2). SS2 mentioned dysarthria exercises were helpful but potentially embarrassing “saying the sounds seems silly but it does help later”. SS10 stated that it was helpful to “practise talking”, SS9 liked the facial exercises and SS6 felt that exercises were given “to meet my needs”. Participants did not identify any elements of the program that were not helpful (Question 3).

Four stroke survivors (SS5, SS7, SS8 and SS10) specifically commented on the regularity of the home visits (in Question 2) as being a helpful part of the program. In particular, stroke survivors from the INT group, reported positively on the availability of daily therapy. They commented that they; “liked daily therapy” with the TA (SS5), appreciated being offered daily therapy (SS10) and that “daily sessions made me get up and go and get out of bed (SS2)”.

No stroke survivors agreed with Question 5 that asked if the treatment program was too long or too intensive but SS8 (INT) alluded to the personal motivation and effort required to participate in daily therapy: “I wanted to get well quicker but it was quite a lot of hard work. It was just about right. It was quite a lot of motivation. It was pretty hard going”.

The TAU participants stated that “you need a certain amount of intensity to improve” (SS7) but that three weeks of RITH therapy “is adequate” (SS6). SS3 reported that it was not too long or intensive and that he could see the results of therapy. However, one stroke survivor from the TAU group commented that he was unsure if he received therapy as frequently as he needed it:

SS6: It's hard to know if frequency was enough. I don't deal with it. I don't know. Not knowing how much I need. I assume I'm relatively good to start with. Other people who are worse than me could benefit and see changes.

The flexibility of the timing of the program was also appreciated by SS8: "The program was very flexible with timing, like managing with appointments or coming earlier (INT)".

In summary, stroke survivors were confident during RITH SP and generally viewed therapy practice and activities positively despite one stroke survivor who mentioned that speech exercises could potentially be embarrassing. Intensive, regular and flexible therapy was viewed positively by the stroke survivors, with one mentioning that high personal motivation needed to complete intensive practice.

Attitudes towards home practice. Three stroke survivors (SS2, SS7 and SS8) reported the independent home exercise program was helpful (Question 2). SS7 (TAU) felt that the independent home practice program was beneficial because "I can do it in my own time. When I was in the hospital, the speech pathologist didn't give me anything to do in the meantime. It was very restrictive." This preference for increasing independence and autonomy over rehabilitation was echoed by SS8 (INT); "leaving me with exercises (was helpful) so I can practice at home". One stroke survivor (SS6) mentioned that having "printed material" to help their independent practice was helpful as it was "hard to remember it all".

Four stroke survivors (SS1, SS4, SS9, SS10) reported, in Question 8, that conducting independent home practice was difficult. For some of these individuals home practice was difficult because there was no-one to help guide them. SS4 (INT) stated "I didn't have the benefit of cues. There were times when I was struggling and

I had to override it because of my problems” (comment alluded to SS4’s verbal dyspraxia). SS9 (TAU) implied that practising independently was difficult because “It’s not the same with having someone here all the time telling you”. This was echoed by SS5 (INT), who reported difficulty with the accuracy of producing the exercises; “Some of the exercises wouldn’t come out”.

Conversely, six stroke survivors reported that independent practice was not difficult to do; with home practice deemed as necessary (SS2) “because you just have to do it” and that the exercises were “manageable” (SS3). While independent practice was not “difficult” for these stroke survivors, motivation (SS3), personal distractions (SS3) and difficulty with articulation (SS5) were mentioned as negative influences on independent practice. The assistance of a family member was deemed a positive influence by SS8 who found practice “easier to do with my son”.

In summary, stroke survivors viewed home practice as a necessary part of the program, and appreciated the individually tailored programs in a printed format. The provision of home practice programs assisted with being in control of their own rehabilitation. However, many reported difficulty practising independently and needed a family member to assist to provide feedback and increase the accuracy of their practice.

Attitudes towards staff. Four stroke survivors (SS2, SS4, SS5, SS6) mentioned the support provided by the SP and/ or the therapy assistant was a helpful part of the program (Question 2). SS4 (INT) and SS6 (TAU) mentioned the SP specifically. SS2, SS4 and SS5 from the INT group mentioned the therapy assistant specifically. SS4 felt that the speech pathologist and the therapy assistant were “well informed and recognised my needs”. SS6 (TAU) reported the SP was flexible and “appeared to adapt to my needs and bring exercises to meet my needs”.

One stroke survivor (SS5) (INT) reported that she liked the clear direction from staff and how she was “told what to do all the time”.

All stroke survivors who received TAU reported in Question 9 that doing practice with a SP was not difficult. However, the stroke survivors highlighted the importance of having home practice and ongoing feedback from the SP, including specific modeling and guidance with how to conduct exercises.

SS6: You need both SP visits and individual practice. If you gave me a set of exercises it's good to see someone explain the sounds and what you need to look for. You need to have someone to demonstrate. If you don't have someone there and if you are doing something wrong you don't know you are doing it wrong. You'd get into bad practice.

Experiences with therapy assistant led intervention. All five stroke survivors who received INT therapy reported that it was easier to practice with a TA, than practice alone. In Questions 9 and 10 the stroke survivors reported positively on their experiences with the TA.

SS2: Someone to sound off. She gave a model/examples. Very helpful.

SS4: She was a bit of a bully and she wasn't afraid to make me work hard.

There were times when I wasn't concentrating (and she made me concentrate).

SS5: She was easy-going. She pointed out, there's commas there.

SS8: Yes it was easier to practice with “Jane”. Because sometimes the words, when I had difficulty with pronunciation, I looked at her mouth.

The TA helped provide models (SS2, SS8) and examples of the exercises (SS2), direction on how to complete exercises (SS5) and engagement to concentrate and practice (SS4).

Functional speech training was mentioned positively by some stroke survivors who received intensive therapy assistant services.

SS10: She asked me about my work, the prices etc. (role play), she corrected me. We practiced on the phone. She trained me how to talk. I talk with my friends on the phone a lot.

General conversational practice was also highlighted as being beneficial by SS2; “In one session, we just talked - it was natural.”

All stroke survivors who received therapy assistant led intervention felt the therapy assistant had sufficient training and skills to help them practice their home program (Question 10). The personal skills of the therapy assistant were highlighted; “She was well equipped to handle my problems... (and) to tell me how to tackle them” (SS4). The therapy assistants were described as being flexible, able to “adapt” (SS2), had a “natural” approach (SS2), were able to provide the services required (SS4), were confident (SS5) and patient (SS5).

In summary, practising with a speech pathologist was not difficult for stroke survivors in the TAU group, with one report that a mix of independent practice and speech pathologist led practice is important. Additionally, the therapy assistant staff were viewed positively by the stroke survivors in the INT group. Therapy assistants were valued due to their flexibility, skills, confidence, patience and direction. The therapy assistant was signalled out as helping the stroke survivors engage in their practice while also providing models and examples and giving exercises that met the stroke survivors needs, including functional speech training.

Attitudes toward setting. Two stroke survivors (SS6 & SS9) noted they valued the home-based therapy setting. SS6 reported that it was “good to have it at home” with “no distractions”, “less time wasted on transport” and that he didn’t “have to worry about the therapist being called away for an emergency” and that there was “more chance of getting therapy”.

Stroke survivor preferences for therapy.

Staff. For those who received intensive therapy with a therapy assistant, four stroke survivors reported (Question 11) they were happy with the way therapy was conducted and did not feel that the program should have been delivered by a speech pathologist.

SS4 (INT): I think (the SP and the TA) were very good at applying and carrying out the program. Practically it was good and it was a friendly exchange.

SS5 (INT) reported that it was “good as it was” but also mentioned that she “would take what I am given”. One stroke survivor from the INT group (SS8) reported the program should have been conducted by a speech pathologist saying “I think ideally by the speech pathologist but given the fact because of the limited funding she (the TA) did a great job”.

Only one stroke survivor from the TAU group (SS1) indicated (Question 10) that they would like a trained therapy assistant to help with their practice. SS3 stated that he would not like a TA to help him practice and that “I would prefer the SP to do the exercises with me”.

Therapy program frequency and intensity. In an attempt to estimate the stroke survivors’ preferred treatment intensity, stroke survivors from both groups were asked how often they would have preferred to be seen by the SP immediately

after they came home in Question 6 (TAU) or Question 7 (INT). Stroke survivors were given a choice of six therapy frequency options; daily, three times a week, twice a week, once a week, fortnightly or monthly with the results outlined in Figure 12.

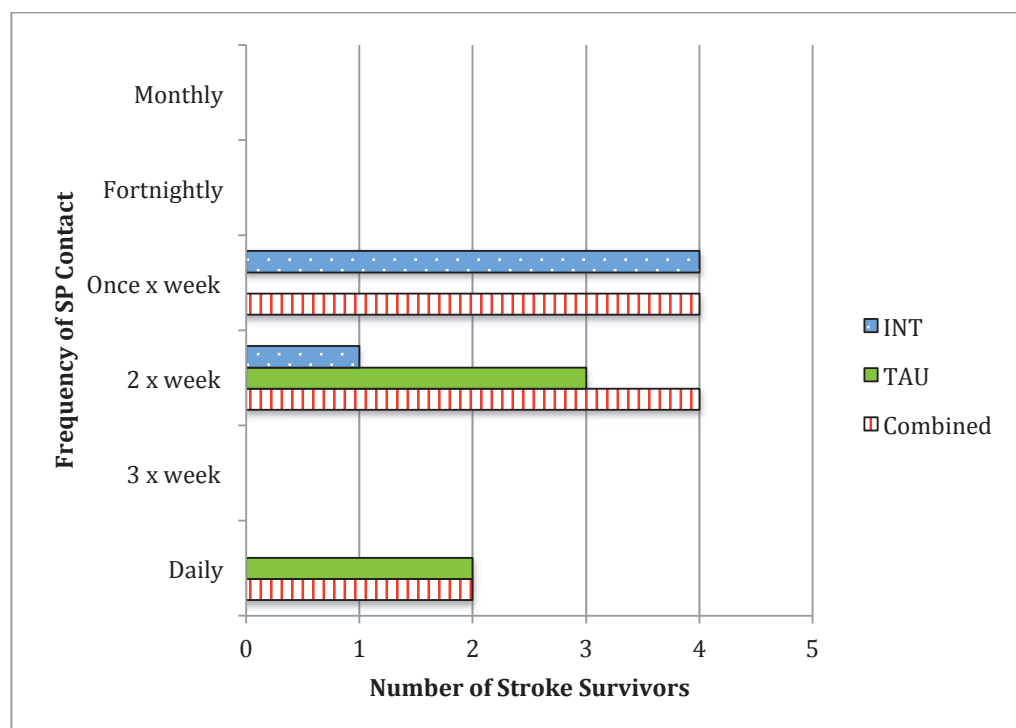


Figure 12: Preferred frequency of SP contacts.

As shown in Figure 12, the preferred frequency of SP contact was once or twice a week, followed by daily therapy. There was a difference between groups, with the TAU group preferring more frequent SP contact than the INT group.

Stroke survivors from both groups were asked in Question 11 (TAU) or Question 6 (INT) about the use and frequency of TAs. INT participants were asked how often they would have preferred to be seen by the TA. TAU participants were asked if they would have liked a trained therapy assistant (TA) help them practice

their exercises, and if so, how often they would have liked to be seen by the TA. The results are presented in Figure 13.

