Exploring Outcomes for Persons with Aphasia: One-year post-stroke

A DISSERTATION

Submitted to the Faculty of

Health Sciences, University of Malta,

in partial fulfilment of the

requirement for the degree of

Master in Communication Therapy

by

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June 2023

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Abstract

This study investigates the factors influencing the outcome of aphasia in stroke patients. Aphasia, a language disorder, affects a significant portion of stroke victims worldwide. The study aims to determine the relationship between diverse variables, including demographics, stroke characteristics, initial aphasia severity, speech therapy, and available services. Additionally, it explores functional outcomes, discharge disposition, and post-therapy support for persons with aphasia (PwA). The study is longitudinal, prospective, and non-randomized which follows participants for one year. Quantitative research methods and various assessment tools were utilised for data collection and analysis. Key findings indicate that initial stroke and aphasia severities, as well as frequent speech-language therapy sessions, are linked to better outcomes. A high percentage of PwA received rehabilitation, but further research is needed due to various factors including limited participation and insufficient local research.

Keywords: stroke, aphasia, outcomes, one-year post-stroke, demographics, stroke characteristics, speech and language therapy, rehabilitation, satisfaction of speech therapy, services accessed

Acknowledgement

Writing a Master's dissertation is long and arduous and cannot be done singlehandedly. First and foremost, I would like to thank my supervisor Dr Ritienne Grima. I am extremely appreciative of all the patience and guidance she has given me throughout the past years. Without her feedback and support, this thesis would not have happened.

I am also deeply appreciative of Dr Monique Borg Inguanez from the Department of Statistics and Operation Research at the University of Malta. She went out of her way and graciously helped with the data analysis.

Special thank goes to the gatekeeper, Ms Amy Lomax, who constantly liaised with me during the initial phase of recruiting participants. I would also like to thank the Speech-Language Pathologists working in the rehabilitation hospital and community who helped me during data collection. Moreover, this study would not have been possible without the participants and their relatives' support and cooperation. Their willingness to help me amid a pandemic was tremendous, and I am truly grateful.

I owe a deep sense of heartfelt gratitude to my friends and family, for their unwavering support. Their ongoing encouragement throughout this process has been immense and truly appreciated. My mere expression of thanks does not suffice. Thanks for all your love and prayers.

Table of Contents

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4: Data Analysis

Appendices

List of Tables

List of Figure

Abbreviations

A & E	Accident and Emergency
ADL	Activity of Daily Living
A-FROM	Living with Aphasia: Framework for Outcome Measurement
ASHA	American Speech–Language–Hearing Association
ASRS	Aphasia Severity Rating Scale
BLS	Best Language Score
CATs	Collaboration of Aphasia Trialists
CAG	Community Aphasia Groups
CIT	Constraint-Induced Therapy
CILT	Constraint-Induced Language Therapy
CIMT	Constraint-Induced Movement Therapy
COVID-19	Coronavirus disease 2019
CVA	Cerebrovascular Accident
DHIR	Department of Health Information and Research
EQ-5D-5L	5-level EQ-5D version
fMRI	Functional Magnetic Resonance Imaging
GDPR	General Data Protection Regulation
HI	Hearing Impairment
ICF	International Classification of Functioning, Disability and Health
iPraise	International Population Registry for Aphasia after stroke
IT	Information Technology
LH	Left hemisphere
LPAA	Life Participation Approach to Aphasia

LTC	Long Term Care
MAST	Maltese Aphasia Screening Test
MCA	Middle Cerebral Artery
MDT	Multidisciplinary Team
MIT	Melodic Induced Therapy
mRS	Modified Rankin Scale
n	Number of participants
NIHSS	NIH Stroke Scale
NINDS	National Institute of Neurological Disorders and Stroke
OT	Occupational therapist
PACE	Promoting Aphasics' Communicative Effectiveness
PD	Parkinson's Disease
PLORAS	Predicting Language Outcome and Recovery after Stroke
PT	Physiotherapist
P-value	Level of significance
PwA	Persons with Aphasia
QoL	Quality of Life
RCT	Randomised Control Trial
RH	Right hemisphere
RQ	Research Question
RTW	Return to Work
SES	Socioeconomic status
SFA	Semantic Feature Analysis
SLP	Speech and Language Pathologist
SLT	Speech and Language Therapy

SPSS	Statistical Package for the Social Sciences
TIA	Transient Ischemic Attack
TOMs	Therapy Outcome Measures
Std Deviation	Standard Deviation
WHO	World Health Organisation
%	Percentage Score
6m	Six months
12m	12 months

Chapter 1

Introduction

Chapter Overview

This chapter intends to give a brief preamble relevant to this study. It describes some background information on stroke, aphasia and outcomes post-stroke and post-aphasia. This research is part of a larger project, the "International Population Registry for Aphasia after Stroke" (iPraise, Ali et at., 2022), which is further explained in this chapter. This research aims to investigate the outcomes for a sample of persons who have experienced aphasia secondary to stroke in Malta. The outcomes which will be measured in this study and the tools used to measure them will be outlined in detail in the Methodology Chapter. This chapter concludes by outlining the study's aim and objectives.

Stroke

Globally, around 1.5 million people suffered from a stroke in 2019 (Virani et al, 2021). In Malta, in 2019 and 2020, an average of 558 people were discharged from the general hospital with a primary discharge diagnosis of Cerebrovascular Accident (ICD-10 codes: I61 to I64) (Department of Health Information and Research, Distefano, personal communication, October 2021)[1]. A cerebrovascular disease (CVA), referred to as a 'stroke' in layman's terms, is a disturbance in blood supply to the brain. There are two main types of strokes: (1) ischaemic and (2) haemorrhagic. Ischaemic strokes occur when the blood supply to the brain is compromised, which

[1] Data collection for the Pilot Study of this dissertation started In October 2018 whilst the data collection for the actual study commenced in October of 2019.

restricts the brain of oxygen and damages brain tissue. This disruption in ischaemic strokes is precipitated by different mechanisms, which include (1) a thrombosis that is an obstruction of a blood vessel caused by a blood clot in the same vessel, (2) an embolism which refers to a blockage of a blood vessel by an embolus travelling from somewhere else in the body, (3) systematic hypoperfusion where there is a general decrease in blood supply and (4) a venous thrombosis where there is an obstruction in a blood vessel in the sinuses that drain blood from the brain. On the other hand, a haemorrhagic stroke develops when an artery in the brain ruptures, resulting in blood pooling, which destroys brain tissue (Cheatham et al., 2020).

According to the Department of Health Information and Research (DHIR, 2015), circulatory system disease was the leading cause of death, accounting for 38.7 % of the total number of deaths in 2015 in Malta. These include ischaemic heart disease, heart failure and stroke. Stroke was the third most common cause of death in males (7.3%) and the second most common cause of death in females (9%) (DHIR, 2015). Research into the global burden of the disease shows that the number of stroke cases is increasing (Johnson et al., 2019). It accounts for almost 5% of all disability-adjusted life-years and 10% worldwide deaths (Johnson et al., 2019). Most patients survive the initial illness; however, it generally causes long-term consequences for them and their relatives. The prevalence of such a burden is likely to increase in the coming years despite developments made in the medical management of stroke. The management of long-term effects will continue to rely on rehabilitation interventions (Langhorne et al., 2009).

There is very limited local research that investigates the outcomes for people who have suffered a stroke in Malta.

***Pathophysiology of Stroke*.** The brain, the central organ damaged by stroke, is metabolically active and requires around 50ml/100g/min blood flow and a metabolic oxygen rate of 3.5cc/100g/min (Doyle et al., 2008; Caplan, 2016). When the blood flow decreases below 10ml/100g/min, brain cell functions are affected, and neurons are unable to survive below 5ml/100g/min. The disruption of blood flow for thirty seconds results in alteration of brain metabolism (Caplan, 2016).

In an ischaemic stroke, hypoxia and hypoglycemia cause the disruption of blood to the brain, which leads to a brain infarction (Doyle et al., 2008; Dirnagl et al., 1999). An ischaemic cascade occurs because of a build-up of sodium, calcium, and water in the injured brain cells, resulting in the release of excitatory neurotransmitters, which cause more cell injury.

A haemorrhagic stroke occurs when bleeding in the brain or between the brain and the skull happens due to a broken blood vessel (Harvard Health Publishing, 2019). They contribute to 10% to 20% of strokes annually (An et al., 2023; Ojaghihaghighi et al., 2017; Chen et al., 2014). Aronowski and Zhao (2011) report that the primary injury in the brain occurs because of the compression by the haematoma that increases the intracranial pressure. Secondary injury happens by the inflammation and disruption of the blood-brain barrier, oedema, overproduction of free radicals, and release of haemoglobin and iron from the clot. Around the haematoma, there is an area of hypoperfusion. Further complications which arise in an intracerebral haemorrhage includes an expansion of hematoma, intraventricular haemorrhage, perihematomal oedema, and inflammation (Chen et al., 2014).

A distinctive feature of the clinical presentation of stroke is the sudden onset of a focal clinical deficit that can be linked to a specific site in the central nervous system. Symptoms include hemiparesis, hemi anaesthesia (one-sided numbness),

aphasia (language impairment), homonymous hemianopia (loss of the same half of the visual field in both eyes), and hemispatial inattention (Campbell et al., 2019).

Aphasia

There is no universal definition of aphasia, but it is generally utilised to describe language impairment caused by an acquired brain injury, including dementia, stroke, traumatic brain injury and brain tumour (Berg et al., 2020; Halpern & Goldfarb, 2013). Researchers agree that a common definition is crucial to better identify and treat aphasia and raise awareness (Simmons-Mackie et al., 2020; Worrall et al., 2016). The definition of aphasia has changed over the years, reflecting diverse linguistic or neurological epistemologies (McNeil and Pratt,2001).

More neuroimaging and robust research methods developed through the twentieth century, which revealed a multidisciplinary approach to the meaning of aphasia. Berg et al. (2020) noted that all the definitions of aphasia have the following common characteristics. Aphasia is a (1) language disorder, (2) which is acquired after normal language has developed, (3) has a neurological origin associated with the central nervous system, (4) which happens after damage to the language dominant hemisphere and (5) impacts all language modalities. Some definitions also specify that aphasia results from focal damage and not the result of a general cognitive damage or decline. The language impairments can be present in all or some of the language components: phonology, morphology, semantics, syntax, pragmatics) and across all modalities: speaking, writing, reading, signing and in the output (expression) and input (comprehension) forms.

For the purpose of this study, the definition for aphasia is "*an acquired selective impairment of language modalities and functions resulting from focal brain lesion in*

the language-dominant hemisphere that affects the person's communicative and social functioning, quality of life and quality of life of his or her relatives and caregivers" (Papathansious & Coppens, 2022; pg 4). This definition encompasses both the characteristics of the impairment whilst also highlighting its impacts on the PwA and the people around them.

Aphasia and Stroke

Numerous institution-based studies have reported that aphasia occurs in between 20% and 41% of people who have sustained a stroke (Pauranik et al., 2019; Flowers et al., 2016; Bohra et al., 2015; Dickey et al., 2010; Pedersen et al.,2004). Controversies in the literature continue regarding the distribution of post-stroke aphasia subtypes (Hoffmann & Chen, 2013). Aphasia is often broadly categorised into 'fluent' and 'non-fluent' types. Fluency involves the competence to retrieve words and integrate them into emerging syntactic sentences, which formulate a message for articulation (Clough & Gordon, 2020). Non-fluent aphasia is identified by increased efforts, deficits in prosody, articulation, and grammar with a predominance of content words (Kertesz, 2007). Contrastingly, fluent aphasia is characterised by uninterrupted speech with different syntactic structures, with normal or 'hyper-normal' phrase length; however, the output lacks meaning and content (Kertesz, 2007; Edwards, 2005). Based on the neoclassical approach to aphasia, Clough and Gordon (2020) expand that non-fluent aphasia syndromes include

global[2], Broca's[3], and transcortical motor aphasia[4], whilst fluent aphasias include Wernicke's[5], transcortical sensory[6], conduction[7], and anomic aphasia[8].

Persons with aphasia (PwA) are a very heterogeneous group. Predicting Language Outcome and Recovery After Stroke (PLORAS, Seghier et al., 2016) is an ongoing research project exploring speech and language recovery after a stroke. Its primary challenge was the heterogeneity of aphasia since strokes could damage the exact location in the brain but can have inconsistent effects on cognitive abilities (including speech and language) in different patients. It is becoming more challenging to predict and identify the type of aphasia because of the heterogeneity of brain damage within groups of the same aphasia type. Additionally, the population of PwA seems to be extremely heterogeneous as to the type and severity of cognitive dysfunctions, which includes communication (Helm-Estabrooks, 2002).

Some PwA may have some combination of symptoms that may appear more frequently. Anomia, or word finding difficulties, is commonly regarded as the distinguishing sign of aphasia (Laine & Martin, 2006). Notably, PwA frequently

[2] Global aphasia involves a breakdown of all aspects of oral and written language (Goodglass et al., 2001). There are severe difficulties in auditory language comprehension and oral use of expressive language is usually limited to single words, whether in spontaneous, elicited or repeated words. Significant difficulties with reading and writing are also present (Galletta and Barrett, 2014).

[3] Broca aphasia is characterised by severe impairment in expressing speech and writing. Comprehension is sometimes affected (Daroff et al., 2012).

[4] Transcortical motor aphasia involves preserved repetition however, expressive language is impaired. Comprehension is better than production, with impairments primarily on complex language tasks (Turkstra, 2011).

[5] People with Wernicke's aphasia are fluent, have normal prosody and follow grammatical rules with normal sentence structure but the content is difficult to comprehend due to paraphrastic errors (Acharya & Wroten, 2020). Comprehension is often impaired (Turkstra, 2011).

[6] In transcortical sensory aphasia repetition is intact whilst auditory comprehension and verbal expression are impaired. Speech is fluent and effortless, with intact grammar and prosody and frequent paraphasic errors (Turkstra, 2011).

[7] Conduction aphasia is characterized by fluent speech and intact language comprehension, but significantly impaired repetition. There is limited content words and several paraphasic errors. Oral reading is impaired (Turkstra, 2011).

[8] Anomic aphasia is a language disorder that leads to difficulty with naming and finding the correct words when speaking and writing (Eyvazzadeh, 2020).

display self-awareness regarding this difficulty and feel frustration at their inability to express their thoughts aloud (Martin & Dell, 2007). Wolf et al. (2014) reported that auditory comprehension difficulties could be present in around 70% of PwA. Often, comprehension difficulties are also evident in those people with non-fluent aphasia (Milman et al., 2008).

Post-stroke aphasia recovery

Price (2010) asserts that predicting recovery post-stroke is crucial as it informs the patients and their caregivers regarding recovery chances. However, predicting outcomes post-stroke is arduous, even between two patients with similar lesions (Fridriksson et al., 2015). According to Watila and Balarabe (2015), recovery of aphasia post-stroke comprises the reconstruction of neural circuitry for language, which relies on several lesion related and non-lesion related factors along with treatment related factors, which will be mentioned briefly in this section and further discussed in Chapter 2.

Lesion-related factors include lesion size and location, initial stroke severity and stroke type. Several studies noted that the bigger the lesion size, the worse the aphasia outcomes (Hensler et al., 2014; Tippett et al., 2014; Naeser & Palumbo, 1994). The location of the lesion is also thought to affect recovery post-stroke, with numerous studies indicating that lesions in the superior temporal gyrus result in poor aphasia recovery (Kertesz et al., 1993; Alexander et al., 1990). Initial stroke and aphasia severity was found to be a strong gauge of aphasia recovery (Jung et al., 2011; Pedersen et al., 2004; Demeurisse et al., 1980). Moreover, haemorrhagic stroke has better recovery than ischaemic stroke (Jung et al., 2011; Basso et al., 1982).