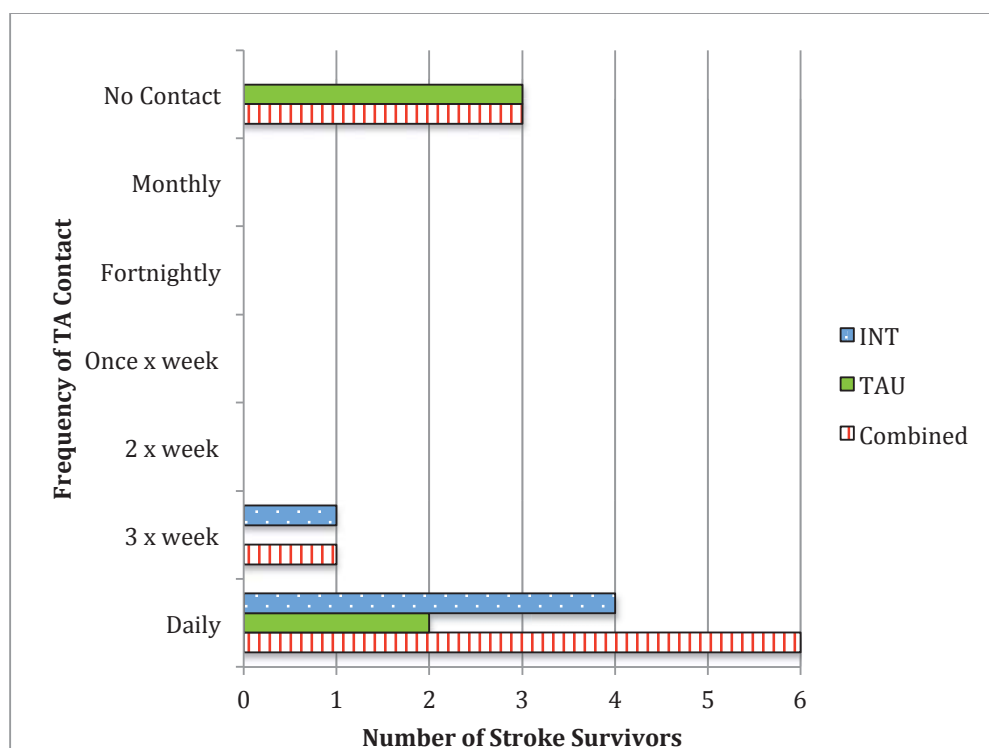


Figure 13. Preferred frequency of TA contacts.

As shown in Figure 13, the most commonly preferred frequency of TA contact was daily therapy, followed by no contact and then three times a week. There was a difference between groups, with the INT group preferring more frequent TA contact than the TAU group.

Most (4/5) INT stroke survivors (SS2, SS5, SS8 & SS10) appeared to be content with the intensity and the combination of daily TA visits and once weekly speech pathologist visits. One INT stroke survivor (SS4) preferred to see the TA three times a week with the speech pathologist once weekly. SS4 felt that he “didn’t

need it everyday” as he could do the practice himself and that there was “conflict” with other therapy appointments.

Three participants from the TAU group reported they would not have liked a therapy assistant to help them practise. Two participants (SS1 and SS3) from the TAU group reported they would have liked a therapy assistant to help them practise (Question 11) with a preference for daily therapy assistant practice. SS3 initially reported he would not like a therapy assistant to visit, but when shown the options for TA frequency on the questionnaire, changed his mind and indicated that if a TA did visit, he would prefer daily visits.

The responses were then combined; to determine the preferred frequency of overall contacts by either a SP or TA, see Figure 14.

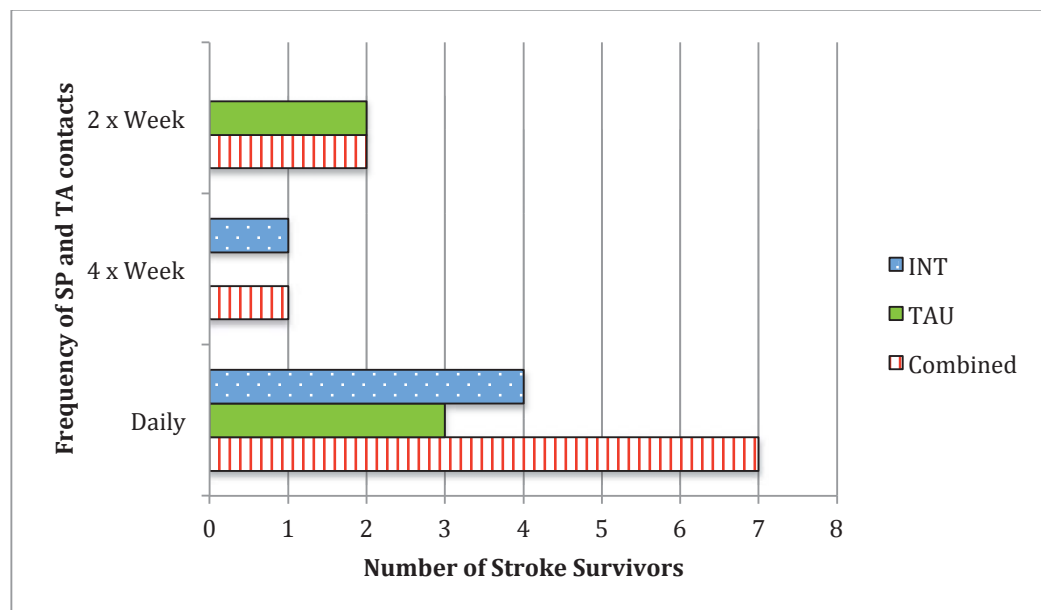


Figure 14. Preferred total number of contacts (by a SP and TA).

Note. Maximum number of contacts calculated to be “daily”.

As shown in Figure 14, the most commonly preferred total number of contacts was daily therapy (7/10), followed by twice a week (2/10) and four times a week (1/10).

There was a difference between groups, with the INT group preferring more frequent total number of contacts than the TAU group. The preferences of the INT group ranged from four times a week to daily therapy. The TAU group ranged from twice a week to daily therapy.

In summary, the stroke survivors who received therapy from a therapy assistant were more inclined to want to use a therapy assistant to help with their practice. Stroke survivors, who received TAU, were more cautious. Daily therapy was viewed positively by most stroke survivors with 80% wanting four or more SP and/or TA contacts per week. Some stroke survivors were aware of external budgetary constraints on the provision of intensive services and one reported the personal impact of having intensive therapy and multiple appointments.

Perceptions, Experiences and Preferences of the Carers

Carers completed a questionnaire, which investigated the carers perceptions, experiences and preferences with RITH SP, including the role of the carers in therapy.

Perceptions of stroke survivor outcomes. All carers reported an improvement in the stroke survivor's speech/swallowing in response to Question 1. Five carers reported a medium amount of change (C1, C2, C4, C9, C10; 2/5 TAU group and 3/5 INT group) and five reported a large amount of change (C3, C5, C6, C7, C8; 3/5 TAU group and 2/5 INT group).

Perceptions of the role of the carer in RITH SP. Results from Question 2 showed seven carers reported that they undertook a role in SP intervention, which included:

- a) assisting with SP exercises and clear speech strategies – (4/10; C1, C5, C6, C8);
- b) providing encouragement or reminders to complete practice - (3/10; C2, C3, C5);
- c) being present in treatment or practice sessions – (3/10; C2, C8, C7); and,
- d) learning strategies from the SP – (1/10; C2).

C2 felt that it was “vital” to be “present” at professionally led therapy sessions and that her role included “listening to” and “learning strategies” which helped C2 “encourage and motivate” her mother to complete independent practice.

Two carers (C9, C10) didn’t report a role in therapy and C4 reported they did “very little” as SS4 didn’t “want to be corrected by” C4. C7 was included in the “being present” category (in Figure 15 below) but her involvement was limited and she reported that she “just looked on”.

Further analysis of responses to other questions across the carer questionnaire revealed that despite only seven carers explicitly acknowledging a “role” in therapy in response to Question 2, eight carers were actually involved in RITH SP. This additional information on carers’ roles is presented in Figure 15.

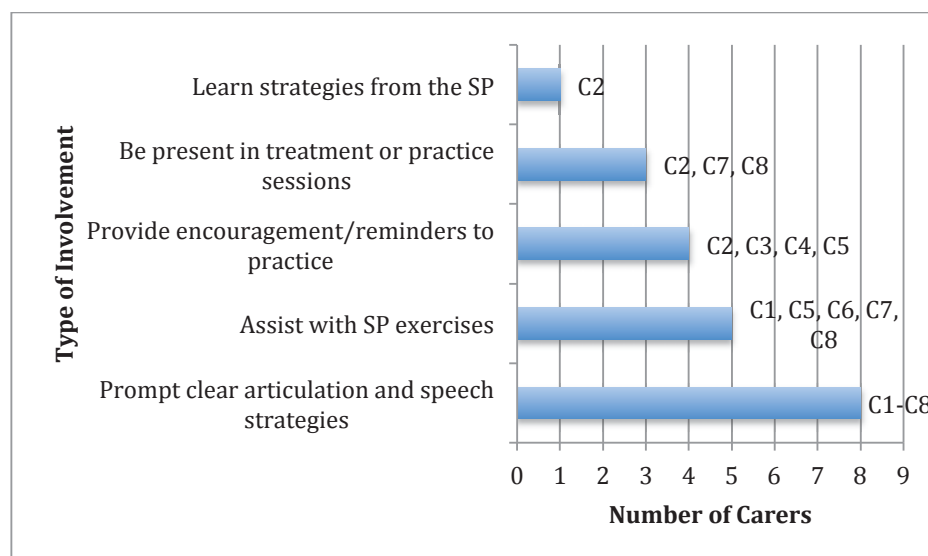


Figure 15. Carer involvement in RITH SP.

As shown in Figure 15, further analysis of the questionnaire revealed that eight carers were actually involved in RITH SP in a variety of ways.

When comparing the roles of carers from the two groups, carers from both the TAU and INT groups reported providing prompts for clear speech. More TAU carers reported that they assisted with SP exercises (C1, C6 & C7) than the INT carers (C5 and C8). More carers of INT group stroke survivors (C2, C4 & C5) reported that they provided encouragement and reminders to practise than the carers of TAU stroke survivors (C3). INT carers also reported more frequently that they were present in treatment or practice sessions and that they learned strategies from the SP (C2).

Carer assistance with home practice. All 10 stroke survivors completed a dysarthria and dysphagia home practice program. Eight carers reported, in response to Question 3, that they helped the stroke survivor complete their home practice. Carers helped in a variety of ways with the responses grouped into the following categories;

1. Supporting specific and active practice of exercises and providing a reminder of strategies and techniques including demonstration and correction of exercises (5/10; C1, C5, C6, C7, C8 – 3/5 TAU and 2/5 INT).
2. Providing praise and encouragement (2/10; C3, C4 -TAU and INT).
3. Prompting the stroke survivor to carry out home practice (1/10; C2 – INT).

Carers in the TAU group more often reported that they actively assisted with home practice. Carers in the INT group more often reported that they provided reminders to practice.

Use and promotion of dysarthria strategies. In response to Question 3, eight carers (C1-C8) reported that they reminded the stroke survivor to use their dysarthria strategies. The strategies that carers reported using most often were to a) decrease their speech rate, b) repeat themselves and c) take a deep breath. C4 reported: "I would say "stop, take a deep breath and have another go". C8 reported he reminded his mother of "techniques learnt during" professionally led therapy sessions while she was completing home practice. For example he reminded his mother to use techniques "such as breathing, slowing down, thinking about what to say first and projecting her voice". One carer (C10) reported she did not have to remind the stroke survivor to use their strategies and one carer (C9) did not answer the question.