Factors which are patient-related are also known as non-lesion factors. Watila and Balarabe (2015) concluded that there are weak and inconclusive research findings indicating that gender affects aphasia recovery post-stroke. They also determined that the impact of age on aphasia prognosis is uncertain; however, older patients are likely to have poorer outcomes. Handedness has no influence on aphasia recovery (Pedersn et al., 1995; Pickersgill & Lincoln, 1983). Connor et al., (2001) noted that those with a higher education level are less likely to have language disruptions caused by stroke.

Aphasia therapy positively affects recovery outcomes (Fridriksson et al., 2015; Rose et al., 2013). Therapy methods and approaches include Melodic Intonation Therapy (MIT), Constraint-Induced Therapy (CIT) and Semantic Feature Analysis (SFA), among many others, as they are thought to facilitate neuroplasticity of the brain (Koenig-bruhin et al., 2013; Martins et al., 2013; Pulvermuller et al., 2005).

Biopsychosocial approach to aphasia

Hilari and Byng (2009) found that deficits in communication infiltrate other areas. Studies show that PwA have high levels of depression (Kauhanen et al., 2000) and social exclusion (Parr, 2007) with only a few participating in social activities (Cruice et al., 2006) and experience a more inferior Quality of Life (QoL) (Ross & Wertz, 2003; Hilari et al., 2003).

The International Classification of Functioning, Disability and Health. A framework that may be used to understand the language impairment of aphasia and its consequences on daily life is the International Classification of Functioning, Disability and Health (ICF, World Health Organisation, 2001). The ICF (World Health Organisation, WHO,2001) takes a biopsychosocial approach as it expands on the

classic biomedical impairment-based models and it accounts for the interaction between the impairment and the environment, making it a consequence-based model. It describes *"conditions in terms of body function and structure, performance of activities, participation in relevant life situations, and the influence on functioning of environmental and personal factors"* (Simmons-Mackie et al., 2005, p. 12).

For PwA, body functions and structures refer to the impairment of the brain and

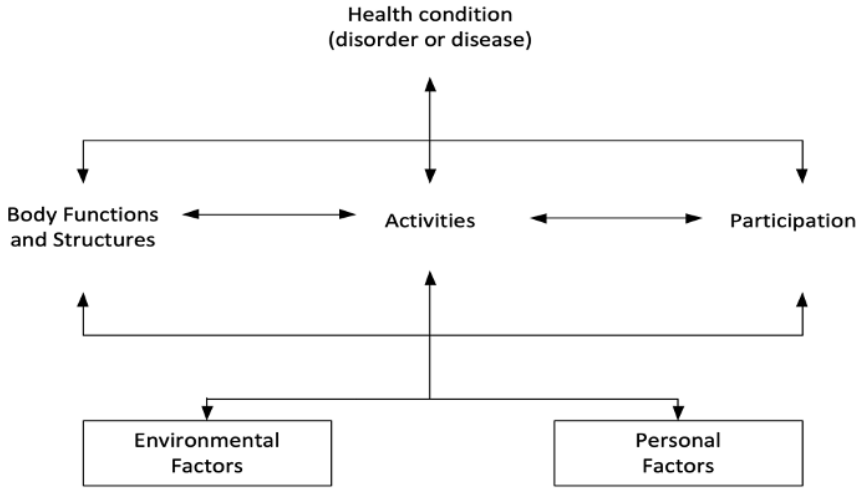


Figure 1.1: The ICF Model (World Health Organisation, pg18) reprinted with permission from WHO

brain function. Activity concerns the tasks or actions involving the four language modalities[9] and daily function communication tasks that require any language modality. Participation involves the engagement and involvement of PwA in their daily meaningful life situations in conjunction with immediate and long-term real-life goals. These include all activities which use language in the context. Environmental

[9]Language comprises four modalities: listening, speaking, reading and writing. Due to study findings, these four modalities are all considered part of language due to shared processing and production areas of the brain (Berninger & Abbott, 2010).

factors make up the physical, social, and attitudinal environment in which people live and conduct their lives" and are external to the individual (WHO, 2001, p. 16). These include physical environmental factors, relationships with others, the attitudes of others in their environment, and society, policies, access to services, etc., which aid or deter communication. These are seen as either facilitators or barriers to recovery (WHO, 2001). Personal factors are the person's inherent characteristics, feelings, emotions, attitudes, and identity or sense of self. They are *"the particular background of an individual's life and living and comprise features of the individual that are not part of a health condition or health states"* (WHO, 2001, p. 17).

The Living with Aphasia: Framework for Outcome Measurement. Speech and Language Pathologists (SLPs) are encouraged to use the biopsychosocial approach rather than focusing solely on an impairment-based approach (Chapey et al., 2000). A user-friendly version of the ICF adapted for PwA is the Living with Aphasia: Framework for Outcome Measurement (A- FROM, Kagan et al., 2008). It was developed by Kagan et al. (2008) in response to their recognition that the ICF's positive influence on healthcare is too vast. This model is more specifically targeted on aphasia and its outcomes. It constitutes four overlapping circles that illustrate how all four domains overlap and interact for the overall picture of Living with aphasia. These four circles represent (1) Participation in life situations, (2) Communication and language environment, (3) Language and related impairments and (4) Personal identity, feelings, and attitudes. Unlike the ICF, the A-FROM places quality of life (QoL) in the centre, which is created by the interaction between the four domains (Simmons-Mackie et al., 2014). SLPs utilise this framework to guide the assessment and therapy process. Improvement in the domains of impairment and environment

are essential to improve the PwA's participation, activity and overall QoL. It manages to capture real-life outcomes which PwA and their relatives frequently report.

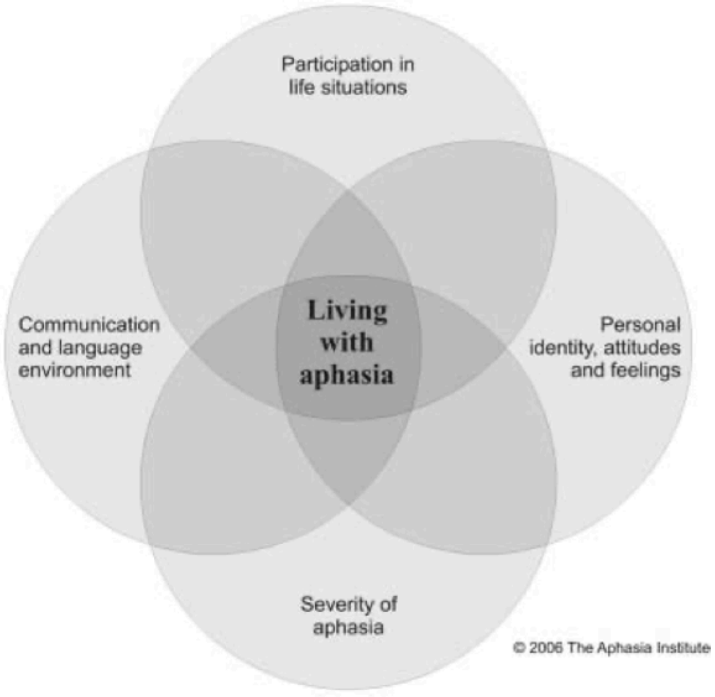


Figure 1.2: Living with Aphasia: A Framework for Outcome Measurement (A-FROM). (Reproduced with permission from Kagan et al., (2008) Counting what counts: a framework for capturing real-life outcomes of aphasia intervention)

I-PRAISE

This study is part of a larger project, the International Population Registry of Aphasia after Stroke (I-PRAISE) by the Collaboration of Aphasia Trialists (CATs, http://www.aphasiatrials.org). This is an international network of multidisciplinary aphasia investigators in rehabilitation, social science, psychology, and linguistics research from across more than 41 countries and 43 languages..

The iPraise (https://www.aphasiatrials.org/I-PRAISE/) intends to recruit over 4000 participants from various countries to investigate the approach of the current health care systems and the integrated social sector services when assessing,

diagnosing, treating, and reintegrating PwA after they suffer a stroke. It also seeks to concentrate on the gaps in knowledge by looking at the recovery of PwA and the services provided for aphasia (Ali et al.,2022).

The purpose of this project is to (1) describe the clinical aphasia population in numerous countries, (2) describe the clinical treatments for aphasia after stroke in the general population and (3) examine the outcomes after clinical intervention for aphasia across different countries. Data is being collected from various sites in other countries, including the United Kingdom, Ireland, Germany, Australia, Cyprus, Israel, Sweden, Italy, Finland, Portugal, Turkey, Chile, Netherlands, Norway, Spain and Malta.

Several countries have started the pilot study of the iPraise project. This local study is considered to be the pilot study of Malta; however, it is a truncated version due to several local limitations. These include (1) a small population when compared to other countries, (2) a limited number of recruitment sites and (3) the limited availability of assessment tools for outcome measures. Therefore, an agreement was reached with the primary investigator Dr Myzoon Ali to adapt the project in Malta.

Problem Statement

Aphasia impacts up to 38% of stroke patients (Rohde et al., 2018). Katz et al., (2000) state that SLPs believe that aphasia is underrated in the health sector as more emphasis is placed on the SLP's role in dysphagia[10] rather than on language and communication.

[10] Dysphagia is a symptom that refers to difficulty or discomfort during the progression of the alimentary bolus from the mouth to the stomach (Rofes, et al., 2011).

The Cochrane systematic review of Speech and Language Therapy (SLT) for Aphasia following stroke (Brady et al., 2016) highlighted that PwA experienced significant benefits to their functional communication, understanding and spoken language due to SLT after stroke compared to no therapy provision. PwA who received high intensity, high dose of therapy for a long duration did significantly better than those who received treatment at a low intensity and dose. There is little conclusive knowledge, both internationally and locally, on the best outcomes for PwA; and whether there is a relationship between outcomes/recovery patterns of persons with aphasia post-stroke and the following, e.g. (i) demographic characteristics (e.g. age, education, gender), (ii) stroke characteristics, (iii) initial aphasia severity, (iv) therapy type/timing/frequency/intensity of SLT and (v) other services available. Hence, this study will look at the different elements which could affect the outcome of aphasia post-stroke. All these factors will be discussed further in Chapter 2 as they will be investigated in this study. Research on outcomes for people with stroke-induced aphasia is minimal.

Additionally, there is little to inform the nature of SLT provision. Few international and local studies have investigated functional outcomes and discharge disposition (home vs other settings) in PwA and the support which is given after they are discharged from therapy. Thus, it is important to explore which services are accessed by PwA after discharge from SLT. This study will provide an insight into the local scene.

Research Aims and Objectives

The current research aims to explore the outcomes for a sample of PwA at six months and one-year post-stroke. The following objectives will be met during this research:

(1) to investigate the relationship (if any) between demographic data and outcomes for PwA at six months and one-year post-stroke,

(2) to investigate the relationship (if any) between stroke-related factors and outcomes for PwA at six months and one-year post-stroke,

(3) to correlate initial aphasia severity to outcomes at six months and one-year post-stroke,

(4) to explore the timing, type and regimen of SLT in relation to outcomes at six months and one-year post-stroke,

(5) to evaluate the satisfaction of SLT services as indicated by the PwA and their relative,

(6) to determine whether the patients with aphasia are accessing any services after discharge and whether this affects the overall outcome.

The different outcomes mentioned in the aims and objectives will be clearly outlined and defined in the next chapter.

Conclusion

This chapter introduced the reader to the definitions of key terminology and the background and aim of this study. Chapter 2 gives an insight into the demographic characteristics of PwA, stroke-related factors of PwA, therapy approaches, and community support services accessed by PwA. Chapter 3 describes the design and method utilised in the study. Chapter 4 presents the results of the data collected,

whilst Chapter 5 discusses the results. The final chapter includes the conclusions and recommendations for future studies.

Chapter 2

Literature Review

Chapter Overview

This chapter reviews the literature related to stroke-induced aphasia and the outcomes of PwA post-stroke. Furthermore, it explores several demographic and stroke-related characteristics, initial aphasia severity, and their relationship, if any, to outcomes for people with aphasia. The literature on speech–language therapy (SLT), intensity, type, and frequency is presented together with reports about possible related outcomes. Also, an outline of other services available in the local context, which PwA can utilize after their discharge from therapy, for support is presented. Subsequently, the existing gaps in knowledge are identified and discussed. The chapter finally concludes with the presentation of the study's research questions.

Aphasia Prognosis

To date, the recovery process post-stroke has been mainly related to three variables (Watila & Balarabe, 2015): (1) demographic variables (Laska et al., 2001), (2) lesion-related variables (Heiss et al., 2003; Maas et al., 2010), and (3) clinical variables (including the type and severity of aphasia and also treatment provided to the patient) (Hillis, 2010). Although demographic variables weakly correlate with long-term outcomes (Plowman et al., 2012), lesion-related variables have been demonstrated to strongly correlate with long-term prognosis (Boyd et al., 2017; Watila & Balarabe, 2015). Clinical variables are considered the best measures that reflect insight into clinical progression (Gerstenecker & Lazar, 2019).

The prognosis of aphasia is dependent on distinct elements, which will be explored in this study. Most patients with post-stroke aphasia improve mostly in the

first few months (Inatomi et al., 2008). Lazar et al. (2010) noted that the severity of aphasia at onset strongly correlates with the long-term deficit, and people with milder degrees of aphasia at onset are most likely to recover completely. In general, complete language recovery is hardly possible, leaving an individual with lasting impairments that affect aspects of QoL (Sagert, 2008).

Spontaneous Recovery

Most PwA undergo a period of spontaneous recovery after a stroke where they attain some language function. This happens swiftly in the first two weeks after an ischaemic stroke and in the first four to eight weeks of a haemorrhagic stroke (Sinanović et al., 2011). Even though most spontaneous recovery occurs in the first year, Fama and Turkeltaub (2014) reported that this might continue after a year. Nonetheless, a full recovery is rare as several studies have reported that aphasia is present in 43% of patients at 18 months post-stroke (Laska et al., 2001) and in 10–38% of patients at long-term follow-ups (Lee et al., 2015).

Demographic Characteristics

Several studies have explored stroke and its outcomes. Ellis and Urban (2016) emphasized the importance of comprehending the demographic and clinical factors that possibly affect outcomes to create an evidence-based plan for treatment. This knowledge conveys to the patients and their relatives an accurate prognosis. Some demographic factors have been reported that could impact outcomes post-stroke including gender (Bushnell et al., 2014; Franzen-Dahlin & Laska, 2012), age (Bushnell et al., 2014; Tang et al.,2014), and education levels (Manders et al., 2010; Singhpoo et al., 2012).

Gender and Stroke. Strokes affect the sexes differently. They are more common among men than in women (Appelros et al., 2009). Locally, in 2020, 282 males and 229 females were discharged from hospital with a diagnosis of a CVA (DHIR, Distefano, personal communication, October 2021).

It is thought that the underlying causes related to stroke are different in women and men. Tate and Bushnell (2011) highlighted that women have distinct characteristics, including lactation, menopause, hormone replacement post-menopause, and oral contraception, which are all associated with stroke. Moreover, pregnancy is another stroke-related characteristic unique to women as it generates temporary changes in the body, which can continue postpartum or accumulate over numerous pregnancies, increasing the risk of a stroke (Tate & Bushnell, 2011). Vladutiu et al. (2017) found that complications during and after pregnancy and postpartum increase the women's chance of having a stroke and having poor cerebrovascular health.

Females are often more affected than males. Berglund et al. (2017) noted that women generally have impaired consciousness, paralysis, and generalized weakness while men experience dysarthria, sensory loss, diplopia, ataxia, and balance difficulties. In addition, case fatality for men was around 20%, while it was about 25% for women (Appelros et al., 2009).

Gender and Aphasia. Although it is thought that women are more likely than males to experience aphasia after a stroke (Berglund et al., 2017), not all research supports this theory (Bersano et al., 2009; Pedersen et al., 1995). Wallentin (2018) reviewed 25 studies and reported that the average aphasia rate for women is higher than for men. He also studied data from the Healthcare Cost and Utilization Project

and recorded that rates of aphasia among women with stroke (33.2%) were higher than in men (30.2%).