Frequency of assistance with home practice. Carers reported, in Question 3, that they helped stroke survivors complete practice regularly, however, there was variability in the frequency with which assistance was provided. The reported range of frequency was from daily to "only occasionally". For some carers, assistance depended on the needs and desires of the stroke survivor (C5: daily – "if she needed my assistance") and the availability of the carer (C7: "Whenever we could"). Two

carers (C9 & C10) reported that they did not help the stroke survivor with their practice, with C9 explaining that he was too unwell to help due to his own disability.

Carer opinions of stroke survivor home practice. Four carers (C1, C2, C4, C10; 3/4 INT and 1/4 TAU) reported, in Question 4, that the stroke survivor had difficulty practising their home program independently. One carer was unsure (C9). One stroke survivor wanted to remain independent and refused help from his carer:

C4: He preferred to practise on his own ...Is he doing it right? No-one knows.

Two carers (C1, C10) reported that it was difficult for the stroke survivor to practise on their own because of their limited English literacy skills. C1 (with LEP) helped her grandmother (with LEP) complete home practice;

C1: I tell her how to do the words. I teach her the words and I tell her how to say them properly.

One carer reported that although it was not difficult for SS5 to practise independently, her mother had different priorities.

C5: Sometimes depending on how many visitors came and if she felt tired. I felt neighbours and visitors very helpful and important to Mum.

When compared to the stroke survivor results, there was general agreement between the stroke survivor and carer reports of difficulty/ease of home practice. C1, C2, C4 and C10 reported that their family member had difficulty completing practice. C9 reported that he did not know if it was difficult for his wife to complete her practice. Interestingly, C2 felt that it was difficult for her mother to practise on her own, but SS2 commented that it wasn't difficult "because you just have to do it."

Five carers (C1, C3, C4, C5, C9) reported in Question 5 that the stroke survivor found recording home practice difficult. Reasons provided for this difficulty included a hemiparesis of the arm (2/10; C4 and C9) or fatigue (1/10; C5). Five

carers reported the stroke survivors did not experience difficulty recording their home practice (C2, C6, C7, C8, C10). C2 reported that SS2 didn't "show" or "include" her in the home practice or recording home practice.

Other caring and therapeutic activities. Five carers (C1, C2, C3, C4, C5) reported in Question 6 that they were involved with other caring and therapeutic activities. Responses were grouped into two categories. Carers assisted with physical exercises (4/10; C2, C3, C4, C5) or activities of daily living including personal activities (2/10; C1, C4).

C4: Transfer practice, walking... butter bread... stack cups. He was going all day long.

One carer also assisted with aphasia therapy (C8). The responses from Question 6 are summarised in Figure 16.

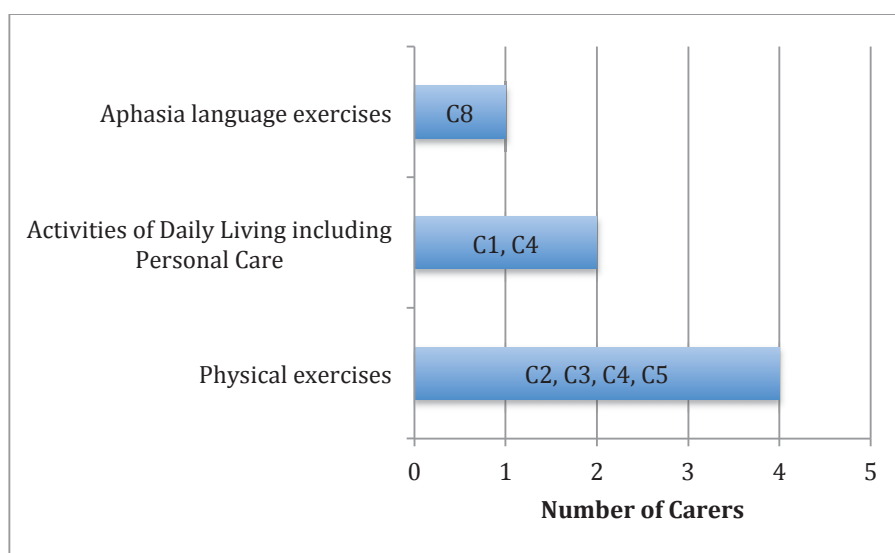


Figure 16. Carer assistance with other activities and exercises.

As shown in Figure 16, apart from assisting with dysarthria and dysphagia therapy exercises, six carers also assisted with other therapeutic, care and/or speech pathology activities.

Carer experiences and preferences for RITH SP. Carers provided reports of their experiences and preferences with RITH SP in Questions 7 and 8 of the carer questionnaire.

Experiences with RITH SP; staff and program structure. Comments about the RITH SP program that related to the staff and the program structure were made in response to Questions 7 and 8. All 10 carers reported that RITH SP services had been helpful. C2 reported that she rated the service “100 out of 10” and that it had been a “fantastic opportunity”. C2 also reported “If I could have paid for it I would have”. The carers reported a range of benefits of the RITH SP program. The skills and support from RITH SP and therapy assistant staff (3/10; C2, C5 and C8) and having the same staff attend was valued (C2). C8 provided a comprehensive summary of the program’s structure and experiences with the staff; “Many useful exercises and a structured program with excellent teaching and support by both the SP and assistant”. The program’s structure, regularity and frequency of appointments (2/10; C8 and C4) were reported as helpful, as was someone “external” to the family being available to provide assistance (C5).

RITH SP was deemed a “more personal service” (C7) and appeared to impact on the SSs. For example, RITH SP helped to build self-confidence in the stroke survivor (2/10; C3 and C7). C8 (INT) also implied that the daily sessions influenced the SS8’s motivation: “Regular sessions also helped with motivation”.

Experiences with and preferences for therapy setting. Many of the reported benefits of RITH SP were related to the home-based setting. The most commonly reported (5/10; C1, C2, C4, C7, C10) benefit in Question 7 was the home-based setting with a reduced need to travel;

C2: Even getting her to the physio pool is difficult.

C4: He wasn't fit enough for in and out of the car.

The home-based setting was more "relaxed" (4/10; C4, C6, C7, C10), provided security (1/10; C4) and prevented "embarrassment" when practising vocal exercises (1/10; C6). One carer (C7) reported that there were no interruptions or waiting in the home setting.

When asked specifically about preferences in Question 8, nine of the carers preferred to have therapy in their home. Hospital-based services were reported as being inhibitory by C2: "I don't think mentally she would have coped at (in-patient rehabilitation ward). It is like containing a wild person to her bed; being a woman that is as capable as she was".

One carer (C4) mentioned that because of the setting, she had respite from caring during SP intervention. "You have to be there for the whole time as they (PT and OT) want to talk to you. I couldn't leave him with OT and physio but I could with speech pathology".

C1 implied the setting was helpful for her grandmother, who may have had difficulty accessing the hospital due to her limited English proficiency (LEP); "It's helpful. She doesn't know how to go there (to the hospital) it is hard. (RITH) is easier for her. It's good for her".

C1 reported that home-based therapy was beneficial at a certain stage in the recovery process. "(RITH was) Good for her (at home). Now it is good for her to get out the house... Good for her to go out now (to hospital out-patient SP appointments)".

Although preferring home visiting to hospital treatment, C4 reported some negatives, including losing "control" over her home, other RITH staff (OT and PT) intruding on the carer's space, expecting and not receiving respite from other RITH

staff and having to be available to assist other RITH staff in therapy sessions. This carer reported that she needed to provide extensive care for her husband and that it was a steep “learning curve”. She also reported that in general, RITH services were not long enough with a lack of “handover”.

Despite reporting that home-based therapy was “hassle-free”, one carer (C3; TAU) was unsure if she preferred home-based therapy; “I don’t think it makes that much difference. It was great ‘cos we didn’t have to get in the car and go anywhere. I wouldn’t have liked to go to (acute hospital) and (rehabilitation hospital) was too far”.

Summary of Results

Prior to the commencement of RITH SP, stroke survivors across both groups were similar in age, stroke severity and most speech and swallowing outcomes measures. The exception was speech rate, as the TAU group had an initial speaking rate that was faster than the INT group. All stroke survivors were able to complete regular home practice with the INT group receiving more professionally led therapy time (by a SP or a TA) than the TAU group. There was a statistically significant change in DIP, OMF, SPINT, TWST and CCT scores over time but with no change in speech rate. The differences in outcomes between the two groups were not statistically significant.

All stroke survivors reported an improvement in their speech and/or swallowing. Stroke survivors from both groups were confident during therapy and provided positive comments about the program, staff and setting. Regular and intensive therapy was viewed positively as was having a therapy and a home program that met their needs. Intensive therapy and regular home practice were deemed to require significant personal effort and motivation but was generally seen

as necessary and beneficial. The support from the SP, TA and/or family in increasing the accuracy of practice was regarded as important, as practising alone was difficult for some. Staff (SP and TA) that were flexible, well informed, recognised and met the needs of the stroke survivors were valued.

Therapy assistants were seen as being well trained with sufficient skill and were positively singled out as being the staff member who provided direction, functional speech training and conversational practice. The stroke survivors who received therapy from a therapy assistant were more inclined to prefer to have therapy from a TA while the SSs who received TAU were more cautious. Daily therapy was preferred by most with 80% of stroke survivors wanting four or more SP/TA contacts per week.

Most carers were involved in speech pathology rehabilitation in the home in a supportive and enabling role. They found the services beneficial and preferable to hospital appointments. However, the impact of limited English proficiency and intensive home-based rehabilitation was raised by some carers. There were small differences in the role of the TAU carers and INT carers; with more TAU carers reporting that they assisted with home practice and more INT carers reporting that they provided encouragement and reminders to practice. Additionally, small differences between groups provide some indication that INT carers also perceived a larger magnitude of change in the stroke survivor's speech/swallowing skills.

Discussion

This exploratory study is one of the first to investigate and document details of a speech pathology intervention program provided as Rehabilitation in the Home (RITH) for two service delivery models: treatment as usual provided by a speech pathologist and intensive treatment with a speech pathologist and therapy assistant. While involving small numbers of participants, it examined the issues of feasibility, effectiveness and acceptability to stroke survivors and their families.

Overall the study found stroke survivors were able to tolerate regular and intensive professionally led speech pathology intervention in the home for management of dysarthria and dysphagia immediately post discharge from hospital after stroke. These stroke survivors were also able to complete regular home practice. There were significant improvements in both disorders across all 10 participants, although no differences between groups were found. In addition, both stroke survivors and carers reported perceived benefits from receiving rehabilitation in the home setting with positive comments from carers and stroke survivors on the program, therapy effectiveness and location of therapy.

This chapter addresses the three research questions;

1. Is a speech pathology RITH intervention program, supplemented with a home practice program:
 - a. feasible; and,
 - b. are improvements demonstrated in dysphagia and dysarthria for the combined group of stroke survivors?

2. Is there any difference in outcomes of a speech pathologist-only led treatment program (TAU) vs. an intensive speech pathologist and therapy assistant practice regime (INT)?
3. What are the perceptions, experiences and preferences of:
 - e) the stroke survivors; and,
 - f) the carers involved in RITH speech pathology rehabilitation?

Traditional Speech Pathology Intervention Program: Effects on Dysphagia and Dysarthria Outcome Measures.

This section discusses feasibility (as measured through compliance with therapy), dysarthria and dysphagia outcomes and the maintenance of skills after RITH SP for the combined group of 10 stroke survivors.

Therapy feasibility. This study provides detailed information on the amount and frequency of SP intervention tolerated by this sample of stroke survivors in the RITH context. It suggests that RITH is indeed a viable treatment option for dysarthria and dysphagia post-stroke. This study also outlines the components of such an intervention and the benefits of it. However, there was some variation in compliance for different aspects of the program.

Stroke survivors were able to participate in regular therapy, with the intensive group undertaking therapy up to five days per week for the first three weeks post hospital discharge. As noted in the results, all INT stroke survivors completed between 13 to 15 sessions with a therapy assistant plus weekly speech pathologist visits over the intervention period with an average of 5.05 hours of professionally led therapy per week. For the stroke survivors in the TAU groups, all stroke survivors were able to meet the recommended minimum number of sessions per week (two

speech pathologist sessions per week). The TAU group had an average of eight visits with a speech pathologist over the intervention period with an average of 2.61 hours of professionally led therapy per week. While some stroke survivors reported the INT therapy regime coupled with the independent home program was “hard work” and that “motivation” was required, other participants appeared to realise that a “certain amount of intensity” was required to improve.

In regards to professionally led therapy time (therapy delivered by either a TA or SP), as expected, the INT group received on average 439 more minutes than the treatment as usual group. The TAU group received an average of 470 minutes of speech and/or swallowing intervention over three weeks. This equates to 2.61 hours of therapy per week. The TAU group dosage is under the recommended level of 45 minutes of daily therapy provided by each discipline as outlined by the UK National Clinical Stroke Guidelines (Intercollegiate Stroke Working Party, 2012). Additionally, it does not reach the ‘threshold’ of three hours or more of therapy a week for aphasia (Bhogal et al., 2003).

For total therapy time delivered by a speech pathologist, the TAU group received significantly more minutes. Although the INT group had reduced overall direct speech pathologist contact, when combined with the TA therapy time, the INT group did surpass the recommended ‘threshold’ for practice. The INT group received an average of 909 minutes of both TA and SP time over three weeks or 5.05 hours of TA and SP therapy per week.

Professionally led intervention time was controlled between and within groups, however there was also variation, largely due to allowances for the stroke survivor to refuse or cancel treatment sessions. The usual treatment group received 375 - 605 minutes of professionally led therapy, whereas the intensive group received 695-

1140 minutes of therapy. This may give some indication of the large individual variation between stroke survivors, including variations in their health, motivation for therapy, need for other health professionals and their own personal circumstances.

These findings provide novel evidence that stroke survivors are able to tolerate intensive dysarthria and/or dysphagia management in the home environment, despite their early stage post-stroke and with concurrent provision of other therapies from allied health professionals. Additionally, the reported use of therapy assistants to enable the increased intensity of treatment is novel within the RITH context. This study demonstrates that within RITH SP, it is feasible to increase professionally led therapy time with a therapy assistant and that this is a viable option to meet recommended levels of rehabilitation and practice. Also, this study demonstrates that using a TA to assist in reducing the workload of speech pathologists is feasible in the RITH environment with stroke survivors.

Independent home practice compliance and feasibility. There is very little published literature on the amount of speech pathology home practice adult stroke survivors are able to complete. In this study, there was wide variation in the amount of home practice completed by the 10 stroke survivors. Only 20% of stroke survivors in this study were able to complete the recommended 15 minutes of daily home practice despite 80% of carers assisting with home practice. This varies from previous studies (Manheim et al., 2009; Robertson, 2001) who reported much higher compliance, with the latter reporting 65% compliance of 30 minutes per day with aphasia home practice. However, the participants of this previous research received different amounts of speech pathology contact, were past the acute phase and were only receiving therapy from a single profession. Additionally, the stroke survivors in this study had therapy in a different setting at a different time point: i.e. adjusting to

their 'new' situation post-stroke while receiving intensive home-based multi-disciplinary therapies. This may indicate that the setting and timing of intervention in particular may impact on the amount and frequency of independent practice.

There was no significant difference between the two groups in relation to the amount of home practice completed. This data provides initial evidence that home-based stroke survivors, even when given intensive daily SP visits, are able to tolerate some degree of home practice outside professionally led therapy time. It is of interest that there were no differences between groups and that a) daily therapy did not encourage the INT stroke survivors to practise less on their own, and b) receiving less therapy did not encourage the stroke survivors in the treatment as usual group to practise more. Regardless of service delivery type, the stroke survivors indicated a motivation to practise beyond the provided level of intervention.

In summary, the stroke survivors in this study were able to participate in both intensive and treatment as usual speech pathology treatment regimes, including home practice, in the home in the early days post-stroke. While stroke survivors may find intensive SP therapy difficult, the use of a therapy assistant to increase practise opportunities appears to be feasible.

Treatment Effectiveness.

Stroke survivor dysarthria outcomes. A statistically significant improvement from baseline to immediately post-therapy was noted in both the Oral Motor Function (OMF) and the Speech Intelligibility (SPINT) measures for the 10 stroke survivors. Furthermore, all stroke survivors and carers reported in the questionnaires improved speech after RITH SP.

With no control group used and spontaneous recovery not accounted for, care must be taken when interpreting the results. The OMF includes ratings of parameters

at rest, isolated movements (lip spread), single repetitive and alternating syllables (“puh puh puh” or “ka la”) and ratings of loaded alliterative sentences (“Kenneth’s dog took ten tiny ducks today”). The OMF rates the lips, palate, larynx and tongue, and also contains ratings on respiration and reflexes such as cough, swallow and drooling. The positive effect found in this study may simply indicate faster, stronger, more symmetrical and/or more coordinated isolated movements or reflexes.

Changes in OMF may not be indicative of gross changes to connected speech (or swallowing) as a whole, therefore it is critical to look at connected speech measures concurrently, such as speech intelligibility.

The Speech Intelligibility (SPINT) outcome measure indicated that there was a statistically significant improvement over the intervention period. The FDA-II rates integrated movements for speech and incorporates single word, sentence and conversation ratings of intelligibility. The treatment hierarchy used in this program intervened in a progressively challenging systematic order (single sounds through to conversation practice), and targeted multiple-systems and speech intelligibility across words, sentences and conversation. Some previous reports of traditional dysarthria interventions have shown great variability between participants (Mackenzie & Lowit, 2007) or have failed to show a statistically significant effect (Mackenzie, Muir, et al., 2012) on speech intelligibility measures. In contrast, in this study, there was a statistically significant improvement in speech intelligibility over the intervention period, which may indicate that this intervention program of RITH SP had a more consistent impact on post-stroke speech intelligibility. Hence, the nature of the therapy in this study, with a systematic progression of interventions, which incorporate conversational practice, could have resulted in a more consistent functional outcome.

There is a noted research gap in dysarthria intervention studies, and the speech outcomes reported here add to the existing small number of published case studies and small group intervention studies, which promote the use of post-stroke dysarthria rehabilitation. The OMF and SPINT results may imply that an integrated, multi-system approach program, based on traditional evidenced-based practice, when used in RITH SP, may have a positive impact on the overall functioning of the oral motor, phonatory and respiratory motor systems for stroke survivors with dysarthria. This data adds to that provided by smaller studies (Ray, 2002; Robertson, 2001) that include oral-motor exercises, and also builds on other studies that include behavioural interventions (Lee & McCann, 2009; Mackenzie & Lowit, 2007, 2012; Mackenzie, Paton, et al., 2012; Mahler & Ramig, 2012; Tamplin, 2008).

The clinical change in rate of speech was not statistically significant with high variability between stroke survivors. Some stroke survivors had an initial decrease in speech rate whilst others had an increase. While decreased speech rate has been reported to be sensitive in indicating abnormal motor speech performance and people with dysarthria have a significantly slower speaking rate than non impaired speakers (Nishio & Niimi, 2001), speech rate should not be assessed in isolation from speech intelligibility data (Tamplin, 2008). Within this study the goal for therapy was often to increase the rate of speech without detrimentally effecting speech intelligibility.

While there were no firm rate control treatments in this study, stroke survivors were often encouraged to decrease their speech rate in an attempt to increase speech precision, as and when required. Over the course of therapy, the stroke survivors were encouraged, as able, to increase their speech rate with increasingly complex speech exercises. Also, as a compensatory strategy, some stroke survivors

were encouraged to slow down and over articulate, in challenging situations such as when reading aloud, when in high background noise environments or with complex articulatory targets. These differing goals appear to be reflected in the results, with individual stroke survivor speech rates varying over time.

In regards to the psycho-social impact of dysarthria on the stroke survivor, there was a significant reduction in Dysarthria Impact Profile scores immediately after therapy for the group of 10 stroke survivors, indicating a positive impact of therapy. While the psychological and emotional impact of dysarthria is known (S. Dickson et al., 2008), there is little published evidence (Mackenzie & Lowit, 2007) that traditional dysarthria interventions are able to ameliorate the impact of the disorder.

Having regular opportunities to practise exercises and conversation may assist in decreasing the longer-term psycho-social impact of dysarthria, either through the potential improvements in their speech, confidence and/or adjustment to dysarthria. Whether this is a true treatment effect, part of natural adjustment (Mackenzie & Lowit, 2007) or as a result of the support and skills of RITH staff, is unclear. As the impact of traditional dysarthria therapies on psycho-social impact of dysarthria is not known, further investigation and comparison of different therapies in different settings is warranted.

Stroke survivor dysphagia outcomes. There was a statistically significant change in Chewed Cookie Test (CCT) scores between assessment one and assessment two indicating a reduction in oral-stage dysphagia immediately after RITH SP. This therapy effect was of interest as there is little published data on outcomes measuring the mastication of solids alone. While the use of part of the

MASA (Mann, 2002) to subjectively measure chewing is novel, it gives ground to measure and rate mastication and swallowing of solids in isolation to fluids.

There was a statistically significant effect for the Timed Water Swallow Test with a statistically significant difference between immediately pre-therapy and two months after therapy. This may indicate a slower, longer-term effect of the intervention on timed water swallow test scores. Potentially a therapy program based on traditional oral motor therapies provided more of an immediate impact for the oral stage of swallowing (as reflected in the chewed cookie test scores) than for overall swallow efficiency for fluids. This effect may be consistent with the greater control required for fluids, which may take longer to regain. While the use of a timed water swallow test to assess swallowing has been reported in the literature (Nathadwarawala et al., 1992; Wu et al., 2004) there has been little uptake clinically. Our results demonstrate that a timed water swallow test can be used to measure swallowing efficiency of fluids across the home-based setting, where access to instrumental assessment may be difficult.

Maintenance of skill gains. The gains made over the intervention period were maintained across the two months between the end of therapy and the follow up assessment for The Dysarthria Impact Profile, Oral Motor Function, Speech Intelligibility and Chewed Cookie Test. This may indicate that the package of intervention provided within this study assisted in a short-term maintenance of skill after the completion of therapy. Although the impact and presence of spontaneous recovery cannot be accounted for, the statistically significant effect for the majority of measures over the intervention period, with maintenance of skills two months afterwards, may add support to indicate a treatment effect rather than spontaneous recovery alone.

In summary, the data from this study supports the initial reports of the effectiveness of RITH SP (Brunner et al., 2008; Holmqvist et al., 1998; Stewart, 2011a). More specifically, this study provides new information about the effectiveness of dysarthria intervention and builds on previous findings on dysphagia outcomes in RITH. In regards to dysarthria, individually tailored, multi-system interventions for dysarthria and dysphagia, coupled with functional practice, delivered in the home-based environment appears to improve oral motor function. Despite some previous dysarthria intervention studies having shown no or variable improvement on speech intelligibility measures, our results demonstrate a more consistent improvement. Although rate of speech was the only measure not to show any significant changes over time, this measure may be sensitive to the individual and their therapy program. Additionally, while natural adjustment cannot be ruled out, the home based setting with opportunities for regular communication practice may reduce the psycho-social impact of dysarthria.

In regards to dysphagia, this study demonstrates some benefit for measuring chewing skills separate to the skills involved with drinking fluids. The chewed cookie assessment data is novel and demonstrates that speech pathology interventions can target and facilitate chewing skills. However, the intervention program described here may have a more immediate impact on chewed solids with a slower, more long-term effect on water swallowing speeds.