A number of researchers have attempted to elucidate potential differences between the genders in language and cognition. The underlying origin of these differences is complex, and the literature has looked into their brain structure and function; however, the results are inconsistent (Wallentin, 2009). Some studies claim that language is more bilaterally organized in the brains of females than in males (Hausmann, 2016;Baron-Cohen et al., 2005; Kansaku & Kitazawa, 2001). Nonetheless, other studies have disputed this claim and argue that it is more lateralized in females (Hirnstein et al., 2019; Sommer et al., 2014; Wallentin, 2009), thus possibly explaining why women are more affected than men. Wallentin (2018) hypothesized that if language is more lateralized, language function is more prone to aphasia post-stroke; however, his findings contradict this motion. He found a higher aphasia rate in men than in women.

Engelter et al. (2006) observed no significant differences in aphasia severity after the first ischaemic stroke between men and women, while Chen and colleagues (2009) found that women had less severe aphasia impairment when compared with men. Howbeit, Ardila and Lahiri (2020) observed that gender did not portend aphasia severity, but it could predict aphasia probability. This is similar to the study done by Paplikar et al. (2019), who found that 75.4% of the patients were male.

Gender and Outcomes Post-stroke. Phan and colleagues (2017) commented that worse outcomes post-stroke are associated with women more than men. Correspondingly, Tomita et al. (2015) reported that women are more likely to have a more severe stroke with a long-term disability than men. Some studies highlighted worse outcomes in women in the following measures: activity limitations

(Appelros et al., 2009; Gall et al., 2012), participation constraints (Gall et al., 2012), depression (Appelros et al., 2009), and health-related quality of life (HRQoL) (Appelros et al., 2009; Gall et al., 2012). Simpson et al. (2021) confirmed these findings. They found that females experience increased activity limitations, worse HRQoL, and a higher prevalence of depression than men after accounting for a range of covariates. Towfighi and colleagues (2017) believed that the higher incidence of depression in females might affect recovery and HRQoL post-stroke. Other determinants that could attribute to these sex differences include women's older age at stroke onset (Reeves et al., 2008) and pre-stroke health (Lisabeth et al., 2015; Renoux et al., 2017), which limit their physical and cognitive abilities (Doherty, 2001; Stern, 2012).

With regard to aphasia, older studies have reported better improvement in verbal expression (Basso et al., 1982) and language comprehension (Pizzamiglio et al., 1985) in females than in males. According to Yamaji and Maeshima (2021), some studies report gender differences correlating with aphasia recovery and specifically women are more inclined to recover than men (Basso et al., 1975, 1982); however, many recent studies contradict this observation (Inatomi et al., 2008; Lazar et al., 2008; Plowman et al., 2012; Seniow et al., 2009; Watila & Balarbe, 2015). Therefore, Yamaji and Maeshima (2021) deduce that no definite and significant correlation between sex and language outcomes has been established. Likewise, a meta-analysis completed by Wallentin (2018) shows that despite aphasia being a strong predictor of outcomes post-stroke (Flowers et al., 2016; Tsouli et al., 2009), the current implication of the analysis proves that gender can be utilized as a weak predictor for aphasia outcomes post-stroke. He concludes that there is limited research that addresses the effects of gender on stroke and its outcomes, therefore

advocating for a non-gender biased approach towards treatment (Appelros et al., 2009).

Age and Stroke. Age is considered a primary factor associated with stroke (Ellis & Urban, 2016; Ellis et al., 2010; Mozaffarian et al., 2015). One can experience a stroke at any age; however, more than two-thirds of all strokes occur after the age of 65 (Hall et al., 2012). Appelros et al. (2009) highlighted that women are generally older when they have their first stroke. Stroke incidence correlates with an increase in age in both males and females. Around 50% of the strokes occur in people over 75 years and 30% over 85 years (Benjamin et al., 2017; Engstad et al., 2012; Venketasubramanian et al., 2005).

Saposnik and colleagues (2008) reported that older stroke patients are at higher risk of mortality, worse functional outcomes, prolonged hospital stay, and institutionalization. Numerous studies, including both young and elderly post-stroke patients, established that age is a strong predictor of functional outcome and discharge destination (Pohl et al., 2013; Mutai et al., 2012; Denti et al., 2008).

Age, Aphasia, and Outcomes Post-stroke. Understanding normal changes is essential for identifying abnormal and extraordinary changes (Craik & Salthouse, 2008). The fact that *tip-of-the-tongue*[11] instances rise with age is merely the beginning of an understanding of the many processes that underpin this occurrence. This alteration is a typical feature of healthy ageing and may be distinguished from retrieval issues associated with neurological disorders. To summarize, language production in older persons is impacted by both general cognitive decline and

[11] The *tip-of-tongue phenomenon is common speech error where an individual believes they know the target word however unable to retrieve it due to difficulty in accessing the phonological information (Shafto et al., 2008).*

physiological neural alterations resulting from brain shrinkage. These can be observed using neuroimaging (Wright, 2016).

Few studies investigate gender-stratified reports of age effects on aphasia. A study by Bersano et al. (2009) reported aphasia rates in four different age groups, highlighting the interaction between age and gender. Gender difference is non-significant in the youngest age group, but it increased in the older age groups; therefore, age should be considered when trying to understand the gender difference in aphasia rates. Age is regarded as a more fundamental causal variable than language as language cannot change age; however, age can change language abilities. Thus, gender differences in aphasia are brought about by age differences in stroke between men and women.

A retrospective analysis of collected data of patients with ischaemic stroke and intracerebral haemorrhage who presented to The Joint Commission Comprehensive Stroke Centre between July 2008 and December 2014 by Boehme and colleagues (2017) found that PwA were older than those without aphasia, thus more assumably to have comorbidities. It has been noted that difficulty in cognition impedes post-stroke recovery in the long term. The inability to communicate might make it arduous to express the presence/worsening of physical symptoms and understand instructions about their care, leading to more complications. Boehme et al. (2017) revealed a higher incidence of aphasia among older patients, females, and those with systemic conditions associated with a cardioembolic stroke.

Many studies have noted that young people are more likely to show greater improvement in language function than older people (Ali et al., 2021; Laska et al., 2001; Sands et al., 1969). A possible interpretation of this observation is provided by Meinzer et al. (2011), who report that there is a difference in brain plasticity relative

to age. They note that in previous studies using functional magnetic resonance imaging (fMRI), young participants utilized the left inferior frontal gyrus during verbal fluency tasks whilst older subjects activated the right inferior/middle frontal gyrus resulting in poorer scores. On the other hand, other research studies demonstrate that no correlation is present between age and language outcomes (Lazar & Antoniello, 2008; Lendrem & Lincoln, 1985; Pedersen et al., 2004; Plowman et al., 2012; Watila & Balarabe, 2015). Due to this incongruity, Yamaji and Maeshima (2021) conclude that language functions are not related exclusively to age. Sample characteristics and/or methodological variations in different studies may contribute to the different or conflicting findings.

Handedness and Stroke. Globally, there is a propensity for the right hand more than the left hand, with 10% of people being left-handed (Papadatou-Pastou et al., 2020; McManuc, 2009; Faurie & Raymond, 2004). Hand dominance is considered imperative when performing motor skills as the dominant hand is utilized for most daily and recreational activities (Provins, 1997). A stroke might give rise to an impairment of the dominant hand, compromising participation in several tasks. A large number of people after a stroke experience upper extremity impairment (Wade, 1989). Around 45% to 50% of people sustain a left-sided lesion resulting in right paresis (Brosseau et al., 2001). Harris and Eng (2010) noted that if complex activities of daily living (ADLs) (e.g., dressing, eating, and bathing) are impacted, people with stroke are more likely to use compensatory strategies along with adaptive equipment to minimize the effect of hand dominance. They conclude that one demonstrates less impairment but does not function if the dominant hand is affected after a stroke. Some studies have reported poorer functional outcomes for right hemisphere lesions for muscle strength (Waller & Whitall, 2005), motor skills

(Bernspng & Fisher, 1995), and measures of Activities of Daily Living (ADL) (Waller & Whitall, 2005; Shelton & Reding, 2001), although others have reported no ramification of lesion on impairment and ADL measures (Macciocchi et al., 1998).

Handedness, Aphasia, and Outcomes Post-stroke. Hand dominance is associated with the language-dominant hemisphere, where 96%, 85%, and 73% of right-handed, ambidextrous, and left-handed people, respectively, have the left hemisphere mainly responsible for language functions (Knecht et al., 2000). Older studies have proclaimed that typically, left-handed people acquire aphasia more than right-handed people (Subirana, 1958; Brown & Simonson, 1957).

The theory of lateralization is also prominent in language recovery in right and left-handed people. Ferro et al. (1999) noted that ambidextrous and left-handed people have a higher chance of having a bihemispheric representation of language and may have a more significant potential for recovery (Pedersen et al.,1995; Pickersgill & Lincoln, 1983). The premise that bilateral language representation in left-handed people accelerates language recovery has not been well proved (Lazar et al., 2008; Watila & Balarabe, 2015).

Disparate studies have reported that handedness, as an independent factor, has not been evinced to influence aphasia recovery (Pedersen et al., 1995; Pickersgill & Lincoln, 1983). Knecht et al. (2002) remarked that left-handed subjects are more likely to recover affected language function because they have some language areas on the unaffected side.

More recently, a study by Hartwigsen et al. (2013) has examined the role of the right hemisphere after left hemisphere stroke in aphasia recovery as it is still ambiguous. They showed that a virtual lesion in the left inferior frontal gyrus resulted in increased activation of the right hemisphere. They postulate that the right

hemisphere may actively contribute to language functions by supporting the disrupted processing in the left hemisphere via interhemispheric connections. These findings elucidate the dynamic regulation of interhemispheric interactions in the human brain.

Gesa Hartwigsen et al, (2013) investigated the areas of the brain which are responsible for speech and how they interact. She observed that both hemispheres interact during speech repetition. In another recent study, Hartwigsen and colleagues at Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig discovered that when there is a second injury in the left side of the brain, the right side becomes more active. These findings might have implications for handedness, language-dominant hemisphere, and aphasia outcomes post-stroke.

Multilingualism and stroke. Aphasia is acquired about as frequently in monolinguals as in multilingual people (Alladi et al., 2016). Some studies recount that language switching evident by bilingual individuals involves the same neural pathways as non-verbal, higher-order cognitive control mechanisms (Declerck & Philipp, 2015; Abutalebi & Green, 2008). Thereupon, this launched a branch of research focusing on whether bilingualism positively affects cognition, other than the linguistic domain, knowns as the ‘bilingual advantage’ (deBruin et al., 2015). Woumans et al. (2015) affirmed that multilingualism could offer protection against cognitive decline, for example, in Alzheimer’s dementia. This protection is also known as ‘cognitive reserve’ (Alladi et al., 2016; Ardila & Lahiri, 2020). This reserve has been related to better performance in cognitive abilities such as executive functions (Bialystok, 2015; 2011), spatial tasks (Greenberg et al., 2013; McLeay, 2003), and working memory (Luo et al., 2013).

However, according to Mukadam et al., (2017), bilingualism does not offer any defence against cognitive decline. The authors evaluated monolinguals and bilinguals for cognitive decline and the start of dementia symptoms in 13 trials (five prospective, eight retrospective). The analysis of four of the five prospective investigations led to the conclusion that bilinguals and monolinguals did not differ from one another, however seven of the eight retrospective studies revealed that bilingualism led to a four-to-five-year delay in the onset of symptoms. The researchers chose to not focus on the retrospective studies as they claim that they may be confounded by participants' cultural background and education levels.

Multilingualism, Aphasia, and Outcomes Post-stroke. Several studies have stated that bilingualism is a type of cognitive reserve (Bialystok et al., 2004; Gold et al., 2013). Similarly, Alladi and colleagues (2016) deduced that bilingualism correlates with a better cognitive profile after stroke, possibly because of the augmented cognitive reserve. They also add that multilingual PwA were shown to have a better recovery post-stroke. Recently, a paper that delved into the protective role of bilingualism in aphasia concluded that bilingual PwA required less time to react to cognitive tasks, when compared to their monolingual counterparts (Dekhtyar et al., 2020).

On the contrary, Dick and colleagues (2019) found no bilingual advantage on cognition. Even though diverse studies support the notion of 'bilingual advantage', others challenge this assumption. Calvo et al. (2015) believe that studies supporting this concept concentrate mostly on working memory and executive function; consequently, a new methodology is needed to eliminate possible sampling errors and confounding errors that might have implied the bilingual cognitive advantage.

Abutalebi and Green (2008) noted that both monolingual and bilingual PwA have different neuroplastic capacities during language recovery after stroke. This difference is associated with the diverse stimulation of their language control during language development and use. According to Kuzmina et al. (2019), language recovery is highly dependent on multiple factors, including the age of language acquisition, language exposure, linguistic similarity between known languages, pre-morbid proficiency, and educational levels. In addition, brain lesions do not influence the first language and the second language in the same way (Van der Linden et al., 2018; Verreyt et al., 2013), thus making the recovery of multilingual PwA a complicated matter.

Paplikar et al. (2019) investigated aphasia severity at three months post-stroke of bilingual and monolingual PwA. They controlled for other variables and found that aphasia severity was significantly higher in monolinguals than in bilinguals. It was inferred that even though bilingual PwA have an equal chance of having aphasia after stroke, it is likely to be less severe than their monolingual counterparts. Contrarily, Hope et al. (2015) ascertained that bilingual non-native English speakers with aphasia performed worse in language tasks administered both in English and in their native language than monolingual native English-speaking individuals with aphasia. This inconsistency could be pinpointed to the premorbid language proficiency or possibly the exemplars used for naming may not have been typical of the referents of target nouns in the patients' native languages. Participants in the study by Paplikar et al. (2019) lived in a multilingual environment and used the language in daily interactions (Vasanta et al., 2010), whereas participants in Hope et al's (2015) study were in an English-speaking environment and typically used

English most of the time premorbid. This further consolidates that language use and exposure affect language recovery (de Briun et al., 2015).

Penn and colleagues (2010) demonstrated that bilingual PwA had better conversational skills related to retained executive functions than monolingual PwA. The bilingual PwA were tested in English, their competent language, and it was found that they had better topic initiation and control, repair, and conversational flexibility, which were linked to their cognitive flexibility. The monolingual PwA had scattered conversational output, which was correlated with their executive functions.

In the 'Kolkata Aphasia Study', Ardilla and Lahiri (2020) investigated the language abilities of 155 monolingual and 53 bilingual PwA post-stroke. They remarked that aphasia was less severe in bilinguals than in monolinguals; consequently, they proposed that prognosis could be anticipated to be better in bilingual than in monolingual PwA.

Numerous studies aim to analyse the recovery patterns of languages in bilingual aphasia (Paradis & Libben, 2014; Faroqi-Shah et al., 2010; Lorenzen & Murray, 2008; Fabbro, 2001). Despite this, no information is available about the magnitude of aphasia recovery in bilingual patients when compared with monolingual individuals. This topic is pertinent to the bilingual/multilingual setting in Malta, but it required a dedicated study with a specific focus on it.

Education and Stroke. Multiple studies correlated low education level with increased stroke risk (Jackson et al., 2018; Sjölander et al., 2013), independent of other risk factors. Therefore, low education levels were associated with stroke incidence (Ferrario et al., 2017; Andersen et al., 2014). In a recent prospective study by Jackson et al. (2018), where 253,657 participants were followed up for a mean

time of 4.7 years, low education levels were linked with increased stroke risks in both genders.

Congruently, Xiuyun and colleagues (2020) found that higher educational levels were linked with a decreased rate of ischaemic stroke incidents but not haemorrhagic stroke incidence. It is thought that education attainment is linked to stroke incidence due to the benefits of education; specifically, a higher educational level is associated with a better and healthier lifestyle, better working conditions, and better access to health care (Woolf & Braveman, 2011; Kilander et al., 2001).

In addition, years of education are regarded as a measure of cognitive abilities because they reflect educational attainment, which could allude to innate intelligence (Stern, 2009). Staff et al. (2004) noted that high years of education correlate with increased synaptic function in the brain, more resilient to ageing and disease.