Stroke Survivor Speech and Swallowing Outcome: Comparison of Service Delivery Models

This small group study provides initial insights into the relative effectiveness of two service delivery models: treatment as usual with therapy provided by a speech

pathologist; and, intensive therapy provided by both a speech pathologist and a therapy assistant.

Comparison of group dysarthria and dysphagia outcomes. The speech and swallowing stroke survivor outcome data indicates intensive therapy, provided by a therapy assistant, had a similar impact on and is not inferior or superior to treatment as usual for the first three weeks immediately post hospital discharge. That is, having fewer therapy sessions with a speech pathologist but more intensive treatment provided by a therapy assistant led to similar results to less intensive therapy provided by a speech pathologist.

There are potentially a number of interpretations of the lack of statistically significant differences in the dysarthria and dysphagia outcome measures between groups. Firstly, the results found here need to be considered within the context of the small sample size, which may have impacted on the lack of significant differences between the two groups. Additionally, missing data from some outcome measures (see Table 4), may also have contributed to the study lacking sufficient power to detect a statistically significant difference in outcomes between groups.

Secondly, the treatment given to the TAU group was potentially provided at a higher rate than is typical in a RITH setting due to the need to control treatment dosage across the usual treatment group. Although the TAU group received less professionally led therapy, they received more speech pathologist-led practice than the intensive group. This makes a direct comparison of the effectiveness of therapy assistants to speech pathologists difficult.

The data may indicate that therapy assistants may not be as effective as a speech pathologist in delivering RITH SP dysarthria and dysphagia interventions, requiring more visits to see the same level of therapy impact. So far, there are

positive reports with using Allied Health Assistants within dysphagia assessment (Kalapac-Trigg, 2013; Ward et al., 2012) but the effectiveness of using assistants in adult speech pathology interventions is largely unstudied. However, as Vickers (2013) suggests, higher rates of dosage of practice may not necessarily be associated with greater outcomes. Individual factors and the quality of practice may contribute more to outcomes and warrants further research.

In the paediatric education setting, speech language therapy assistants are reportedly as effective as a speech pathologist for delivering certain interventions (Boyle et al., 2007) however generic school staff are not as effective as their speech language therapy assistant counterparts (McCartney et al., 2011). The therapy assistants involved in this study were not speech pathology assistants but multi-disciplinary assistants, who delivered multi-disciplinary interventions concurrently at the same time as delivering the RITH speech pathology services reported here. Although this study in RITH SP was not designed to compare the effectiveness of therapy assistants to speech pathologists, there is a need for further research into the effectiveness of both generic therapy assistants and single discipline speech pathology assistants within adult speech pathology intervention.

Lastly, there were some differences in the characteristics between groups at baseline. The TAU group may have had less severe speech impairment at baseline as they spoke at a significantly faster rate than the intensive group. Although not statistically significant for both factors, the TAU group completed more home practice and were younger than the intensive group. Brunner et al. (2008) found that older stroke survivors had significantly less change than younger stroke survivors on the Participation Restriction and Distress/Wellbeing domains on the AusTOMS (Perry & Skeat, 2004). However, Bagg, Pombo, and Hopman (2002) report that advanced

age has no effect on functional outcomes. These factors, amount of home practice completed, age and baseline rate of speech, may have reduced the ability to detect any statistically significant differences in outcomes between groups.

Perceptions, Experiences and Preferences of the Stroke Survivors

When trialling new therapies and treatments it is important to include the participants' voice, alongside objective outcomes when determining the effectiveness of an intervention (Kovarsky, 2008). This section will discuss the perceptions, experiences and preferences of the stroke survivors of the therapy received.

Perceptions of outcomes. All stroke survivors reported positively on speech outcomes with gains made ranging from a small to a large level of improvement. This finding supports that of the quantitative data and shows the treatment effect was noted by the participants in their day-to-day communication. The stroke survivors in the INT group appeared to report a greater level of improvement in their speech compared to the TAU group. As there is no significant difference in speech and swallowing outcomes between groups, this difference may reflect subtle differences that the outcomes may not have picked up. Alternatively, this may be representative of the INT group receiving intensive therapy and having more regular positive feedback. Additionally it may be a reflection of the small group sizes impacting on results for example there may be differences in how the individuals perceived and/or responded to the question.

The perceived extent of change was less in relation to dysphagia when compared to dysarthria. None of the participants reported a large change in swallowing skills with three stroke survivors reporting that their swallowing had remained unchanged. Some stroke survivors stated they did not have any difficulties

swallowing, despite initial RITH assessments diagnosing some degree of dysphagia in nine stroke survivors. This may indicate a reduced awareness of or concern for dysphagia in some participants.

Differences in terminology may have also impacted on this result. Stroke survivors were asked to comment on their swallowing skills. Considering that this study was primarily to remediate oral stage dysphagia, a more pertinent question could have been about eating, chewing and drinking skills. Using the term 'swallowing', while it is often used within the SP and medical field to encompass the swallow over the oral and pharyngeal stages, 'swallowing' to a stroke survivor may mean something different.

Experiences with the RITH SP program. In general, stroke survivors reported positively on their experiences with RITH SP treatment. Stroke survivors stated they had high levels of confidence during therapy and reported benefits from receiving regular practice opportunities. Some participants commented positively on the home-based setting although some individuals stated the exercises were potentially embarrassing.

Both groups of stroke survivors reported that they were confident when participating in RITH SP which echoes previous dysarthria intervention studies (Mackenzie et al., 2013; A. Young et al., 2013). Stroke survivors who received therapy from a therapy assistant were no less confident during their practice than those who received therapy from a speech pathologist. This provides support that stroke survivors find RITH SP acceptable, regardless of the involvement of a therapy assistant in intervention with improvements in self-confidence after therapy ceases.

Regular visits and communication practice opportunities and the flexibility of the content and timing were reported as beneficial. The feedback given here, is

similar to the reports of A. Young et al. (2013) who found that their stroke survivors with dysarthria or aphasia highly valued regular and continued interaction with someone outside of the family to practise communication or regular daily activities in the early sub-acute stage.

In this study, one stroke survivor mentioned that doing some of the dysarthria exercises seemed “silly”, which was echoed by one carer who felt that doing the exercises at home prevented embarrassment. These results echo those of Brady et al. (2011), who reported that people with post-stroke dysarthria felt that some exercises were embarrassing or ridiculous and that these exercises were often ceased. Walshe and Miller (2011) reported people with acquired dysarthria already combat negative experiences such as embarrassment, sensitivity, lack of confidence and feeling inadequate. Therefore, it seems that for people with acquired dysarthria, there is a risk of compounding and intensifying already existing negative feelings of self, by the type of therapeutic exercise or the way that the therapy is provided or delivered.

While stroke survivors were not specifically asked about the home-based setting, two stroke survivors in the TAU GROUP reported it as being helpful. In particular, one stroke survivor appeared to prefer therapy at home to the hospital setting, and he inferred that he had experienced interruptions to his hospital based therapy schedule. Mackenzie and colleagues (2013) found that stroke survivors reported positively on having therapy in a community setting with hospital-based therapy being seen as inhibitory. The therapeutic setting preferences of stroke survivors with communication and/or swallowing difficulties has yet to be explored in depth and warrants further investigation.

Experiences with independent home practice. There was a wide range in the amount of home practice completed by the stroke survivors, with no difference in total minutes completed between the two groups. Although there were no statistical differences between groups, there were subtle differences in the qualitative data retrieved from the questionnaires. Three stroke survivors (two from INT group) highlighted the independent home practice program as being a helpful part of the service they had received. While not conclusive, it is of interest that the participants within the usual care group did not comment more on the importance of the home program. It would be natural to assume that the home program would be more important for those who received less professionally led therapy and less important for the intensive group who received daily input and practice opportunities. Perhaps with regular guidance from the TA, the value of regular practice is reinforced.

The desire for these stroke survivors to take control over their own recovery and practise independently echoes the results from an earlier dysarthria study and two aphasia studies. Brady et al. (2011) report that people with post-stroke dysarthria felt responsible for their own rehabilitation and exercises that were embarrassing, were not functionally relevant and did not challenge the stroke survivor were often ceased. A study of the goals of 50 stroke survivors with aphasia reported that some stroke survivors, as a form of “taking control” (p.315), took on home practice and continued for years following their discharge (Worrall et al., 2011). Increasing knowledge about therapy options and home practice has been reported as an area of interest for adults with chronic aphasia (Hinckley, Packard, & Bardach, 1995).

One reason for the stroke survivors appreciating the home program in this study was, perhaps, that exercises were monitored and upgraded in difficulty every

few days over the intervention period. Exercises were individually tailored to meet their needs and included functional speech and swallowing practice. A. Young et al. (2013) also report that functional activities such as practising everyday activities and having regular contact with trained volunteers assisted with their confidence.

Although the home program was perceived as a positive element of the program, practising on their own was difficult for many stroke survivors. Motivation and the lack of cues and feedback were highlighted as barriers to independent practice. Ada et al. (1999) found stroke survivors have difficulty 'bridging the gap' between supervised and unsupervised practice. Additionally, stroke survivors reported that they appreciated being given printed material, as it was hard to "remember it all". This difficulty with unsupervised practice may be in part due to post-stroke altered cognitive status, effecting the processing of information, memory and attention, which may have an impact on dysarthria outcome measures (Mackenzie & Lowit, 2007).

Experiences with staff. Speech pathology and therapy assistant staff were viewed favourably by the stroke survivors with their knowledge, flexibility and direction specifically mentioned as being helpful. Although small numbers, it seemed that the stroke survivors who received INT therapy were more likely to report staff as being a helpful part of the program.

Experiences with therapy assistants. The intensive group agreed that the therapy assistant had sufficient training and skills to support their practise and they reported they found it easier to practise with a therapy assistant. This finding supports those of a study by McElhone (2011) in which stroke survivors in an in-patient setting reported they were comfortable with allied health assistants and also found them to be effective. In this present study, stroke survivors reported the

therapy assistant provided models, examples and direction; and engaged them in conversations they reported as being “natural”. People with acquired dysarthria are known to experience a loss of independence and feelings of isolation (Walshe & Miller, 2011). Therapy assistants who provided intensive services may also play a supportive role, providing encouragement and developing rapport over the frequent contacts reported in this paper. There is a potential for intensive services to also reduce these feelings of isolation while encouraging the stroke survivors’ independence to participate in everyday activities and tasks, similar to that reported by A. Young et al. (2013).

Functional speech practice, such as role-plays or practising speaking on the phone was positively mentioned by two stroke survivors from the intensive group. Although both groups in this study received similar treatments, based on a hierarchy of tasks, there may be subtle differences in the content of the therapy delivered. Although the therapy assistants were closely supervised and supported by the speech pathologist, they did have some degree of autonomy and were able to make decisions about which exercises to deliver on a particular day. The stroke survivors in the INT group received more professional contact time and may have had more opportunities and time to practise ‘real-life’ conversations and functional speech activities.

Functional communication training within aphasia has been reported, including the use of role-play to train conversation partners (Kagan, 1998) and ‘situation-specific’ therapy such as training people with aphasia to use the telephone in emergencies (Hopper & Holland, 1998). Although little is known about the impact of dysarthria on everyday interactions (Guo & Togher, 2008), functional, context-specific training is used within dysarthria. There are some reports that functional

activities are a viable option for dysarthria treatment in the clinic setting, with phone practice highlighted as an activity for functional generalisation (Guo & Togher, 2008). Certainly, the home is thought to be a contextually relevant setting for stroke rehabilitation (Koch et al., 1998) and in dysarthria therapy, perhaps may be a prime setting to practise situation specific therapeutic activities.