A higher level of education was associated with better motor and functional recovery in inpatient rehabilitation post-stroke (Putman et al., 2007). One study found that lower levels of education influenced functional dependence in ischaemic stroke survivors (Fernandes et al., 2013).

Education, Cognition, Aphasia, and Outcomes Post-stroke. Extensive research unanimously agrees that PwA coming from higher educational achievement suffer from a less severe aphasia post-stroke with a faster recovery than those having lower educational levels (e.g. Gonzalez-Ferbabdez et al., 2011; Connor et al., 2001).

Some studies attribute this to the increased cognitive reserve in higher education participants (Staff et al., 2004). Elkins and colleagues (2017) argue that this is just a possibility as little research has tackled the notion of cognitive reserve in

relation to stroke. Similarly, Marinelli et al. (2017) examined 189 PwA with language tests and the Cognitive Test Battery for Global Aphasia (CoBaGA; Marinelli et al., 2009). They grouped the PwA into three different subgroups with different types and severity of cognitive impairment: Group 1 had intact intellectual functions, Group 2 was more heterogeneous and generally performed worse than Group 1, and Group 3 included PwA with severely impaired cognitive functions. The groups differed in educational attainment, where the best cognitive efficiency was characterized by the highest level of school attendance. Therefore, they concluded that the group with a significantly higher education level showed higher percentages of accuracy for all cognitive functions, predicting a better and faster recovery of linguistic abilities.

Recently, more studies have investigated the correlation between linguistic deficits and cognitive difficulties in PwA. The latter are strongly associated with more severe aphasia (Kang et al., 2016). Kalbe et al. (2005) report that the presence of cognitive difficulties with language impairment worsens the symptomatology of aphasia, and this impacts therapy effectiveness (Albert, 1998). Consequently, a high level of cognitive abilities predicts better and faster recovery of linguistic abilities (Hachioui et al., 2014). In opposition, Helm-Estabrooks et al. (1995) presume that cognitive functions are not linked to the level of education.

Connor and colleagues (2001) demonstrated no significant relationship between educational achievement and aphasia prognosis. Despite that, they noted that initial aphasia severity was worse in those with less education than in those with higher education levels. Conversely, Lazar et al. (2008) noted that the education level does not impact initial aphasia severity or prognosis. Likewise, Watila and Balarabe (2015) propose no apparent link between the education level and aphasia severity or recovery. Plowan and colleagues (2012) hint that possible reasons for

this lack of evidence are because of the intertwined relationship amongst the following characteristics: socioeconomic status (SES), literacy levels, general intelligence, pre-morbid learning disabilities, and cultural influences.

Some studies reported that education was linked to aphasia severity but not the recovery rate (Laska et al., 2001). Lazar and colleagues (2008) support the notion that years of education do not affect language recovery post-stroke. In opposition, a study by Hills and Tippet (2014) concluded that education levels impact language recovery. The results prove that the improvement of 45 patients with acute left hemisphere ischaemic stroke 35 months post-stroke could be predicted by a model comprising of education, age, lesion size, and antidepressant use. They determined that better language recovery from chronic aphasia is associated with years of schooling.

According to Chapter 327 of the Laws of Malta – The Education Act – and following amendments, education in Malta is mandatory for all children and youths aged from 5 to 16 years. It comprises six years of primary education followed by five years of secondary education. It is offered full-time and free in all state schools, but parents can opt to educate their children in Church or Independent schools at a cost. Locally, on the 1st of February 1946, education became mandatory for children up to 14 years. After Malta gained its independence in 1964, a new Education Act was passed 1988, which reduced the compulsory education age to 5 years. This is defined in Chapter 327 of the Laws of Malta - The Education Act - and subsequent amendments. Therefore, most of the elderly population may have not benefited from compulsory schooling for up to 16 years and local studies should take this phenomenon into account.

Socioeconomic Status (SES), Stroke, Aphasia, and Outcomes Post-stroke. SES is an essential predictor of stroke incidence, impact, and mortality (Johnston et al., 2009; Kim & Johnston, 2011). The association between lower SES and stroke incidence has been reported across stroke subtypes, but some studies have reported a non-significant or weaker association with haemorrhagic stroke (Cesaroni et al., 2009; Li et al., 2008; Kuper et al., 2007).

Diverse studies highlight that people with a lower SES experience worse outcomes post-stroke (Bettger et al., 2014; Chen et al., 2013; Grube et al., 2012; van den Bos et al., 2002). A review demonstrated an increased impact of stroke in lower SES people with 30% higher incidence, with more severe comorbidities and higher case fatality (Addo et al., 2012). This study's findings pinpoint that more impoverished people in a population have poorer outcomes after stroke. Feigin et al. (2014) noted that from 1990 to 2010, stroke incidence diminished significantly by 12% in high-income countries whilst it increased significantly by 12% in low income and middle income, despite being nonsignificant. The rising trend of urbanization, pollution, smoking, obesity, physical inactivity, unhealthy diets, and aging, particularly in low- and middle-income countries, may contribute to the rising incidence of stroke in these countries, along with a larger population with limited access to healthcare (Avan et al., 2019).

In a study by Connor et al. (2001), 39 PwA were examined at both 4 and 103 months post-stroke to determine the degree to which educational achievement and SES influenced initial aphasia severity and recovery. They report that both educational achievement and SES did not impact the aphasia recovery rate. Although some research shows that SES is likely to affect initial aphasia severity and language recovery, the sample sizes are often small; thus, it is problematic to draw

any conclusions (Ali et al.,2021). This was also acceded by Hunting Pompon and colleagues (2017).

Stroke Characteristics

According to Jeffers et al. (2020), plentiful research indicates that some factors post-stroke could reveal the recovery potential of someone suffering from a stroke. Both lesion location and volume have been shown to affect recovery (Chen et al., 2000), but volume, without consideration for location, is considered a poor predictor of prognosis (Chen et al., 2000; Page et al., 2013). A retrospective study by Bhaskar et al. (2017) established that initial stroke severity calculated by the National Institutes of Health Stroke Scale (NIHSS) is the strongest predictor of stroke outcomes, with a worse score correlating with poorer outcomes. The outcomes considered were the 90-day functional outcome, duration of hospital stay, and mortality. They also note the thrombolytic therapy and care in a stroke unit assumed significance for one or more of the final measures of outcome. These factors will be further expanded on in the following section.

Stroke Type. The majority of strokes occur due to cerebral infarctions (87%). These are known as ischaemic strokes. The remaining strokes are haemorrhagic strokes resulting from an intracranial haemorrhage (Feign et al., 2009; Roger et al., 2011). A haemorrhagic stroke is equated with a higher fatality rate when compared with ischaemic strokes, and around 50% of patients with a haemorrhagic stroke die within the first-month post-stroke onset (Labovitz & Sacco, 2001; Vermee et al., 2002). In accordance with the studies mentioned, Simon (2013) notes that patients with an ischaemic stroke have a better survival rate than those suffering from a

haemorrhagic stroke as the latter damages brain cells and may lead to extra pressure on the brain or spasms in the blood vessels.

It is presumed that patients with a haemorrhagic stroke have better functional outcomes than those having a non-haemorrhagic stroke (Perna & Temple, 2015). Perna and Temple (2015) measured functional outcomes using the Mayo Portland Adaptive Inventory-4 (Malec, 2005), which assesses physical, cognitive, and emotional behaviour and social functioning. This finding is also reported by Paolucci and colleagues (2003), who found that patients with a haemorrhagic stroke had better functional outcomes at discharge. Other studies report that people having a haemorrhagic stroke had greater improvement but progressed slower (Kelly et al., 2003; Ween et al., 1996).

Stroke Type, Aphasia, and Outcomes Post-stroke. Paolucci and colleagues (2003) found no significant differences in the presence and type of aphasia between ischaemic and haemorrhagic strokes. As delineated in the previous section, people with a haemorrhagic stroke have better outcomes than ischaemic stroke survivors (Basso et al., 1982a, 1982b; Jung et al., 2011). This denotes that an ischaemic stroke is a negative predictor of aphasia recovery. Basso et al. (1992) explain that this could be due to fibre bundles being displaced without damage in haemorrhagic strokes.

In a recent study by Lahiri (2020), the ratio of PwA between ischaemic and haemorrhagic strokes did not differ (0.4 versus 0.39). Using univariate analysis, they note that PwA with an ischaemic stroke had poorer recovery, which was attributed to the nature of damage imparted to the brain tissue by ischaemia compared to haemorrhage. Another study observed that global aphasia was the most common type in people with post-ischaemic stroke whilst Wernicke's aphasia was more

frequent in those who have suffered from a haemorrhagic stroke than in those patients with an ischaemic stroke (25% vs 7.69%, respectively) (Cheon et al., 2020). They also note that there were no differences in the initial assessment using the Korean version of the Frenchay Aphasia Screening Test scores and the Korean version of the Western Aphasia Battery.

Lesion Site. The location of the infarct reveals regional factors linked to poor outcomes. The limbic, default-mode, and language areas in the left hemisphere, as well as the visuospatial and motor regions in the right hemisphere, are all critical for prognosis (Yassi et al., 2015).

Lee et al. (2016) report that even though several researchers have investigated the long-term outcomes and prognosis of stroke lesions, there is still a lack of published data. In their study, they concluded that the anterior limb and genu of the internal capsule are related to upper limb recovery whilst the anterior half of the middle third of the corona radiata, the anterior limb and genu of the internal capsule, and the caudate nucleus are linked to the recovery of the lower limbs. In addition, the middle third of the corona radiata and the lentiform nucleus were linked with sensory recovery.

Stroke Lesion Site, Aphasia, and Outcomes Post-stroke. A study by Hope et al. (2013) noted that in accordance with the conclusion from a review by Plowman et al. (2012), lesion site influences speech production abilities post-stroke. Individual regions of the brain are known to be traditionally responsible for language, namely the Broca's and Wernicke's sites, along with the transcortical and subcortical pathways connecting them (Charidimou et al., 2014).

Several studies have demonstrated that language areas associated with the Broca's complex, including the inferior prefrontal gyrus, insular cortex, Wernicke's

complex, premotor cortex, and superior temporal gyrus, are heavily linked to language (Friederici & Gierhan, 2013; Poeppel, 2014; Sul et al., 2016). Consequently, a considerable number of studies have concluded that a lesion in the superior temporal gyrus, notably in the posterior superior temporal gyrus, leads to worse aphasia and lengthy recovery of language post-stroke (Hanlon et al., 1999; Kang et al., 2010; Watila & Balarabe, 2015).

In addition, a lesion in the basal ganglia often signifies an occlusion of the middle cerebral artery (MCA) before the bifurcation into the upper and lower division. Nadeau and Crosson (1997) noted that an intact basal ganglion in a MCA stroke could indicate that the embolism progressed to the isle Corte or beyond, which results in less severe ischaemia.

In a retrospective study by Sul and colleagues (2019), they observed 31 right-handed PwA and reported that specific lesion sites are predictors of aphasia prognosis in patients with their first stroke one-year post-stroke. Table 2.1 summarizes their findings.

Table 2.1

Summary of lesion location and its effect on language (Sul et al., 2019)

Lesion Location	Effect
Rolandic cortex, Heschl's gyrus, posterior corona radiata, supramarginal cortex, superior longitudinal fasciculus, superior temporal gyrus, and insula	Overall poor outcomes
Inferior triangularis and inferior operculum of the frontal cortex, supramarginal cortex, and insula	Poor fluency
Parietal cortex, angular cortex, temporal middle cortex, sagittal stratum, and superior temporal cortex	Poor comprehension skills
Angular cortex, supramarginal cortex, posterior corona radiata, superior longitudinal fasciculus, internal capsule, superior temporal cortex, and temporal middle cortex	Poor recovery of naming abilities
Superior temporal cortex, posterior corona radiata, and superior longitudinal fasciculus	Poor recovery of repetition skills

The PLORAS Database contains anatomical and functional imaging data, as well as standardized sensory, motor, and cognitive ability ratings, demographic information, and medical history. The database largely contains data from stroke survivors, with the goal of predicting language prognosis and recovery after stroke based on a single structural brain scan that identifies the location and extent of brain damage (Seghier et al., 2016).

Hemisphere Affected, Stroke, and Outcomes. There are insufficient studies on how the side of the brain on which the lesion appears affects the rate and amount of stroke recovery. Some cortical functions may differ as a result of a hemispheric lesion. Generally, persons with left-hemispheric (LH) stroke have language deficits (Mohr et al., 2016; Lin et al., 2015; Fink et al., 2008, Ito et al.,2008) whilst hemispatial or unilateral neglect present themselves more frequently and gravely with a right-sided (RH) hemispheric stroke (Stein et al.,2016; Fink et al., 2008).

Patients with RH lesions perform worse than those with LH lesions, according to some research of the outcomes of patients referred to rehabilitation facilities (Laufer et al., 2003; Ween et al, 1996). Nonetheless, other studies have not demonstrated this to be the case (Ring et al.,1997). Some research of incident stroke patients have revealed a worse functional prognosis for patients with RH stroke, but not others (Macciochi et al., 1998; Johansson et al.,1992).

Fink and colleagues (2018) discern no differences in functional outcomes between persons suffering from RH stroke and LH stroke, as measured by the modified Rankin Score at 90 days. They found that the baseline NIHSS score strongly correlates with functional outcomes for patients with both RH and LH stroke. However, patients with RH stroke are had lower scores and the prognostic implication of the NIHSS score is different for each hemisphere.

Hemisphere Affected, Aphasia, and Outcomes. Notwithstanding overwhelming research alluding that the LH is dominant for language processing in most right-handed persons, there is growing evidence that the RH supports language functionality in neurologically typical individuals (Sollmann et al., 2014; Hartwigsen et al., 2010) and language recovery subsequent to LH damage (Nardo et al., 2017; Xing et al., 2016; Forket et al., 2014; Thiel et al., 2006; Crinion & Price, 2005) or LH processing (Jung & Lambon Ralph., 2016; Hartwigsen et al., 2013).

An experimental study by Gajardo-Vidal et al (2018) uncovered through associating behavioural, lesion and fMRI data that permanent speech comprehension difficulties were commonly noted in right-handed patients with right inferior frontal damage which can be elucidated by disruption to normal functional anatomy instead of being attributed to crossed aphasia/atypical language lateralization. Furthermore, the same regions of the RH are involved in executive functions and sentence comprehension.

Research regarding the different aphasia outcomes based on the hemisphere involved in the stroke is scarce as aphasia post-RH stroke is not as common as LH aphasia after a LH stroke.

Lesion Volume. Many studies have investigated the correlation between lesion volume and stroke severity and lesion volume and function outcomes (Binkofski et al., 2001; De Reuck et al., 2004; Engelter et al., 2006; Johnston et al., 2002). Nonetheless, little research looks at the relationship between lesion volume and stroke severity in the acute stage (Leinonen et al., 2000; van Everdingen et al., 1998).

Leinonen and colleagues (2000) found a consequential correlation of the lesion volume (MRI scans) with the NIHSS and the Barthel Index assessed at a mean of 2.2 days poststroke in 22 patients with acute stroke. Similarly, Schiemanck et al. (2005) correlated the lesion volume with the NIHSS, Barthel Index, and Rankin Scale. They discovered that an ischaemic lesion volume is greatly associated with stroke severity and correlates with motor impairment and activity limitations. This study did not consider the influence of lesion location.

Lesion Volume, Aphasia, and Outcomes Post-stroke. Differing results have been reported regarding the relationship between language recovery post-stroke and lesion size/volume. Considerable studies discovered a significant relationship between the latter two factors (Benghanem et al., 2020; Heiss et al., 2003; Henseler et al., 2014; Hope et al., 2013; Plowman et al., 2012; Watila & Balarabe, 2015) whilst others noted that there is no association between lesion size and aphasia severity or language recovery (Laska et al., 2001; Lazar et al., 2008). In general, a small lesion in language-sensitive areas results in more initial language deficits and a slower overall recovery of language function than a large lesion in an area less strongly associated with language ability.

Another study by Døli et al. (2021) established that increased lesion volume was linked to patients' performance on the total aphasia score as well as the subtests of auditory comprehension, repetition, naming, reading comprehension, and reading aloud. Therefore, lesion volume negatively impacts initial aphasia severity. This is consistent with the findings of various studies that demonstrate lesion volume is a key determinant in aphasia healing and prognosis (Forkel et al., 2014; Plowman et al., 2012).

Forkel et al. (2014) discovered that lesion volume was a predictor of aphasia recovery six months after a stroke using diffusion tractography. Plowman et al. (2012) investigated stroke-related factors in post-stroke recovery and discovered that while both lesion volume and lesion site were associated with aphasia severity six months after the stroke, initial aphasia severity was the best predictive determinant of aphasia recovery. However, there appears to be agreement that when evaluating the first aphasia assessment result post-stroke, lesion location may be more relevant to examine than lesion size (Cherney & Robey, 2008; Crinion et al., 2013).

Initial Stroke Severity and Outcomes. Wouters and colleagues (2018) remarked that the initial stroke severity, measured by the NIHSS, is a good predictor of functional outcome 90 days post-stroke. They found that accounting for the changes in stroke severity throughout the first 24 hours improves the accuracy of a multivariate prediction model. The receiver operating characteristic curve analysis showed that an NIHSS score of <7 was a good predictor of functional outcomes, which is similar to findings in previous studies (Adams et al., 1999; Sablot et al., 2011; Sato et al., 2008; Schlegel et al., 2003). Furthermore, an NIHSS score of 5 was strongly linked to returning home, a score of 6–13 to rehabilitation, and a score of >13 to admission to a nursing institution (Schlegel et al., 2003).

A study executed by Adams et al. (1999) highlighted that an NIHSS score less than 7 was found to be a strong predictor of long-term outcomes whilst a high score, particularly more than 16 or 17, was found to be associated with a higher mortality and poor outcomes. Bhaskar et al. (2017) published a study in Neurology India investigating the impact of acute stroke severity on 90-day mortality and stroke outcome. This retrospective study investigated 608 acute ischaemic stroke patients from a single tertiary care centre in Australia from January 2006 to December 2013

and 608 acute ischaemic stroke patients from a tertiary care centre. The aim of the study was to ascertain how the initial stroke severity compares to other possible outcome indicators in predicting the outcome of ischaemic stroke. Three outcomes were evaluated: 90-day functional result, hospital stay duration, and mortality. The investigators found that NIHSS at stroke onset was the strongest predictor, with a higher score indicating a worse outcome in all three endpoints. Although age, thrombolytic therapy, and care in a stroke unit all played a role in outcome variables, the initial severity of the stroke had the highest link to the outcome.

Previous stroke and outcomes. Recurrent strokes are still common despite increased efforts for risk factor management (Lee et al.,2016). According to Boulanger et al. (2018) the recurrence rates range from 7–20% at one year to 16–35% at five years. Within a few days or weeks following the initial occurrence, almost half of the patients who survive an acute ischemic stroke or TIA have an increased chance of having another stroke, especially within the first week (Arsava et al., 2016).

A history of stroke is thought to be associated with significantly higher rates of all-cause death and elevated risk of subsequent stroke. However, a history of transient ischemic attack[12] (TIA) was not associated with a significantly elevated risk for death or another stroke (Hacke et al., 2019). This was observed in the ARFIELD-AF risk score for death and stroke/SE at baseline which considers the history of stroke and not a TIA. The data from the GARFIELD-AF[13] cohort were used to create the GARFIELD-AF risk score, which was then independently verified in a substantial

[12] According to the American Heart Association and the American Stroke Association (AHA/ASA) Transient Ischaemic Attack (TIA) is a transient episode of neurologic dysfunction caused by focal brain, spinal cord or retinal ischemia without acute infarction." (Donald et al., 2019).

[13] The Global Anticoagulant Registry in the Field-Atrial Fibrillation (GARFIELD-AF) is a prospective, observational, worldwide registry of 52,014 patients with newly diagnosed AF who were enrolled in 35 countries between March 2010 and August 2016.9 All patients were followed for a minimum two years.

cohort of AF patients in the USA (Fox et al.,2017). Compared to patients with a history of stroke (who were classified as being at intermediate risk) and a history of both stroke and TIA (who had the worst prognosis and highest prevalence of comorbid disease)., patients with a history of TIA had a lower GARFIELD-AF risk score in this study.

Recurrent strokes have been related to functional dependence and higher mortality (Jorgensen et al., 1997), however, this has not been adequately explored. Elwan and his colleagues (2021) note that the second stroke is not simply another stroke as it causes additional strain on brain plasticity leading to magnified cognitive and physical impairment. They recruited forty participants in group I with a first stroke and another 40 in group II with a second stroke. The results highlight significant differences between the two groups in the Modified Rankin Scale (mRS) scores and NIHSS scores at baseline, after 2 weeks and after 3 months. The second group had a high NIHSS score which implies that the deficits and outcomes are worse as Alemam and colleagues (2017) showed a highly statistically significant correlation between NIHSS score and stroke outcomes.

Thrombolysis and Outcomes. Thrombolysis is beneficial in patients with acute cerebral ischaemic stroke (Saver, 2013), referring to the degradation of fibrin, which forms the cloth that blocks blood flow to the brain. Early reperfusion results in early blood supply to the brain territory devoid of oxygen supply, and the tissue can be salvaged, thus reducing the damage. Thrombolytic drugs break down blood clots by activating plasminogen. The potency of the thrombolytic drugs relies upon the clot’s age and the lytic’s specificity for the fibrin (Loren et al., 1989).

The time window for lysis was found to be the most crucial factor. An independent study that re-analysed the National Institute of Neurological Disorders and Stroke data highlighted that it is essential to treat the patients as early as possible (Hacke et al., 2004). The odds ratio of a favourable 3-month outcome increased as the onset to treatment time decreased (p = 0.005). Benefits were best observed when patients were treated within the first two hours after onset (Marler et al., 2000). The Royal College of Physicians (2012) argue that thrombolysis should be considered for everyone within 3 hours of symptom presentation, irrespective of age, provided that there are no contraindications.

An audit was done in Malta in 2012. Patients admitted with a stroke to the state general hospital were recruited over eight months. Only four patients out of 251 patients (1.59%) were eligible for thrombolysis, and they all agreed to receive the treatment. The most typical reasons why patients in this audit were not eligible for thrombolysis include (1) presentation after 3 hours of the onset of symptoms, (2) over 80 years, (3) high blood pressure, (4) haemorrhagic stroke, (5) minor deficits and/or improvement of symptoms, (6) signs and symptoms not diagnostic of stroke, (7) prior anticoagulation, (8) diabetes with the previous stroke, (9) symptoms lasting less than 30 minutes, and (10) seizures. Two of the patients who received treatment were sent for rehabilitation: one was sent home, and the other died four days later (Micallef et al., 2015).

***Thrombolysis and Aphasia Outcomes*.** Aphasia caused by an ischaemic stroke is thought to have a low chance of recovery (Croquelois & Bogousslavsky, 2011; Godefroy et al., 2002; Pedersen et al., 2004). Denier et al. (2015) looked at the aphasia recovery following thrombolysis in 137 PwA post-stroke. Aphasia

improved in most patients within a week of the stroke, and in 35 cases, it improved dramatically.

Patients who did not have limb motor impairments recovered from aphasia more quickly. Similarly, Felberg et al. (2002) noted that 22% of PwA with a middle cerebral artery infarction demonstrated significant improvement after thrombolysis with a pattern of delayed and worse recovery of aphasia compared to limb motor impairments (In this study, only seven PwA had a remarkable recovery, including two with complete aphasia recovery, four with partial recovery, and one with no change.

Menichelli et al. (2019) administered a language assessment to 116 PwA after an ischaemic stroke. They found that aphasia recovery was more significant in those who received thrombolysis, with a significantly higher percentage of patients completely recovering from aphasia in the treated group than in the non-treated group. They also note that global aphasia was lower in the PwA in the treated group than in the non-treated group. This is in accordance with prior research (Crijen et al., 2016; Furlanis et al., 2018), which supports that reperfusion treatment is effective in treating aphasia of varying degrees of severity.

Mechanical Thrombectomy and Outcomes. Mechanical thrombectomy is a procedure performed under local anaesthesia when an arterial occlusion is present. The blocked thrombus is trapped between the stent strut and vessel wall when the stent retriever is deployed, which allows rapid restoration of the blood flow.

A study has shown that mechanical thrombectomy is not better than thrombolysis (Kidwell et al., 2013). Other studies have noted considerable improvement in clinical outcomes (Flynn et al., 2017). It is effective up to six hours post-stroke onset, although it indicates exponential diminishing benefits with increasing time from stroke onset (Berkherem et al., 2016; Goyal et al. 2016). There

is little clinical experience with mechanical thrombectomy as it is costly and needs specialized units with extensive training. Even though reperfusion therapies were introduced in acute stroke management, PwA still need inpatient rehabilitation and SLT (Meyer et al., 2012). Four studies have noted that mobility outcomes are more significant than aphasia outcomes following mechanical reperfusion therapy (Crijnen et al., 2016; Layton et al., 2006; Santos et al., 2014). Little data is available regarding the effects of mechanical thrombectomy on aphasia outcomes.

Initial Aphasia Severity and Outcomes . Initial stroke and aphasia severity are considered stroke-related factors that affect outcome measures as studies highlight a relationship between the two elements (Berthier, 2005; Laska et al., 2001; Pedersen et al., 2008). Initial aphasia severity appears to be one of the greatest indicators of aphasia outcomes among clinical factors (Glize et al., 2017).

Lazar et al. (2010) affirmed that initial severity not only predicts the outcome of aphasia, but it is the greatest predictor of outcomes. Laska et al. (2001) highlighted that those individuals with severe aphasia (those who had global and Wernicke's aphasia) improved more than those suffering from mild aphasia, yet they did not achieve the same level of language function as people who had milder aphasia. Correspondingly, Pedersen et al. (2008) noticed that language outcome could be determined by initial stroke and aphasia recovery but not by age, gender, or aphasia type. They observed that aphasia symptoms remained one year after stroke; however, the majority of participants improved, having language functionality. This relationship is most predictive of long-term language outcomes. Plowan et al. (2012) indicated that the optimal prognostic window is two to four weeks after stroke.

A previous study by Pedersen and colleagues (2004) evaluated potential predictors for language outcome one-year post-stroke. They considered the initial

aphasia severity and stroke severity as possible factors. From the data accumulated, they were able to assume that around 30–40% will have global aphasia in the first week, about 12% will have Broca's aphasia, and 15% will have Wernicke's aphasia. However, the percentage of anomic aphasia is uncertain. After one year, 61% of their patients still presented with aphasia, although it was milder. This was also observed in other older studies (Kauhannen et al., 2000; Kertesz & McCabe, 1977; Pashek & Holland, 1988). Another study presented a modified version of the Aphasia Quotient for assessing acute stroke, which included the comprehension, repetition, and naming sections of the Western Aphasia Battery, having all sections equal weight on the final score (Lazar et al., 2010). They recruited people with mild and moderate aphasia post-stroke and reported that initial severity was a good predictor of recovery during the first 90 days post-stroke.

A study which included individuals with severe aphasia, discovered that the relationship between stroke severity and other characteristics in patients with more severe aphasia might be different (Benghanem et al.,2019). Gerstenecker and Lazar (2019) affirmed that the inclusion of individuals with severe aphasia makes data analysis more challenging, but it is consequential in order to depict a more realistic and therapeutically relevant scenario.

Lahiri et al. (2020) observed that the initial aphasia severity remains the most important predictor for aphasia recovery post-stroke, given comparable rehabilitation measures to all the participants. Aphasia severity, which is related to lesion volume, is one of the few characteristics that has been deemed as a valid predictor of SLT results, and it is well believed that patients with more severe aphasia are less likely to respond to SLT (Pedersen et al., 2004; Plowman et al., 2012). The trials by Breitenstein et al. (2017), Nouwens et al. (2017), and Godecke et al. (2021)

concurred that aphasia severity was a strong predictor of overall outcome where individuals with severe aphasia benefit less from SLT. Aphasia severity is multidimensional because different PwA might present with very different language impairment profiles. Despite this, patients with more severe aphasia have a lower chance of spontaneous recovery and therapy-induced recovery. Moreover, according to a study done by Cheng et al. (2020), SLPs are aware of the relationship between severity and treatment outcome. They distributed a survey to 54 SLPs where the severity and nature of post-stroke aphasia were identified as the most important factors to consider for an aphasia prognosis.

Some studies report that improvement in comprehension is more significant than that in speech production (Kenin & Swisher, 1972; Vignolo, 1965), whilst other studies disagree (Demeurisse et al., 1980; Sarno & Levita, 1971; Vignolo, 1965). The findings from Pedersen et al. (2004) indicated that improvement in comprehension is similar to that of spontaneous speech and naming. Recovery in repetition abilities is more varied. Pedersen et al. (2004) hypothesized that this could occur as comprehension is more lateralized with increasing age (Code & Rowley, 1987). Another explanation could be brain plasticity.

Even though the relationship between the two is robust, other studies claim that this is not strong enough for individual prognosis until the second to fourth week (Lendrem & Lincoln, 1985; Pedersen et al. 1995). The findings of Pedersen et al. (2004) confirmed this relationship between initial severity and outcome. In addition, they highlight that taking into consideration the neurological severity of the stroke on admission increased the accuracy of aphasia prognosis. However, one must be cautious in giving a prognosis, as in some cases, patients having low Aphasia Quotient ended up having a nearly average or typical improvement. Similarly,

Enderby et al. (1987) noted a fixed degree of improvement irrelevant to the initial severity within the first three months. The study by Pedersen et al. (2004) found slightly lesser gains with a high initial score.

Studies do not agree on whether the type of aphasia affects language function during recovery. Kertesz and McCabe (1977) commented that the highest recovery rates arise in Broca's and conduction aphasia, whilst the lowest recovery rates occur in untreated global aphasia and anomic aphasia. Sarno and Levita (1979) found no major differences; however, those with fluent aphasia have an earlier recovery when compared to those with global and non-fluent aphasia. Demeurisee et al. (1980) discovered that recovery in global aphasias is poor, but no difference noted between Wernicke's and Broca's aphasia. Other studies (Lendrem & Lincoln, 1985; Lendrem et al., 1988) observed no difference between the aphasias. This is contradicted by Dunn and colleagues (2016). They state that, as aphasia is an evolving syndrome, the initial severity is considered a weak predictor of the severity at acute stroke discharge.

Nonetheless, recent studies have proposed that initial aphasia severity may not be the most pertinent factor in predicting outcomes, implying that other linguistic aspects of initial language deficits may be more relevant, such as phonology score (El Hachioui et al., 2013; Glize et al., 2017; Nouwens et al., 2018). Tábuas-Pereira et al. (2019) cite that the single-word repetition score in the initial stages post-stroke is a reliable determinant of long-term outcome in PwA post-ischaemic stroke.

PwA who have comprehension difficulties, both auditory and reading, have a higher probability of being discharged in a setting other than home (Gonzalez-Fernandez et al., 2013) and are more likely to have a worse functional status at admission to an acute rehabilitation setting (Paolucci et al., 2005). An assumption

that has yet to be researched is that people with comprehension difficulties are less able to understand things essential for their own care and are unable to express complaints about their physical status, which increases the rate of complications.

Another gap in the literature is the study of spontaneous recovery, which has been barely studied in the weeks following the onset of a stroke (El Hachioui et al., 2013; Furlanis et al., 2018; Pedersen et al., 1995), and is impossible to analyse in longitudinal studies due to the effect of therapy and rehabilitation.