This varied functional practice, when used in a hierarchy of tasks, may assist in providing disseminated practice (McCabe, 2010) and may assist the stroke survivor to improve their skills, with an increase in accuracy and speed so that the skill is maintained and generalized (McIlwaine et al., 2010). The effectiveness and acceptability of functional 'situation-specific therapy' within dysarthria has not been extensively researched or described and is in further need of exploration in speech pathology.

Despite the positive reports of therapy assistants by the intensive group, one stroke survivor from the intensive group reported he would have preferred therapy to be delivered by a speech pathologist. The stroke survivors who received treatment as usual also expressed some apprehension in relation to the concept of having extra therapy practice sessions with a therapy assistant. Despite this, some stroke survivors were aware of external budgetary constraints, and the difficulty in providing intensive speech pathologist led rehabilitation and most appeared to appreciate daily contact by the therapy assistant. McElhone (2011) provided initial reports that the SP was deemed to be more effective than the allied health assistant in providing specific information and education. In this study, while this apprehension to practise with a therapy assistant or the preference to practise with a speech pathologist was not explained, it warrants further investigation.

Preferences for therapy frequency. The participants' overall desire for frequent therapy sessions across the week is consistent with the clinical context and with previous reports in the literature that stroke survivors desire frequent (A. Young et al., 2013) and additional therapy (Pullenayegum et al., 2005). The stroke survivors here appeared to want to be offered regular and intensive therapy services, potentially, to assist in their desire to return to normal, a common report in dysarthria (S. Dickson et al., 2008). This data is novel and may assist in shaping rehabilitation services. It is of interest however that it seemed the stroke survivors who received INT therapy were more likely to report the regularity of practice or visits as being a helpful part of the program. Potentially, the value of intensive practice was reinforced by the regular encouragement and reminders to practice that the INT group received.

Perceptions, Experiences and Preferences of the Carers.

All carers reported improvements in the speech/swallowing of the stroke survivors after RITH SP. This provides further support for the positive impact of the treatment programmes and the generalisation of improvements noted on the assessment tasks to everyday communication. Little is known about the impact of having intensive home-based therapy or using a therapy assistant on the carer. When comparing the two groups of carers, the intensive group carers reported a slightly greater magnitude of change to the stroke survivor's speech/swallowing compared to the treatment as usual carers. On its own, this small difference between groups is inconclusive. However, the stroke survivor qualitative data also slightly favours the intensive group, where the stroke survivors in the intensive group were more likely to attribute a larger magnitude of change than the treatment as usual group. There may have been greater expectations of outcomes by the intensive

group, which may have confounded the results. With such small numbers, and small differences between groups, further investigation is warranted.

In the process of supporting therapy within the home, the carer results suggest carers can and do play a prominent role in providing support and encouragement to stroke survivors in therapy in the home. This is consistent with Mackenzie, Paton, et al. (2012) who reported some carers took on a helping and supportive role when participating in a dysarthria therapy. Carer support was not limited to speech pathology, with most carers providing other types of care or helping with other therapeutic activities. Of note, most carers in this study underestimated their involvement in therapy, which may support findings of O'Connell and Baker (2004) who reported carers experience uncertainty about their role as carers.

While little is known about the role carers take on in home-based rehabilitation, carers have been involved in community based intervention programs, such as the Living with Dysarthria group (Mackenzie, Paton, et al., 2012). While not specifically targeted in this study, some carers were informally provided with education, conversation support strategies and information on how to supervise and refine therapy practice. While it is widely acknowledged that conversation partner training (Kagan, 1998) may be an important intervention for aphasia, it has not been traditionally recognised as a key factor in dysarthria treatment. Recently, there has been a move within the dysarthria literature, to consider the importance of training and educating the main communication partner (McAuliffe, Borrie, Good, & Hughes, 2010; Tjaden & Wilding, 2004; Walshe & Miller, 2011).

Many carers reported the stroke survivor had difficulty practising independently and that they were involved in therapy. These findings are consistent with the reports by Cecil et al. (2011) who reported some carers heavily assisted with

speech pathology rehabilitation. While the establishment of regular home practice may enhance treatment effectiveness (Robertson, 2001), the present study found that many stroke survivors, in the early stages post stroke, require some level of assistance to complete dysarthria and dysphagia tasks assigned for home practice.

The role of the carer showed slight differences between groups with the TAU carers actively assisting with practice more frequently. Additionally, the intensive carers reported positively on receiving brief periods of respite and communication practice with someone external to the family. Respite is a known factor in maintaining good carer well-being (O'Connell & Baker, 2004). It appears that for this set of carers, having intensive therapy from a therapy assistant may allow subtle changes to the role of the carer in therapy. Having daily therapy with a therapy assistant may lessen the need for carers to actively help with home practice, and through providing short periods of respite, may subsequently assist with relieving carer burden.

All carers found RITH SP helpful with speech pathology services seen to be highly valued, consistent with previous carer reports (Cecil et al., 2011). The home-based setting was highly valued with carers concerned about travelling, waiting for therapy, and interruptions to therapy associated with external appointments. The support for home-based therapy from the carer questionnaires echoes the findings of Mackenzie et al. (2013). They reported that people with dysarthria deemed hospital based services as inhibitory and “uptight” (p. 412) while the community based setting was more personal and friendly (Mackenzie et al., 2013). The information provided here gives some evidence to support home-based stroke rehabilitation being more contextual (Koch et al., 1998), located in a prime setting for functional therapy activities. The home setting may also alleviate carer stress with a reduction in the

need to commute to external therapy appointments and may also provide comfort and security to stroke survivors adjusting to life back at home.

Culturally and linguistically diverse stroke survivors all preferred RITH services during this phase of stroke recovery. However, practising independently and accessing hospital services were identified by carers as problematic for stroke survivors with limited English proficiency. This is consistent in with previous reports of people with limited English abilities having reduced access to health care services (Hu & Covell, 1986; Woloshin, Schwartz, Katz, & Welch, 1997). While therapy was adapted for stroke survivors with attempts to provide culturally and linguistically appropriate therapy targets (Stewart, 2011a), more research is needed to determine the specific needs of culturally and linguistically diverse stroke survivors receiving speech pathology rehabilitation, in the home-setting and otherwise.

Clinical Implications

People who have dysarthria and dysphagia, in the early days post-stroke, appear to benefit from individually tailored therapy, as described in this study, provided within the context of Rehabilitation in the Home speech pathology services. Although no differences were found when comparing intensive therapy provided by a therapy assistant and speech pathologist practice to treatment as usual, there were reported benefits from having daily communication and exercise practice opportunities.

While the effectiveness of dysarthria and dysphagia interventions is not well understood in the literature, the results of this study support traditional, individually tailored, clinically practiced, multi-system intervention. These results, although limited in generalizability, indicate that an evidence-based intervention program appears to assist with the remediation of dysarthria and dysphagia, as well as reduce the psycho-social impact of dysarthria. This echoes the current recommendations in the literature, which support the ongoing use of behavioural intervention in dysarthria and dysphagia management post-stroke.

While the evidence so far supports intensive post-stroke intervention, recommended levels of intensive practice may be difficult to achieve within speech pathology (Bowen et al., 2012; Ciccone et al., 2013; Godecke et al., 2012). Therapy assistants and a home practice program were used in this study to provide additional practice and communication opportunities which may be decreased post-stroke (Bowen et al., 2012). Through the use of therapy assistants, intensive, high frequency practice was achieved with participants obtaining similar outcomes to those receiving a greater number of speech pathologist led sessions. While user

feedback about the therapy assistants' level of skill, conduct and training was positive, there were some concerns that therapy assistants may not be as effective as speech pathologists, especially by those who had not received therapy from an assistant. While the use of a therapy assistant may address resource limitations and provide additional practice time, the results here are inconclusive. Further research is warranted investigating which stroke survivors may be most appropriate for therapy assistant practice, the acceptability of therapy assistants by the key stakeholders, the cost-effectiveness of such additional practice and also the effectiveness of the therapy assistant themselves.

Stroke survivors with dysarthria and dysphagia preferred services that included a home program, were flexible with intensive visits that included therapeutic exercises, communication practice and including functional speech training. Staff who were well informed, flexible, confident and provided models, direction and encouragement were valued. Speech pathologists need to be aware that people with dysarthria and dysphagia, in the early stages post-stroke, may benefit from impairment based intervention but also appreciate conversational practice and may require emotional / psychological support in their attempts to achieve functional outcomes. In addition to this, dysarthria intervention has the potential to reinforce negative feelings, such as embarrassment during the completion of some therapy tasks. Rationales for therapeutic exercises must be clearly provided and people with post-stroke dysarthria should be asked whether the interventions are acceptable to them. If not, alternative therapeutic exercises or modifications should be considered for those who experience negative feelings while practising.

Independent home practice was valued by stroke survivors despite being difficult for some to complete and record. Speech Pathologists should discuss the

rationale for the provision of home exercises as well as providing specific instruction on how the exercises are to be completed. Preferably information presented to stroke survivors should also be provided in a printed format. For home practice to occur, stroke survivors may require a significant amount of carer support, especially for those stroke survivors with limited English proficiency. Stroke survivors and carers both reported on the importance of accuracy when practising independently. Supervised practice was reported to aid the accuracy of practice; while the provision of encouragement and reminders assisted in practice completion. Considering that post-stroke cognitive changes may occur and impact on intervention outcomes, this supervised practice may be a key feature in encouraging quality practice and needs to be considered by speech pathologists when contemplating intervention.

The carer role may be complex, with many carers required to help the stroke survivor with not only speech pathology home practice, but also other types of care and therapy such as personal care and physiotherapy exercises. Such a multiplicity of responsibility may well affect the carer's ability to participate fully in their relative's home practice for speech pathology intervention and has the potential to increase carer burden. Speech pathologists need to consider the role that carers may play in home-based SP and find ways to increase therapy practice to meet recommended intensive rehabilitation levels. Additionally, knowing that stroke survivors may feel embarrassment when practising dysarthria exercises, these negative feelings may be heightened if the stroke survivor requires assistance from a carer. The speech pathologist should discuss, with the stroke survivor, the way they feel when practising therapy with their carer and if negative experiences are reported, alternative models, such as practising only with the speech pathologist, a trained volunteer or therapy assistant should be considered.

For carers of stroke survivors with dysarthria or dysphagia in the early weeks and months post-stroke, home-based interventions have high user acceptability if: skilled and consistent staff are used, the staff and program are flexible and regular and frequent services are provided. Given the significant role carers play, speech pathologists need to consider conducting initial family interviews to discuss the potential impact of therapy, the role that the family may play as well as any need for carer respite. This may facilitate a discussion about family needs and abilities in being able to support the stroke survivor in home-based rehabilitation. Speech pathologists should provide education for carers (Cecil et al, 2011), in a suitable format and discuss the benefits of regular practice, the optimal duration and frequency of therapy visits and independent practice and the characteristics of the stroke survivor, which may help or hinder practice. If carers are unable to support independent practice, alternative models of service delivery, such as involving a trained volunteer (Bowen et al., 2012) or a therapy assistant may be considered.

Limitations and Future Directions

Limitations

Small pilot studies are designed to test the safety, acceptability and potential impact of interventions and often precede a more robust, larger randomized, controlled trial (Robey & Schultz, 1998). The data provided here, while being novel, may have limited generalizability. It is acknowledged that the small sample size, inclusion of participants with aphasia or LEP, provision of questionnaires by the treating therapist and lack of assessment blinding and pre-intervention stability, without the use of a control group limit the interpretation and generalisation of results.