Speech-Language Therapy

Aphasia causes deficits at the syntactic (grammatical), lexical (word-form), semantic (meaning) and/or phonological (sound) levels, and there are often complex interactions between these deficits at different psycholinguistic levels. The nature and severity of the impairments result in language characteristics, such as agrammatic sentences or phonemic paraphasias (Whitworth et al., 2008). A Cochrane review established that communication abilities, reading comprehension and expressive language skills were ameliorated when PwA received therapy (Brady et al., 2012). SLT intends to augment communication skills or particular language competencies, such as naming, reading and sentence production. According to the American Speech-Language-Hearing Association (ASHA), treatment can be restorative and/or compensatory; that is, the therapy may seek to improve the impaired function and/or focus on compensation for these functions. Treatment varies according to individuals' language profiles and communication needs. Webster et al. (2015) state that speech-language therapy aims to: (1) maximise gains in everyday communication, (2) reduce the disability associated with aphasia and (3) increase participation. However, according to Brady et al. (2016), 'There was

insufficient evidence within the most recent Cochrane review to establish the effectiveness of one SLT theoretical approach over another, with little indication of a difference between group SLT versus one-to-one SLT, and computer-mediated SLT versus therapist-delivered SLT' (p. 51).

Therapy Type. SLT effectiveness regarding the treatment of aphasia has been reported in a Cochrane review (Brady et al., 2016). The time at which speech therapy is initiated (Nouwens et al., 2015; Allen et al., 2012; Moss et al., 2006) and the duration and intensity of the therapy (Dignam et al., 2015) are still controversial. Numerous SLT treatment approaches could be applied for aphasia intervention.

The ICF (WHO,2001) classifies health conditions into three domains: body functions and structure, activity, and participation (kindly refer to Introduction Chapter, pg 35) The environmental domain is also significant. Galletta and Barrett (2014) contend that all these domains are equally important thus, the best aphasia treatment plans should take into account all of these domains.

As mentioned in the previous section, aphasia therapy approaches focus either on the restoration of skills or compensation for deficits. Russo et al. (2017) explain that restorative approaches specifically target language deficits by retraining from word-finding difficulties to more complex grammatical elements. Aforesaid evidence-based restorative approaches for the management of severe aphasia were shown to be effective for ameliorating language abilities post-stroke (Koyuncu et al., 2016; Laska et al., 2011). These include stimulation, pragmatic, neurolinguistic, syndromic, cognitive-linguistic, functional, conventional, impairment-based, constraint-inducted, verb comprehension and semantic-based approaches (Basso et al., 2013; Brady et al., 2016).

Contrastingly, compensatory approaches predicate on the assumption that language function has been lost (Russo et al.,2017). They aim to establish functional communication and are typically tailored to the needs of each person with language impairment. These functionally oriented approaches are best summarised by the AFROM (Kagan et al., 2008) which demonstrates that the four domains that affect PwA consist of (1) Language and related impairments, (2) Environment, (3) Participation and (4) Personal factors. This approach was explained in more detail in Chapter 1. Conversational therapy approach which will be discussed in the next section, modifying environment, and looking at the factors which either served as a facilitator or barrier to participation to make communicating easier are all examples of treatment focusing on consequence-based approach (Galletta & Barrett, 2014).

The overarching goal of aphasia intervention is improvement in language and communication, therefore, in agreement with Galletta and Barrett (2014) believe that it is crucial to include impairment-based treatment as well as functionally oriented treatment, rather than focusing only on one domain, as this provides for the best outcomes for aphasia post-stroke. A more in-depth overview of therapy types can be found in Appendix A.

Speech Language Therapy Dosage. The Cochrane Collaboration (Brady et al., 2016) found evidence that intensive SLT may make little or no difference in improving language functions for PwA following stroke compared to no therapy. Therapy at high intensity probably improves functional communication and auditory comprehension compared to low-intensity treatment. However, the value of the evidence is meagre due to imprecision in the results and some risks of bias. Clinically, research on therapy dosage in aphasia is essential. An inaccurate dose may be useless, waste resources or be equivalent to no intervention (Baker, 2012).

Kamhi (2012) reported that it is difficult to determine the best treatment and its dosage due to the countless aspects that impact treatment effectiveness. Imperative units needed for rehabilitation include dosage, therapeutic relationship, therapy delivery, client motivation, cognitive ability and neurological stability, along with task-specific practice (Whitworth et al., 2014). Thus, the dosage of the therapy delivered is essential. Treatment aims to work on and increase the brain's natural implicit plasticity, which underpins learning (Crosson et al., 2019). Robbins et al. (2008) highlighted that neurorehabilitation focuses on practice to induce lasting neuronal change. In concordance, Kleim and Jones (2008) reported that increased repetition of the new behaviour/skill is needed to induce lasting neuronal changes; thus, the more frequently two relevant brain events coincide, the more effective the connections established (Pulvermüller & Berthier, 2008). Two components must be considered during rehabilitation: (1) the hypothesis that there is a point at which the intensity of therapy begins to produce diminishing returns, and the dosage associated with a therapeutic 'sweet spot' is yet to be discovered; and (2) the concept of a 'reaction range'; that is, the concept that the response to therapy varies depending on the individual's brain function (Yoder et al., 2012). Therefore, greater intensity of aphasia therapy may not always be better (Godecke et al., 2018).

The recent Cochrane review highlighted that SLT is advantageous for PwA (Brady et al., 2016). There is a plethora of research investigating the optimal intervention intensity and dose (Off et al., 2016; Baker, 2012). Nevertheless, the ideal treatment dose and intensity in aphasia rehabilitation remain unknown (Dignam et al., 2015). No fixed definition of dosage and intensity is available in aphasia research, and these inconsistencies present a challenge for researchers and clinicians. Similarly, there is no definition of dosage in the stroke rehabilitation

literature. The Cochrane review (Brady et al., 2016) defines dosage as hours of therapy provided, reflecting how dosage is most frequently described in studies.

When the correlation between intensity and therapy outcomes has been studied, it is ambiguous whether the effects of therapy result from the intensity at which the treatment was provided or from the contents of the therapy (Sage et al., 2011). Enderby (2012) noted that intervention studies do not comment on optimal intensity, nor do they report on typical aphasia therapy dosage, since benchmarking studies are scarce. Therefore, therapists are not aware if the dosage they are providing or the type of therapy is affecting outcomes; as such, it is vital to establish normative data before manipulating dosage (Dignam et al., 2015).

A recent study investigated data from 959 participants across 25 trials (Brady et al., 2021). The highest increases in overall language and comprehension were related with SLT dosages ranging from 20 to 50 hours. The greatest clinical increases in overall language, functional communication and comprehension were associated with between two and four hours, and nine or more hours of SLT per week. The greatest clinical gains were associated with frequent SLT for overall language, functional communication (3–5+ days/week) and comprehension (4–5 days/week). Evidence of comprehension gains was absent for SLT ≤20 hours, <3 hours/week and ≤3 days/week. Mixed receptive-expressive therapy, functionally tailored, with prescribed home practice was associated with the greatest overall gains.

One-to-One Therapy vs Group Therapy. A study by Ribiero Lima et al. (2018) concluded that group therapy for PwA after three months post-stroke and improved communication resulted in a better perception of QoL in the communication and physical domains. Another small-scale study noticed that

providing PwAs with both individual and group therapy could contribute to better therapy outcomes (Archibald et al., (Commentary authors), 2012). The writers emphasise that these results highlight the improvement in QoL, which should not go unnoticed. Studies regarding the QoL of PwAs who are receiving group speech language therapy are still incipient; therefore, further research is warranted (Brady et al, 2016).

A critical review reported conflicting results for the effectiveness of group treatment as opposed to individual therapy in improving aphasia outcomes (Egan, 2018). Egan (2018) noted two studies that showed that therapy delivery style appears to have minimal impact on functional language or pragmatic outcomes (Avent et al., 1998; Wertz et al., 1981), two studies that indicated that group therapy results in greater language outcomes (Fama et al., 2016; Pulvermüller et al., 2001) and one study that demonstrated that individual therapy results in more noticeable improvement in verbal communication (Wilssens et al., 2015). This review by Egan (2018) also noted that most of the previous studies looked at different outcomes, therefore making direct comparison between studies problematic.

Group therapy was found to facilitate more communication initiation, increase the diversity of expressive modalities and increase communication purposes (Fama et al., 2016), improving naming, language comprehension, following directions and performance in everyday life (Pulvermüller et al., 2001), as well as improving language production and phonology (Wilssens et al., 2015; Pulvermüller et al., 2001). Individual therapy was found to be more effective at eliciting new, real words (Fama et al., 2016), improving repetition (Pulvermüller et al., 2001), increasing scores on verbal and gestural communication indexes (Wertz et al., 1981) and improving language comprehension, semantics and verbal communication (Wilssens

et al., 2015). However, these mixed results are backed by very little data. While many trials were well-designed, it was sometimes impossible to discern which variable accounted for the observed advantages, since outcomes were frequently connected to multiple factors other than delivery style.

Telerehabilitation. Speech therapy post-stroke generally starts at a hospital in the acute phase, continues in intensive rehabilitation programs and ends at home or in weekly visits to outpatients (Tousignant et al., 2018). In certain places like Canada, access to SLT is delayed because of the unavailability of timely rehabilitation services (Tousignant et al., 2018). Therefore, there was a necessity to develop an efficient complementary service delivery. With the development of new technologies in the area of information and communication technology (ICT), SLPs were able to devise an innovative treatment delivered remotely using speech teletherapy (Choi et al, 2016; Stark & Warburton, 2018; Kiran et al, 2014; Saposnik et al., 2014; Hoover & Carney, 2014).

Molini-Avejonas et al. (2015) noted that telehealth has often been used for aphasia's remote language and communication assessment. The majority of the studies they investigated reported that telehealth therapy has significant advantages over the non-telehealth alternative. Another study listed several benefits of telerehabilitation in PwA. Telehealth had positive outcomes on functional communication in chronic aphasia (Macoir et al., 2017).

Tousignant et al. (2018) reported that participants were satisfied with speech telerehabilitation (93% satisfaction). They felt that contact with a therapist was adequate despite not being face-to-face. Additionally, they acknowledged the positive benefit of not having to travel for therapy. This study found that older age was correlated with

adverse effects on satisfaction with technology, but these effects were not significant enough to result in overall dissatisfaction. However, satisfaction with the services delivered was lower, at 73% satisfaction, possibly attributable to the questions used by the researchers, which were not adapted to this population (e.g. 'The professionals tell you about the different choices you have'). After three weeks of intervention, satisfaction with functional communication was high, signifying that teletherapy seemed to improve functional communication as perceived by patients and their relatives.

Due to the social and geographical isolation established to prevent infection during the COVID-19 pandemic (Tsatsakis et al., 2020; Fisicaro et al., 2021), most PwAs did not receive treatment or received only partial or incorrect treatment (Tsatsakis et al., 2020; Pennisi et al., 2020; Maniaci et al., 2020). More crucially, most non-urgent or elective healthcare services (such as SLP clinics) have suffered significant interruptions or fragmentation of their operations (Wosik et al., 2020). As a result of the COVID-19 pandemic, the healthcare system was forced to dramatically alter its service offerings and delivery modes, resulting in a rapid rise of telehealth and telerehabilitation (Tenford et al., 2020; Coccuza et al., 2020; Ferlito et al., 2020).

Satisfaction with Speech-Language Therapy

Even though there is expansive literature related to aphasia rehabilitation and outcomes (Brady et al., 2016), little research has examined PWA's satisfaction with aphasia treatment. A qualitative study by Tomkins et al. (2013) investigated the satisfaction of 50 PwA receiving face-to-face aphasia therapy. They noted that the following seven factors contributed to patient satisfaction: (1) forming relationships; (2) manner and methods of service delivery; (3) information, communication and knowledge; (4) structure and relevance of therapy; (5) organizational management; (6)

individual support; and (7) positivity and improvement. The authors concluded that both tangible and personal values impacted ratings of satisfaction with aphasia therapy. Some studies have reported that participating PwA had a positive experience with language rehabilitation (Grohn et al., 2014; Hersh, 2009; Jones et al., 2008). Other studies have noted that participating PwAs reported that there needs to be more SLT resources and rehabilitation in hospitals (Hallé et al., 2014; Morris et al., 2014).

Hersh (2009) reported that satisfaction regarding the timing and frequency of therapy varies, as some people prefer intensive therapy later in the recovery process whilst other people prefer a flexible approach, wherein they decide when to start and stop therapy depending on their health. Another study noted that it is crucial that therapy lasts longer and meets the needs of people at different stages of recovery (Worrall et al., 2011). PwAs have reported feeling concerned about their aphasia in relation to other physical impairments and comorbid health conditions (Armstrong et al., 2015; Armstrong et al., 2012; Brown et al., 2010). Younger PwAs reported a lack of support in the long-term as they have to face challenging new situations, such as parenting and reduced income (Hersh, 2015, 2009). Several studies have reported that PwAs described language therapy as too theoretical, difficult, patronizing or irrelevant to their needs (Hallé et al., 2014; Tomkins et al., 2013; Worrall et al., 2011; Hersh, 2009). Numerous studies have reported that PwAs accessed community health clinics, home care programmes, caregivers and community nurses for support (Doughty Horn, 2016; Hallé et al., 2014; Armstrong et al., 2012). A participant stated that if one does not reach out for help and support, one gets nothing and ends up isolated (Hallé et al., 2014).

Satisfaction with services and perception of healthcare have a significant effect on rehabilitation outcomes (Piron et al., 2008). In concordance, Keith (1998) explained that when patients are pleased with their care, they are more willing to make an effort in

therapy, thus improving their own QoL. Satisfaction is a pertinent outcome of rehabilitation, as it offers an insight into the quality of therapy (Ellenberg, 1996) and reflects its relevance to the patient's needs (Kielhofner et al., 2004).

Care post-stroke

Two-thirds of patients survive their first stroke (Rothwell et al., 2004). After a stroke, patients may experience long-term problems, including cognitive impairment, loss of physical function, falls, fatigue, disability, pain and depression; these have serious implications for their health, functional ability and QoL (Danzl et al., 2013; Brown et al., 2012; Carod-Artal, 2012; Kim, 2009; Pang et al., 2007; Cott et al., 2007; Haacke et al., 2006; Carota et al., 2005; Yates et al., 2002). Both patients and carers have reported being unaware of available services to help them with their persistent problems (Hare et al., 2005). Hare et al. (2005) concluded that primary care could have a crucial role in addressing the physical and social exclusion experienced by many stroke patients and carers. Thus, this lack of awareness is also a part of exclusionary practices.

Rehospitalisations are extremely common in the first year after discharge from an inpatient rehabilitation setting due to another stroke or other complications that may have been preventable (Olson et al., 2013; Demaerschalk et al., 2010). Studies have pointed out that people who have suffered a stroke who live in rural areas have an additional risk of complications linked with lack of access to specialised support services, lack of care coordination and limited healthcare provider knowledge about the healthcare needs of individuals with complex conditions, such as stroke (Danzl et al., 2016; Danzl et al., 2013; Lustig et al., 2004).

Common reasons for hospitalisations have been established in various studies; however, further research is needed to determine the causes of long-term readmission in stroke patients. The following table summarises the common causes of readmissions:

Table 2.2

Summary of common causes of rehospitalisation

Studies	Types of stroke	Common causes for rehospitalizations
Bravata et al. (2007)	Ischaemic stroke	· Pneumonia, · Acute MI · Recurrent stroke · Gastrointestinal disorders · Congestive heart failure · Other vascular diagnoses · Cardiothoracic procedures · Psychiatric disorders · Hip fractures
Tseng and Lin (2009)	Haemorrhagic and ischaemic strokes	· Recurrent stroke · Infections · Accidents · Cardiopulmonary disease · Cancer · Diabetes
Burke et al. (2014)	Ischaemic stroke	· Recurrent stroke · Infections · Cardiac conditions
Ottenbacher et al. (2014)	Haemorrhagic and ischaemic strokes	· Urinary tract infection · Pneumonia · Heart failure and shock · Oesophagitis · Gastritis

Rehabilitation

Most post-stroke patients need rehabilitation to augment their recovery whilst diminishing disability (Duncan et al., 2002). Pinedo et al. (2014) described that a multidisciplinary team (MDT) is involved in hospital and community rehabilitation settings

post-stroke to optimize patients' outcomes and reintegrate them into family, social and work life.

A good stroke care system should provide a smooth transition between acute care, subacute care, rehabilitation, and community (Schwamm et al., 2005). It is crucial that stroke patients receive adequate rehabilitation, as studies have shown that stroke units in acute care and inpatient rehabilitation services have great benefits (Zhu et al., 2009; Langhorne & Pollock, 2003).

In Malta, there is only one 274-bed inpatient rehabilitation hospital. It consists of 10 inpatient rehabilitation wards. One ward is dedicated to patients with a brain injury, spinal cord injury, orthopaedic injury, or neurological or medically complex condition. One ward is dedicated to COVID-19, seven wards are geriatric wards, and one ward is a stroke unit.

If post-stroke individuals are not transferred to an inpatient hospital, Active Ageing and Community Care provides community rehabilitation consisting of physiotherapists (PT), Occupational Therapists (OT) and podiatry services to people over 60 residing in a government home or those who live at their home and are housebound due to health and physical difficulties. With regards to SLT, the Speech and Language Centre has an open referral system in place to ensure that the general public has the greatest possible access to the services provided. Services in the community are offered by all health centres and various district clinics to ensure service-user access. Home visits are arranged for service-users with mobility issues (Government of Malta, 2021).

Reintegration into the Community

An important goal after rehabilitation is the reintegration of patients into the community. The need to decrease the length of stay at hospital is kept in mind during rehabilitation (Forchheimer & Tate, 2004). Wood et al. (2010) noted that

rehabilitation goals frequently change to reintegrate into the community throughout the first year following a stroke.

Stroke rehabilitation is concerned with community reintegration. The importance if reintegration is often overlooked (Bhogal et al., 2003). Community reintegration is the 'reorganization of physical, psychological and social characteristics so that the individual can resume well-readjusted living after incapacitating illness or trauma' (Wood-Dauphinee & Williams, 1987, p.492). It also refers to going back to family and community life whilst engaging in familiar roles and responsibilities, actively contributing to one's social groups and society as a whole (Dijkers, 1998). Self-perceived participation in the community reflects one's perception of and satisfaction with their involvement in life. Numerous post-stroke individuals have low satisfaction with community reintegration after they are discharged from the hospital and return to the community (Pang et al., 2007).

Various studies have investigated the effects of certain stroke-related factors on community reintegration (Ostir et al., 2005; Carter et al., 2000). Physical impairment greatly affects community reintegration. Additionally, emotional alterations are common following a stroke (Murtezani et al., 2009). Similarly, Carter et al. (2000) noted physical disability and depression as two major factors inhibiting community reintegration. The latter is often characterised by sadness, loneliness, irritability, worthlessness, hopelessness, agitation and guilt (Sharp & Lipsky, 2002). Depression is the most prevailing mental health condition post-stroke (Ghose et al., 2005) and is correlated with poor functional outcome, slower recovery and lower QoL (William et al., 2005). It affects 25% of patients within the first year after a stroke (Dobkin, 2005) and is most apparent within the initial two years after the stroke (Teasell et al., 2003).

Mayo et al. (2000) reported that outpatient home rehabilitation has been shown to induce motor and functional gains, translating into a greater degree of higher-level function and satisfaction with community reintegration.

Return to work. Return to work (RTW) is the term used to describe the act of starting back to work following a period of sick leave. The predictors for RTW include mild stroke severity along with positive self-rated health (Larsen et al., 2016). Palstam et al. (2019) report that indicators for no RTW encompass physical dependency at discharge, higher degree of residual disability (Bonner et al., 2016; Wang et al., 2014; Tanaka et al.,2011), sick leave prior to stroke (Westerlind et al., 2017) unemployment prior to stroke, comorbidities (Virtanen et al., 2017), low socio-economic status (Glader et al., 2017), older age and being female (Endo et al., 2016).

According to a study, it is challenging to combine several impairments with various employment demands (Wozniak et al.,2002). Whereas physical deficiencies are challenging to overcome in some types of jobs, cognitive disability may provide a challenge in others. Indeed, the RTW group scored low in both cognitive and motor deficits in NIHSS compared to the no RTW group.

In a six-year follow up after stroke, 74.7% of the participants did RTW (Westerlind et al,. 2017). They noted that participants continued to RTW even up to three years post stroke. Previously, this was not reported due to shorter follow-up time (Larsen et al. 2016; Hackett et al., 2012).

The objective of a review done by Graham et al (2011) was to document the success rate of RTW for younger stroke survivors with aphasia. They highlight that aphasia is a good indicator of someone's failure to RTW after a stroke. The degree of functional language impairment, the presence of comorbid conditions, the nature

of the job, and the working environment are likely to also be significant contributors. It is currently difficult to establish causation or any significant connections between these factors due to the diversity and dearth of the aphasia RTW literature. Similarly, Dalemans et al (2008) observe a lesser rate of employment when compared with survivors without aphasia. Additionally, those aphasia survivors who did resume their jobs had their hours drastically cut and task changes.

Institutionalisation after stroke. Long-term care (LTC) has increasingly become a feasible choice for many stroke survivors due to the functional impairments and limitations caused by stroke. Admission to long-term care (LTC) after a stroke is frequent. In the United States, around 26% of people who survive a stroke are admitted to LTC after 6 months (Kelly-Hayes et al., 2003). A national audit programme in the United Kingdom demonstrates that between 2017 to 2018, 10.9% of patients with stroke were admitted to LTC directly after the episode of care caused by the stroke (King's College London, 2018).

Stroke patients in LTC generally have persistent and severe functional and cognitive difficulties (Cowman et al., 2010). In their study, Burton et al., (2017) concluded that after an acute stroke, age and stroke severity are significant predictors of LTC admission. There is evidence that people who live alone prior to the stroke have a higher probability of being discharged to LTC compared to those who lived with others before the stroke (Clery et al.,2020; Nguyen et al.,2017).

Stein and his colleagues (2015) highlighted that stroke survivors with higher Barthel Index (BI) scores had a higher chance of being discharged home rather than to an LTC facility, showing that severe stroke with more impairments results in institutionalization. In accordance, other research found that severe impairments

resulting post-stroke were linked with discharge to LTC (Portelli et al.,2005; Brown et al.,1999). Contrarily, Pasquini et al. (2007) demonstrated that regardless of the level of physical disability, cognitive impairment is a robust predictor of institutionalization within 3 years following a stroke.

Local Community Support Services

Locally, the Parliamentary Secretariat for the Rights of Persons with Disability and Active Ageing provides several services aimed at older adults to help them with their everyday lives. They give both community care and home services.

Domiciliary caring and nursing is available to patients who cannot leave their home without assistance, those who are discharged from acute hospitalization and need short- or long-term care and who are unable to attend clinics, patients who need pre-operative preparation, and those who need treatment that cannot be appropriately administered at health centres and clinics. A multidisciplinary team is involved and consulted accordingly for holistic services. The CommCare team assesses the patient and identifies their needs. These needs are then considered when creating a care plan with the patient, the family and other carers.

Active ageing centres are available in 21 localities in Malta: Bugibba, Birkirkara, Bormla, Dingli, Hamrun, Kirkop, Luqa, Mellieha, Mgarr, Mosta, Msida, Naxxar, Qormi, Safi, Siggiewi, Sliema, St. Lucia, St. Paul's Bay, St. Venera, Zejtun and Zurrieq. These offer a chance for older adults to remain physically, mentally and socially active. The service is provided to people over 60 years of age who are not highly dependent. Those who attend meet new people or old friends in a relaxed environment and engage in creative, social, physical and educational activities. They attend several talks on different topics, as well as physical exercise sessions,

dancing, crafts, first aid trainings, information technology (IT) trainings and even intergenerational activities wherein both students and the elderly are invited to interact and share experiences.

Meals on Wheels is a system that delivers meals to persons over 60 years of age and persons with special needs registered with the National Commission for Persons with Disability. It aims to aid eligible persons in continuing to live within their own homes. Meals are delivered chilled and can be consumed at the recipient's discretion; however, some meals must be heated before being consumed. Each meal comprises two courses and a dessert. There is a choice in each course, whilst the desert consists of either fresh fruit or a sweet speciality of the day. Each menu is provided depending on the clients' needs. There are different types of meals, including normal, diabetic, low salt and soft food. There are also gluten-free, lactose-free, nut-free and vegetarian meals. This service is provided at a government-subsidised price of €2.20 per meal.

People with any type of disability have to learn to cope with and adapt to the effects of the illness in several ways (Bury, 1991). The expanding qualitative research on living with aphasia is looking at the psychosocial experiences of PwAs, exploring factors such as participation, integration, coping and QoL (McMenamin et al., 2015; Simmons-Mackie & Lynch, 2013; Mumby & Whitworth, 2013).

Long-term access to numerous services post-stroke benefits PwAs (Manning et al., 2019). This systematic review found around 30 articles that support this notion. Some studies reported a lack of follow-up therapy after discharge from the hospital (Armstrong et al., 2015; Hemsley et al., 2013). Tomkins et al. (2013) reported that the level of satisfaction with the health care was determined by the total number of therapies

provided, the service provision and the perceived support received at discharge and at home.

Support Groups and Outcomes

Following discharge from inpatient and outpatient rehabilitation services, PwAs struggle to re-adjust to work, family and community life (Howe et al., 2011; Worrall et al., 2011). According to Shadden and Agan (2004), 'Group interventions are often considered to be an important transitional step in moving beyond a strictly language-based focus' (p. 177). Several support groups have diverse aims and roles (Simmons-Mackie, 2008; Pound et al., 2000). Psychological and communication support for PwAs and their relatives can be accessed through community aphasia groups (CAGs). There are no fixed definitions of such groups. Still, a study by Rose and Attard (2015) proposed that CAGs generally include the following elements: (1) at least two PwAs from the same community repeatedly meet, introduced together by a facilitator who may or may not be present for such meetings, and (2) there are two or more activities related to conversation, communication therapy, social or psychological support, or education about aphasia.

A systematic review that investigated the effectiveness of CAGs found a moderate positive relationship between CAGs and social and community access (Lanyon et al., 2013). It has also been noted that PwAs in CAGs benefit from them through increased communicative confidence, improved mood, increased participation in social activities and improved family support (Attard et al., 2015). Vickers (2010) carried out interviews and surveys with PwAs in CAGs and reported that they feel less socially isolated than their counterparts who did not attend CAGs; they also reported increased social support. Shadden and Agan (2004) stated that

such group settings are ‘the place where that experience [of stroke] becomes something positive, and where aphasia that is disrupting one’s life also gains one membership in this new community’ (p. 180). Currently, there is no active stroke support group in Malta.

Chapter Summary

International research has revealed new information on the post-stroke recovery process, showing that specific demographic data and characteristics associated to stroke may not have a direct impact on outcomes at the 6-month and 12-month marks following a stroke. Instead, the early severity of the stroke and the initial severity of the aphasia emerge as the primary drivers of outcomes. Notably, such comprehensive data are conspicuously lacking in the local context, necessitating a more focused analysis into the unique variables influencing post-stroke recovery in the Maltese community. Furthermore, there is a significant knowledge vacuum about speech therapy in Maltese research, necessitating further investigation and research.

Research Questions

After reviewing the relevant literature, it is clear that there are numerous gaps in knowledge regarding possible factors which may influence outcomes for persons with aphasia post stroke. Locally, no such research has been carried out. The following research questions were derived from the review of the literature:

1) In a sample of people with aphasia living in Malta, do demographic factors influence outcomes at six months and one year after stroke?

2) In a sample of people with aphasia living in Malta, do stroke related factors influence outcomes at six months and one year after stroke?
3) In a sample of people with aphasia living in Malta, does initial aphasia severity influence outcomes at six months and one year after stroke?
4) In a sample of people with aphasia living in Malta, do type, timing, frequency and intensity of SLT influence outcomes at six months and one year after stroke?
5) In a sample of people with aphasia living in Malta, how do they and their carers perceive SLT services provided to them?
6) In a sample of people with aphasia, what community support services and/or organisations, if any, are accessed post-stroke?

Conclusion

This chapter presented an overview of the literature related to demographic characteristics, stroke-related factors and initial aphasia severity regarding stroke outcomes. It also explored the different components of SLT therapy provided to PwAs and their effects, along with supplementary services that can be accessed after a stroke to improve the aftereffects of a stroke. The subsequent chapter will outline the methodology used in this research. The design of the study is followed by a detailed description of the data collection procedures and tools utilised.

Chapter 3

METHODOLOGY

Chapter Overview

This chapter describes the research methodology and procedures used for data collection. It outlines the inclusion and exclusion criteria adhered to. The limitations of the research method utilised are also discussed, along with the ethical considerations that were kept in mind while conducting this study. This is followed by the reliability and validity measures that were considered. Finally, statistical tests to address the research questions are outlined.

Research Design

The research design paves the way for how a project will be carried out and analysed. Beck and Polit (2010) identified several dimensions that determine the chosen research design. These include the (1) degree of structure, (2) type of group comparison, (3) time frame, and (4) control over the independent variable.

This study was structured as the design was specified before the data collection. This is a common characteristic of a quantitative design. The time frame for data collection included three phases over 12 months, making it a longitudinal prospective study. Longitudinal observational studies have played a major role in geriatric research and in defining the scope of many health concerns in older adults, their risk factors, and their natural history (Newman, 2010). The study is a prospective, non-randomised observational study interested in the participants' recovery. New participants were recruited for six months and followed for one year. This cohort follow-up study investigated a particular subpopulation (persons with aphasia post-stroke) over time to determine their outcome after a year.

This is non-experimental research, as the research questions require a description; thus, manipulation is not needed to observe the expected outcomes of aphasia post-stroke. Hence, the data obtained from the data collection should be evaluated and interpreted to obtain a conclusion (Sim & Wright, 2000). There is an absence of a control group in such an observational and non-experimental study as it is "A study in which the investigator(s) does not control the exposure/ intervention status of study participants (i.e., the assignment of the intervention or exposure of interest is not under the control of the investigator(s)). The simplest form of observational study is the case report or case series, which describes the clinical course of individuals with a particular condition or diagnosis. Observational studies include descriptive and analytic studies. " (Hartling et al., 2010, pg G-5).

This one-year longitudinal study involved a quantitative research method. This refers to a technique that engages several research methods, employing numerically collected data (Punch, 2009). Quantitative research aims to examine the answers to the research questions (Rasinger, 2013). It focuses on gathering numerical data and generalising it across groups of people or explaining a phenomenon (Babbie, 2010; Muijis et al., 2011). A quantitative approach was chosen because it enables the researcher to recognise and identify relationships between different variables.

It was deemed essential to gather such data to look at any correlation amongst the demographic characteristics of the participants, stroke factors, initial aphasia severity, speech-language therapy type, timing, frequency and intensity, other services available, and the participants' six months and 12 months after the stroke. Quantitative research is a snapshot of a moment without any elaboration or minimal depth (Schofield, 2007).

Data Collection and Tools

Research data could involve using existing data or collecting data. This project involved collecting data, as no data were available on the local scenario. Beck and Polit (2010) believe that data collection varies in these four dimensions: (1) structure[14], (2) quantifiability, (3) research obtrusiveness, and (4) objectivity. A structured plan[15] was devised before the data collection, which stated what and how the data were to be collected. This included highly structured interviews and language assessments. The data would be measurable, which is also a characteristic of quantitative research. Objectivity was ensured through structured data collection. A part of the data collection involved self-reporting, in which the participants were asked about their quality of life and their perceptions of SLT services. Language assessment included direct assessment. On the other hand, questions in the rating scales were closed-ended or fixed-alternative, which involved giving set answers, and the participants choosing the one closely resembling their answer. These questions included multiple-choice questions, forced-choice questions, and rating questions.

14 In structured data collection, identical data is collected from all participants in a comparable, predetermined manner.

[15] The plan was designed in-agreement with principal investigator of I-Praise (Myzoon Ali) and a truncated version was implemented locally.