The Participants. The data reported here was limited to a small sample of 10 stroke survivors and 10 carers. Given that recruiting large numbers of stroke participants with dysarthria is difficult (Mackenzie, Paton, et al., 2012), small, descriptive studies of dysarthria interventions are typical. There are noted difficulties (Mackenzie et al., 2012) in using small, heterogeneous groups of stroke survivors with dysarthria in research, who vary greatly in regard to their individual profile of impairment, severity, recovery patterns and other physical and cognitive impairments. Mackenzie, Paton et al (2012) suggest that even for small studies investigating dysarthria, a large stroke population, over a wide area, with an active recruitment strategy, large budget and the narrowing of exclusion criteria (thus limiting data integrity) may be required. In this study, undertaken within a routine clinical service, none of these recommendations were practical or achievable. A

larger scale study incorporating such recommendations would add to the limited literature currently available.

Stroke survivors with aphasia, limited English proficiency (LEP) and cognitive impairment were included in this research project to ensure maximum numbers of stroke survivors with dysarthria and/or dysphagia were recruited and were representative of the clinical setting. The inclusion of these participants may have influenced the results of the study in terms of the effect of RITH SP on their speech and swallowing outcome measures, their compliance with therapy and home practice and the information provided by the stroke survivors in the questionnaires. These factors are discussed below.

While pre-existing cognitive difficulties were excluded, it is possible that subjects with some degree of new, stroke-related cognitive difficulties may have been included. Mackenzie and Lowit (2007) suggest that the effect of post-stroke altered cognitive status on dysarthria intervention outcomes must be considered. They comment that cognitive skills, such as speed of processing information and attention, may contribute to the variability of response in dysarthria intervention. Within the current study and in accordance with RITH screening policies, any stroke survivor referred to RITH is able to participate in a goal-orientated rehabilitation program, with support generally limited to that of their family/carer. Therefore, prior to intervention, subjects who were assessed by hospital in-patient staff and were deemed to have rehabilitation potential were only included. Future studies would be advised to include measures of cognitive performance.

In an attempt to both control the effect of aphasia, while also allowing participants with aphasia to participate, all participants were screened. The participants who prioritised aphasia over dysarthria and dysphagia were excluded.

To be representative of usual treatment, and in order that aphasia treatment was not withheld, those participants with aphasia who were included in the study were offered additional aphasia intervention. For those participants with aphasia, only one accepted additional language therapy intervention during the intervention period. This extra session per week with the speech pathologist was not included in the therapy time, and for this subject, the additional conversation practice and inadvertent feedback from the speech pathologist, may have had a positive effect on that participant's results. Alternatively, this stroke survivor may have spent more time practising aphasia therapy tasks, instead of dysarthria and dysphagia activities in home practice. For those individuals with aphasia, the presence of aphasia may have reduced the participant's ability to take part in therapy, either through for example, a reduced comprehension of task instruction or perhaps a decreased ability to read articulation drills and speech scripts. Additionally, there may have been a negative impact on assessment scores. For example, some may have had a reduced reading proficiency, which may have impacted on the speech rate measures.

Stroke survivors and carers were from a diverse range of backgrounds; with all participants with limited English proficiency (LEP) included and supported to participate. Non-English speaking and LEP participants are under represented in research (Frayne et al., 1996) and were purposefully included in this project. Cultural and linguistic differences were addressed by the attempted provision of culturally appropriate therapy and through professional interpreting services. The inclusion of such participants does, however, provide some further limitations. Some assessments, such as the Dysarthria Impact Profile (Walshe et al., 2009), have not been tested on culturally and linguistically diverse populations (except for within a

small French sample) (Letanneux, Walshe, Viallet, & Pinto, 2013) and may not be relevant or accurate reflection of outcomes. Similarly, the interventions used have not been reported in the literature with culturally and linguistically diverse populations.

Study Design, Data Collection and Analysis. It is important to obtain naturalistic data (Mackenzie & Lowit, 2007) that reflects the setting and people being studied. This study is clinically based and attempts were made to control confounding variables within the provision of therapy and in data collection, within the constraints of a limited budget and occurring in a real clinical setting.

In this exploratory study, there was intent to control the treatment type delivered and also the dosage within groups. The treatments given to both groups were similar, based on a hierarchy of treatment activities and using a standard set of exercises and articulation drills. However, each intervention program was multi-dimensional and individually tailored to the stroke survivor and their impairment profile, as recommended by Yorkston et al. (1999), and as such, the specifics of the treatment were not controlled. There was intent to control dosage within groups but, to allow for flexibility in accommodating the goals and desires of the stroke survivor, as well as the clinical decision making of the speech pathologist, the home visiting schedule for treatment as usual was flexible with participants permitted to refuse treatment.

Due to the exploratory nature of the project, there are known flaws in the quality of data collection and analysis. Examiner bias cannot be accounted for, as a blinded assessor was not used in the assessment of the stroke survivors or the administration of the questionnaires. Response bias, where the participants may have provided a 'socially desirable' response instead of their true response, may be

present with the information reported in the questionnaires. However, participants were assured that their responses would be confidential and were prompted to be open and honest.

Pre-intervention stability was not demonstrated as some patients were transferred into RITH and recruited within three months of the stroke event when spontaneous recovery might still have been occurring. This has been noted as being especially relevant for participants with dysarthria resulting from a single lesion (Canbaz et al., 2010). Spontaneous recovery is always a challenge for early intervention studies and without the use of a control group, who received no speech pathology intervention, spontaneous recovery cannot be ruled out and the true effect size of therapy cannot be measured. However, the immediate improvement of most stroke survivor outcome measures between pre-therapy and immediately post therapy with no subsequent improvement in scores from at two-months after therapy does lend some support for the effect of RITH over that of spontaneous recovery alone.

Future Directions

Given this study has provided preliminary research into the area it is recommended that further quantitative studies, replicating elements of this study are completed. In doing so it is recommended future studies have a larger sample size and incorporate changes to the design such as using a blinded assessors and monitoring treatment fidelity. In addition the area of research could be expanded to further investigate the specific areas outlined in the following paragraphs.

Often, randomised controlled trials (RCTs) are recommended, however, it has been suggested that this type of trial may not be the most relevant type of study for

the dysarthric population, with the presentation of dysarthria varying greatly, with treatment often targeting multiple systems using a variety of intervention techniques (Yorkston & Baylor, 2009). The lack of RCTs within the dysarthria literature supports this presupposition. In order to gain a larger sample size and fulfil the requirements of a RCT, future studies may decide to include alternative speech pathology disorders, such as aphasia and include more generic ratings of communication effectiveness or broad outcome measures.

Further research into the effectiveness of assistants in RITH speech pathology, including gathering cost effectiveness measures is recommended. While this study does not compare the effectiveness of therapy assistants to speech pathologist, future studies may like to examine this. More specifically, a study, which compares the outcomes of the delivery of specific therapeutic interventions provided by a speech pathologist to therapy provided by a supervised therapy assistant, both delivered with the same intensity. Alongside this, further qualitative and more robust investigation into the stroke survivors' and carers' opinions and experiences of working with therapy assistants is needed.

In addition, future studies may like to investigate the specific benefit of additional therapy time with a therapy assistant. A study of this type would tease apart the effect of extra therapy practice with a therapy assistant, where the amount of speech pathology contact between groups is provided with the same intensity.

Future studies may also compare the effectiveness of speech pathology assistants to generic, multi-disciplinary therapy assistants. Multi-disciplinary therapy assistants may spend very little time delivering speech pathology interventions to adults (Knight et al., 2004; Stewart, 2011b) and may be less effective than speech pathology assistants (McCartney et al., 2011). Furthermore, the impact of the home

setting on speech pathology outcomes when using therapy assistants is still largely understudied. Future replication of this study in an in-patient hospital setting would be beneficial along with the comparison of outcomes and key stakeholder satisfaction between RITH SP and routine in-patient rehabilitation.

It is also recommended that future studies include qualitative data, which investigate the experiences and preferences of the key stakeholders with data collected in semi structured interviews and focus groups. Additionally, it would be beneficial to have an interviewer who is not the treating therapist and who is external to the RITH program to administer the interviews and analyse the responses and data. This may reduce bias from the examiner and response bias from the participants. Furthermore, the use of video-records during the interviews may assist with the collection of data with high inter-rater agreement (Mackenzie & Lowit, 2007).

Finally this study also raises questions about other largely unstudied areas in speech pathology. Future studies into the effectiveness, ease, accuracy and impact of home practice (on both carer and stroke survivor), and the amount of carer assistance required to complete independent practice are recommended along with specific investigation of the cultural and linguistic challenges in RITH SP, from the carer and stroke survivor point of view.

Conclusions

Therapy assistants are widely but not routinely used in the speech pathology clinical context, with scant literature on the outcomes of using a therapy assistant within the post-stroke population. This exploratory project was designed to describe the outcomes for two groups of stroke survivors who were given evidence based dysarthria and dysphagia interventions and to explore the treatments' acceptability for the key stakeholders in the RITH setting.

The main study findings demonstrate that a dysarthria and dysphagia treatment program, based on traditionally used interventions, was feasible and tolerated well by stroke survivors in the RITH setting. Improvements were found in most speech, swallowing and psycho-social measures for the stroke survivors across the intervention period with maintenance of skills when treatment ceased. All stroke survivors in a sub-acute phase were able to tolerate regular intervention, with half receiving intensive daily intervention through the use of a supervised therapy assistant.

In addition, intensive therapy provided by a supervised therapy assistant was found to be as effective as usual care and the key stakeholders experiences of home-based speech pathology services was positive. Despite there being no additional gains in speech and swallowing outcomes from intensive daily therapy, the option to have daily therapy, delivered by a SP or a therapy assistant was preferred by most stroke survivors.

Stroke survivors and carers valued having a home practice program to carry out when not in professionally led therapy sessions. However, difficulties were reported in carrying out regular practice independently, with supervision of and

assistance with practice required for many. Most carers were heavily involved in RITH SP with some actively assisting with home practice. The home based setting and the strain of intensive multi-disciplinary RITH services was reported.

This exploratory study provides unique insights into the outcomes associated with involving therapy assistants in the delivery of speech pathology programs to stroke survivors in their homes. It is an authentic, clinically based study with a treatment protocol that may be replicated by practicing speech pathologists. This project expands on an initial RITH speech pathology reports (Brunner, Skeat & Morris, 2008) and is the first to use detailed speech, swallowing and psychosocial measures with pre, post and follow-up outcomes. The inclusion of qualitative data from carers and stroke survivors introduces the unique experiences and opinions of the key stakeholders.

Locally, the dissemination of the results may inform new practices in RITH and may make a significant contribution to the therapy assistant, dysarthria and RITH literature with the results laying the foundations for future research. These findings may also help guide the development of home-based care-giving within SP practice.

Although the numbers in the research were small, this study demonstrates the potential for examining the impact and effectiveness of using an assistant to deliver therapy within the speech pathology profession as well as the roles and opinions of carers for stroke survivors with dysarthria and dysphagia. However, replication of this study in a larger scale, with the use of a blinded assessor is required to draw conclusions.

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Appendices

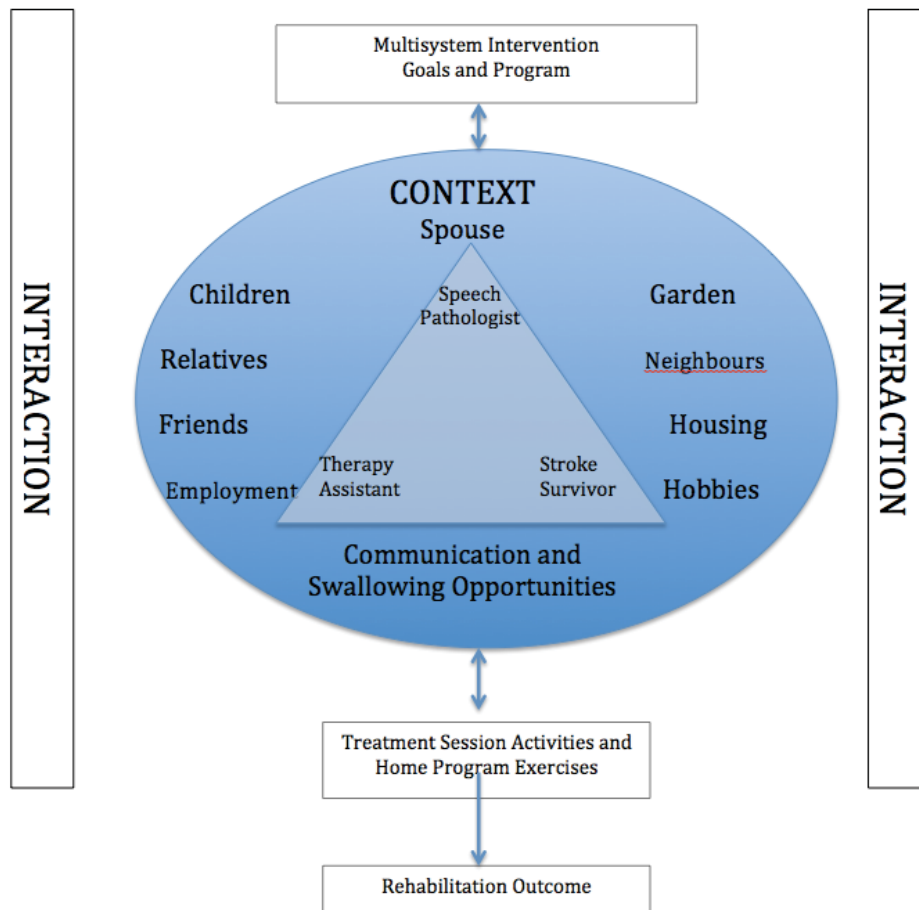
Appendix A. Assistants in Speech Pathology.

Authors	Year	Assistant Type	Setting	Study Design
Wirt et al.; Cultbertson & Tanner	1990; 1998	Speech Therapy	Paediatric 1. Cleft palate services; Sri Lanka 2. Distance education	Descriptive Case Study
Hoerster et al.; Dijkstra et al.; Bourgeois et al.; Chang & Lin.	2001; 2002; 2005; 2005	Nursing Assistants	Adult Nursing Homes	Single subject; Quasi- experimental; RCT; RCT
Boyle et al, Dickson et al, McCartney et al.	2007; 2009; 2011	SLT & Education Assistants	Paediatric School based	RCT; RCT; Non-RCT
Mecrow et al.; Binger, et al.	2010	Specialist/ Education Assistants	Paediatric School based	Case Series; Single Subject
McElhone	2011	AHA	Adult In-patient Group	Small group
Ward et al.	2012	AHA	Adult Telerehab.	Small group
Kalapac- Trigg	2013	AHA	Adult Acute Dysphagia Assessment	Small group

Appendix B. RITH Intervention Program with Hierarchy of Therapy Tasks.

 Stroke Survivor and Carer Education	Stage of Program	Examples of Dysarthria and Dysphagia Interventions	Evidence Base
	Functional Practice 	<ul style="list-style-type: none"> • Role-Play 1:1 and on the phone • Real life communication practice and set challenges (changing appointments, ordering library books, social phone calls, ordering at cafes, requesting foods in the market etc.). • Supervised diet and fluid trials • Swallowing practice with difficult textures • Gargling, swirling fluids etc. 	McNeil Dysphagia Program, Carnaby-Mann & Crary, 2010; Crary et al., 2012; MacKenzie et al., 2012.
	Compensatory Strategies 	<ul style="list-style-type: none"> • Normalise speech rate • Over-articulation / precise speech • Promotion of increased breath support • Volume cueing • Prosody and emphasis on key words • Repetition • Background noise • Facing the listener • Double swallow • Lingual sweep of oral cavity • Safe swallow strategies 	Berry & Sanders, 1983; Aten, 1988; McHenry & Wilson, 1994; MacKenzie & Lowit, 2007; MacKenzie, Paton et al., 2012; Mahler & Ramig, 2012; MacKenzie et al., 2012.
	Articulation Phonation Respiration Resonance Swallowing Drills 	<p>Articulation: Targets progressed from; single phoneme → syllables → words → phrase → sentences. Targets embedded in a mixture of “environments” including verbal repetition, reading aloud, structured conversation.</p> <p>Practice altering speech parameters to normalise speech (i.e. intonation/resonance/speech rate).</p> <p>Phonatory/Respiratory systems: diaphragmatic breathing, coordination of breathing and phonation, prolonged vowels, volume, melodic intonation, singing, and pitch control exercises.</p> <p>Swallowing: Shaker, lip seal</p>	Aten, 1988; Robertson, 2001; MacKenzie & Lowit, 2007; Robbins et al. 2007; Tamplin, 2008; Lee & McCann, 2009; Clark et al., 2009; Hagg & Anniko, 2008,2010. Mahler & Ramig, 2012.
	Oral Motor Exercises 	<ul style="list-style-type: none"> • Lip rounding, spread and seal • Tongue protrusion, lateralization • Soft palate <p>Targeting weakness, endurance, rate and range of movement while respecting overload, progression, recovery, and specificity. Improving awareness and control over articulators. Used as a building block to proceed to articulation and swallowing drills.</p>	Robertson, 2001; Clark, 2003; Robbins et al. 2007; Clark et al., 2009; Hagg & Anniko, 2008,2010.

Appendix C. RITH Intervention Triad.



Rehabilitation in the Home Speech Pathologist, Therapy Assistant, Stroke Survivor

Triad. Stewart, 2013. Based on Koch et.al, (1998).

Appendix D. Patient Diary (TAU and INT).

Patient Name _____ Therapy Assistant Name _____

Please record a short entry of your home practise each day. Please be as honest as possible. We understand that it may be difficult to practise on your own. This study will help us to collect information on why it is difficult to practise at home.

Monday Date _____	<p>What Speech Pathology exercises did you practise today?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>How many minutes did you practise for? _____</p> <p><u>If you were not able to practise, what was the reason?</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> I had visitors – (Family/friends) <input type="checkbox"/> I was unwell (this can include being back in hospital) <input type="checkbox"/> I was too tired <input type="checkbox"/> I felt upset /sad / down / frustrated <input type="checkbox"/> I had appointments at home <input type="checkbox"/> I went out (medical or social appointments) <input type="checkbox"/> It was not a priority <input type="checkbox"/> I didn't feel like it <input type="checkbox"/> I forgot <input type="checkbox"/> The Therapy Assistant visited today <input type="checkbox"/> I didn't understand what I had to do <input type="checkbox"/> I don't think the exercises will help me <input type="checkbox"/> I don't think I need therapy <input type="checkbox"/> I practiced other exercises eg. for Physio/Occupational therapy <p>Other: _____</p>
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Appendix E. Table of Assessments.

Assessment Name	Outcome Measure Name	Outcome Measure Acronym	Author
Dysarthria Impact Profile		DIP	(Walshe et al., 2009)
The Frenchay Dysarthria Assessment – 2nd edition (FDA-II)	Oral Motor Function	OMF	(Enderby & Palmer, 2008)
	Speech Intelligibility	SPINT	
The Grandfather Passage	Speech Rate (words per minute)	WPM	(Van Riper, 1963)
Timed Water Swallow Test (TWST)	Water Swallow Speed (mls per sec)	WSS	(Nathadwarawala, Nicklin, & Wiles, 1992)
Mann Assessment of Swallowing Ability (MASA)	Chewed Cookie Test	CCT	(Mann, 2002)

Appendix F. Stroke Survivor Post-Therapy Questionnaire (TAU).

Please note that your comments will be kept confidential. Your name will be removed from all comments and you will remain anonymous.

Please fill out the following information below.

Your Name _____ Today's Date _____

1. Overall, how confident did you feel when you were participating in this treatment program?

No						Medium					Highly
Confidence						Confidence					Confident
0	1	2	3	4		5	6	7	8	9	10

2. What did you find helpful about the program?

3. Is there anything you didn't find helpful about the program? YES/ NO.
Please explain your response

4 a) Do you feel like that the treatment program has improved your speech and/or swallowing? YES /NO
Please explain your response

4 b) If you think your speech/swallowing has improved, please indicate the extent of change to your speech/swallowing by circling one of the following:

Small change	Medium change	Large change
---------------------	----------------------	---------------------

5. Do you think that the treatment program was too long or too intensive?
YES /NO. Please explain your response

6. Therapy was offered to you regularly. How often would you have preferred to be seen by _____(Speech Pathologist)?

Please circle your preferred response below;

Daily
Three times a week
Twice a week
Once a week
Fortnightly
Monthly

8. Did you find doing home practice on your own difficult? YES / NO

Please explain your response

9. Did you find doing practice with the Speech Pathologist difficult? YES / NO

Please explain your response

10. Would you have liked a trained Therapy Assistant to come out to your home and help you practice your exercises? YES / NO

Please explain your response

11. If yes, how often would you have liked the Therapy Assistant to come and help you practice?

Please circle your preferred response below;

Daily
Three times a week
Twice a week
Once a week
Fortnightly
Monthly

Appendix G. Stroke Survivor Post-Therapy Questionnaire (INT).

Please note that your comments will be kept confidential. Your name will be removed from all comments and you will remain anonymous.

Please fill out the following information below.

Your Name _____ Today's Date _____

1. Overall, how confident did you feel when you were participating in this treatment program?

No						Medium					Highly
Confidence						Confidence					Confident
0	1	2	3	4		5	6	7	8	9	10

2. What did you find helpful about the program?

3. Is there anything you didn't find helpful about the program? YES/ NO.

Please explain your response

4 a) Do you feel like that the treatment program has improved your speech and/or swallowing? YES /NO

Please explain your response

4 b) If you think your speech/swallowing has improved, please indicate the extent of change to your speech/swallowing by circling one of the following:

Small change	Medium change	Large change
---------------------	----------------------	---------------------

5. Do you think that the treatment program was too long or too intensive? YES /NO

Please explain your response

6. Therapy was offered to you five days a week.

How often would you have preferred to be seen by _____ (Therapy Assistant)?

Please circle your preferred response below;

Daily

Three times a week

Twice a week

Once a week

Fortnightly

Monthly

7. How often would you have preferred to be seen by _____ (Speech Pathologist) immediately after you came home?

Please circle your preferred response below;

Daily

Three times a week

Twice a week

Once a week

Fortnightly

Monthly

8. Did you find doing home practice on your own difficult? YES / NO

Please explain your response

9. Was it easier to practice with the therapy assistant? YES / NO

Please explain your response

10. Do you feel the therapy assistant had sufficient training and skills to help practice your home program? YES / NO. Please explain:

11. Do you feel that this program should have been delivered by a Speech Pathologist? YES / NO. If yes, please explain why

Appendix H. Carer Questionnaire.

1. Do you think your relative has made improvements? YES / NO

If so, was this a;

SMALL change

MEDIUM change

LARGE change

2. What was your role in the therapy process?

3. Did you have to help your relative complete their home practice?

YES / NO

How did you help them?

How often did you help them?

Did you have to remind them to use their strategies? YES / NO

What did you say to your relative?

4. Was it difficult for the patient to practice on their own? YES / NO

5. Was it difficult to record the home practice? YES / NO

6. What other exercises did you have to help your relative with?

7. Do you think the home visiting has been helpful? YES/NO

How was it helpful?

8. Did you prefer to have therapy in your own home rather than in the hospital setting?

YES / NO