Table 3.1

Tools utilised in each phase of this research

Tools	Phase 1 (up to 15 days post-stroke)	Phase 2 (6 months post-stroke)	Phase 3 (12 months post-stroke)
Demographic Information	✓		
Stroke Characteristics and Medical History	✓		
Maltese Aphasia Screening Test (Grima, 2015)	✓		✓
Aphasia Severity Rating Scale (BDAE-3, Goodglass et al., 2000)	✓	✓	✓
The Functional Communication Measure (Therapy Outcome Measure for Aphasia (Enderby & John, 2015)	✓	✓	✓
Modified Rankin Scale	✓	✓	✓
European Quality of Life Scale (EQ-5D-5L, 2009)		✓	✓
Therapy Description Form		✓	✓
Support Services & Resource utilisation form			✓
Therapy Satisfaction Form			✓

In the following section, the data collection tools will be described.

- **Demographic Data:** "Demographic variables are characteristics or attributes of subjects that are collected to describe the sample" (Nancy et al., 2007). Although demographic variables cannot be manipulated, researchers can explain the relationships between demographic variables and dependent variables.

  A form created by the International Population Registry for Aphasia after Stroke (I-PRAISE) project was used (Appendix B1). The first section gathers personal details about the participant, such as date of birth, nationality, years of

education, handedness, and employment. After conducting the pilot study, it was noted that some premorbid demographic details were not gathered namely prior language knowledge, reading, and writing skills, and vision and hearing abilities. Therefore, a demographic and clinical data form was utilised, based on Hallowell (2009), Roberts et al. (2003), and Brookshire (1983). This is attached in Appendix B2.

- **Stroke Characteristics and Medical History:** The second section of the form found in Appendix B1 focuses on gathering information regarding stroke, comorbidities, immediate stroke care, and neuroimaging.

Along with demographic data, stroke characteristics and medical history, information in relation to the participants' functional communication and aphasia severity was collected.

- **Language assessment**: This research involved a comprehensive language screening assessment at Phase 1 (on initial recruitment) and Phase 3 (at 12 months post-stroke). The Maltese Aphasia Screening Test (MAST; Grima, 2015, unpublished) was utilised. This Maltese language screen comprises 11 subtests, which are impairment-based, to assess the different domains of language. These subtests aim to assess: (a) spontaneous conversational speech, (b) overall spoken communication rating scale, (c) auditory comprehension of single words, (d) auditory comprehension of language: yes or no questions, (e) following instructions, (f) repetition, (g) picture naming, (h) fluency naming, (i) automatic speech, (j) reading and reading comprehension, and (k) writing. Bonello (2020) demonstrated that the MAST is a reliable and valid tool for identifying language-related difficulties following a stroke. The test lasted around 10–30 minutes, depending on the participants' language impairments. Those with no or little impairment had no difficulty completing the assessment quickly, while those with greater impairment took longer to complete

it. Each section has its own marking system. A total score out of 100 was given after adding the scores from each subtest.

- **Aphasia Severity Rating Scale**: The Aphasia Severity Rating Scale (ASRS; BDAE-3, Goodglass et al., 2000) was utilised when the participants were recruited in Phase 1, in the second phase (six months post-stroke) and in the final phase (12 months after the stroke). It is a rating scale from zero to five, reflecting the participants' language impairment, with 0 indicating no speech and comprehension abilities, and five, which signifies minimal difficulties, perceived only by the participant. This data was gathered through observation. This can be found in Appendix B3.
- **Functional Communication Measure**: The Functional Communication Measure (Therapy Outcome Measures (TOMs) for Aphasia; Enderby & John, 2019) (Appendix B4) was also used when the participants were recruited, in the second phase, six months post-stroke, and in the final phase (12 months after the stroke). Enderby and John (2015) designed a questionnaire for SLPs to capture abilities and difficulties of a patient in the hour domains with the aim of the monitoring changes over time. The following areas are addressed: (a) impairment, (b) activity, (c) participation, and (d) wellbeing or distress. These are based on the World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF, WHO, 2001), with Enderby (1992) adding the last section. Each of the TOM dimensions was rated individually. It uses a 6-point ordinal rating scale, with zero being the severe end and five representing adequate measures. This was gathered mostly through observation during each phase.
- **Modified Rankin Scale**: The Modified Rankin Scale (mRS), which can be found in Appendix B5, was used during all three phases of the study. Marotta (2007) reported that this clinician-reported measure is widely applied for evaluating stroke patient

outcomes. The original scale dates back to 1957 and was developed by Dr John Rankin in Glasgow. It is a rating scale ranging from zero to six, describing the participants' global disability. Global disability refers to both physical disability and the instrumental ADLs and basic ADLs. The first mRS was gathered from the medical file, as it was written upon admission. The mRS in subsequent phases was gathered through observation.

- **European Quality of Life Scale: The European Quality of Life Scale** (EQ-5D-5L, 2009) (refer to Appendix B6) was administered in the second and last phases post-stroke. The instrument was developed by the EuroQol Group (2009), which comprises a descriptive system and an analogue scale. The descriptive section is divided into five domains: (a) mobility, (b) self-care, (c) usual activities, (d) pain or discomfort, and (e) anxiety or depression. Each area has five levels, ranging from no problems to extreme problems. Each domain had five statements, and the participants had to choose which one applied to them the most. Each statement has a one-digit number that indicates the level in that domain. The numbers of all the domains are then combined into a five-digit number that describes their current health state. If the participants were literate, they were given the questionnaire to tick the appropriate response. If participants were not literate, the questionnaire was read to them. If the participants had severe aphasia affecting their comprehension, these questions were given to their relatives. The analogue scale required the participants to self-rate their health on a vertical analogical scale. Zero represented the worst health one could possibly be in, and 100 signified the best health one could imagine. This was not completed by those participants with severe aphasia that affected their comprehension.

Additionally, 12 months post-stroke, the following data were gathered:

- **Therapy Description Form**: This form was given to every SLT service that had contact with the participants. It focuses on obtaining information on the therapeutic approach, intensity, dose, and setting of therapy given to the participants. It consists of open-ended and multiple-choice questions. It takes no longer than 10 minutes to complete (refer to Appendix B7).
- **Support Services & Resource Utilisation Form**: This is a form that was given to the participants 12 months post-stroke in Phase 3 (refer to Appendix B8). It was completed by the participants if they were literate. If they were not literate, the researcher asked the questions and completed the form, depending on the answer given. If the patient had severe aphasia, his or her relatives were asked to fill in the questionnaire. The questionnaire consisted of nine multiple-choice questions and open-ended questions to gather information on what services the participants had accessed after their discharge from the hospital post-stroke. It also enquired whether further hospitalisations have occurred since discharge after the stroke.
- **Therapy Satisfaction Form**: The researcher created this form to obtain feedback on the participants' and carers' satisfaction with SLT services. It includes 3 Likert-type questions frequently utilised in medical education research (Sullivan & Artino, 2013). The 'likert scale' was developed in 1932 by Rensis Likert (1932) to measure attitudes, knowledge, perception, and value (Vagias, 2006) and typically includes a 5- or 7-point ordinal scale, in which the participants may choose to rate their responses to evaluative questions (Vogt et al, 1999). The questions were on a 5-point ordinal scale, with pictographic responses to facilitate comprehension for PwA. Große et al. (2015) noted that pictograms could provide effective information for communication when patients have limited knowledge or cannot speak normally

under special conditions. This questionnaire was also given to the participants' relatives. The form is attached in Appendix B9 and B10.

Participant Recruitment

Sampling entails the process of choosing a portion of a population to represent an entire population. Sampling designs could either be probability sampling or nonprobability sampling (Beck & Polit, 2010). Criterion sampling was used for this study, which involved recruiting those who met the predetermined criteria (Patton, 2001). Thus, every person who fit the inclusion criteria listed below was considered a possible recruitment participant.

During the pilot study, 13 participants were recruited from the stroke unit of a state general hospital. A section dedicated to the Pilot Study can be found below in the chapter. Seventy-one participants were eligible to participate in the main study, and 44 participants were recruited. Fourteen of the eligible participants refused to participate in the study, while 13 other eligible subjects were discharged from the hospital before the researcher collected data for the first phase. In the second phase, 39 people participated in this study, as four recruited people had died, and another patient had gone abroad and thus could not be followed up on. In phase three, 30 people were followed up on, as another five patients had died, and four people had withdrawn from the study.

An onsite nursing officer served as an intermediary between the participants and the researcher. All the participants who were suspected of having aphasia were referred to the researcher. The nursing officer identified 71 potential participants. However, after the language assessment was done with the participants, the researcher (a qualified Speech Language Pathologist) confirmed that 44 of them had

aphasia. The potential participants were PwA patients secondary to stroke. They were included in this study if (i) they had given informed consent and (ii) the person was medically stable, could sit up, and pay attention for at least ten minutes. These previously mentioned conditions are in line with the I-PRAISE project.

All participants were chosen based on the following inclusion criteria:

(a) person over 18 years of age;

(b) both males and females;

(c) a diagnosis of ischaemic or haemorrhagic stroke;

(d) presence of aphasia;

(e) medical stability (participant can sit up and pay attention for ten minutes).

The exclusion criteria were as follows:

(a) presence of language or communication difficulties, which may be attributed to neurological aetiologies other than stroke;

(b) presence of dysarthria or apraxia of speech alone;

(c) pre-stroke clinical diagnosis of dementia;

(d) known life-threatening illness that is likely to lead to death within six months.

Table 3.2 illustrates a succinct summary of the demographic details of the subjects in the study whilst Table 3.3 elucidates a more exhaustive description of the participants' demographic data, based on the DESCRIBE Standards Checklist (Isaacs et al., publication in progress; Wallace et al., 2022).

Table 3.2

The demographic details of the participants

Age	Gender		Literate		Handedness		Type of Stroke	
	Males	Females	No	Yes	Right	Left	Ischaemic	Haemorrhagic
40-49 years	1	5	2	4	6	0	5	1
50-59 years	2	0	0	2	1	1	1	1
60-69 years	11	3	4	10	13	1	12	2
70-79 years	12	2	4	10	10	4	13	1
80-89 years	1	6	5	2	5	2	5	2
90-99 years	0	1	0	1	1	0	1	0
Total	27 61.4%	17 38.6%	15 34.1%	29 65.9%	36 81.8%	8 18.2%	37 84.1%	7 15.9%

Table 3.3

The distribution of the participants in relation to their demographic information

Code	Age	Sex	Education Level	Handedness	Primary Language	Language[16] Status	History of condition impacting communication or cognition	History of Previous stroke	Stroke type	Lesion Hemisphere
P201	43	Male	primary	Right	Maltese	Maltese and English	n/a	n/a	Ischaemic	Right
P202	69	Male	secondary	Right	Maltese	Maltese only	n/a	n/a	Ischaemic	Left
P203	66	Male	secondary	Right	Maltese	Maltese and English	n/a	Yes (Left)	Ischaemic	Right
P204	70	Male	primary	Right	Maltese	Maltese and English	n/a	n/a	Ischaemic	Left
P205	65	Male	primary	Right	Maltese	Maltese and English	n/a	n/a	Ischaemic	Right
P206	78	Male	primary	Right	Maltese	Maltese and some English words	n/a	Yes (Left)	Haemorrhagic	Left

[16] It refers to the language knowledge as reported by the participants and/or relatives present during the data collection.

P207	79	Male	primary	Right	Maltese	Maltese and some English words	PD[17]; HI[18]	Yes (Bilateral)	Ischaemic	Right
P208	60	Male	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P209	62	Male	post-secondary	Right	Maltese	Maltese only	HI with hearing aid	n/a	Ischaemic	Bilateral
P210	46	Female	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P212	74	Male	primary	Left	Maltese	Maltese only	n/a	n/a	Ischaemic	Right
P213	78	Male	university	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P214	57	Male	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Haemorrhagic	Left
P215	44	Female	primary	Right	Maltese	Maltese only	n/a	n/a	Haemorrhagic	Right

[17] Parkinson's Disease
[18] Hearing Impairment

P216	69	Male	post-secondary	Right	Maltese	Maltese and some English words	n/a	Yes (Left)	Ischaemic	Left
P217	74	Female	secondary	Right	Maltese	Maltese and English	n/a	n/a	Ischaemic	Right
P219	74	Male	primary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Right
P220	45	Female	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P221	82	Female	primary	Right	Maltese	Maltese only	n/a	n/a	Ischaemic	Left
P222	45	Female	post-secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P224	69	Female	post-secondary	Right	Maltese	Maltese and English	n/a	n/a	Ischaemic	Left
P225	82	Female	primary	Right	Maltese	Maltese only	n/a	n/a	Ischaemic	Right
P226	80	Female	primary	Right	Maltese	Maltese and some English words	n/a	Yes (Left)	Ischaemic	Right

P227	89	Female	primary	Right	Maltese	Maltese only	HI	n/a	Haemorrhagic	Right
P228	68	Male	primary	Right	Maltese	Maltese and some English words	n/a	Yes (Right)	Ischaemic	Left
P229	52	Male	post-secondary	Left	Maltese	Maltese and English	n/a	n/a	Ischaemic	Left
P230	73	Male	secondary	Right	Maltese	Maltese only	n/a	n/a	Ischaemic	Bilateral
P232	62	Male	primary	Right	Maltese	Maltese and some English words	ALS	n/a	Ischaemic	Right
P234	60	Female	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P235	67	Female	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Right
P236	93	Female	secondary	Right	Maltese	Maltese and English	HI with hearing aid	Yes (Right)	Ischaemic	Right
P237	68	Male	primary	Right	Maltese	Maltese only	n/a	n/a	Haemorrhagic	Left
P238	86	Female	secondary	Left	Maltese	Maltese only	n/a	n/a	Ischaemic	Right

P239	88	Female	primary	Right	Maltese	Maltese only	HI	Yes (Left)	Ischaemic	Left
P241	69	Male	primary	Left	Maltese	Maltese only	HI	n/a	Ischaemic	Left
P242	80	Male	secondary	Left	Maltese	Maltese only	n/a	Yes (Left)	Haemorrhagic	Bilateral
P244	71	Male	primary	Right	Maltese	Maltese and some English words	HI	n/a	Ischaemic	Left
P245	74	Female	secondary	Right	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Right
P246	73	Male	primary	Left	Maltese	Maltese only	HI	n/a	Ischaemic	Left
P247	64	Male	secondary	Right	Maltese	Maltese and some English words	psychiatric disorders	n/a	Haemorrhagic	Right
P248	75	Male	post-secondary	Left	Maltese	Maltese and some English words	n/a	n/a	Ischaemic	Left
P249	72	Male	primary	Left	Maltese	Maltese and some English words	HI	n/a	Ischaemic	Right

P250	78	Male	secondary	Right	Maltese	Maltese only	n/a	n/a	Ischaemic	Bilateral
P251	45	Female	university	Right	Maltese	Maltese, English & Italian	n/a	n/a	Ischaemic	Bilateral

Ethical Considerations

Ethical considerations play a crucial role in the planning and implementation of health research. This study was approved by the University of Malta Research Ethics Committee and the Faculty of Health Sciences Research Ethics Committee (Reference number 1881_23052019) to safeguard the rights and welfare of the study subjects.

As confidentiality was of the utmost importance, all participant details were securely stored in line with data protection practices. To ensure respect for data protection and privacy, the EU General Data Protection Regulation (GDPR) contains a number of key principles for the processing of personal data (2018). This regulation provides a legislative framework for data protection and privacy issues in member states of the European Union.

The participants' identity will not be revealed in any part of this dissertation or any publication which results from this research. They were given alphanumeric codes to ensure pseudonymity and to safeguard their identity. All data were handled in line with the GDPR. The hard copies were stored in a locked filing cabinet, while a soft copy was password-protected and stored in an encrypted computer owned by the researcher. Personal data (names and respective codes) are stored separately and will be immediately destroyed after the publication of results. The coded data will be retained in anonymous format.

Since the MAST (Grima, 2015) was used as a language screening assessment, permission was granted by Dr Ritienne Grima to be utilised for this study. Permission to use the Maltese version of the EQ-5D-5L was requested by registering the research on the website of the EuroQol Research Foundation.

Permission was granted by the foundation (Appendix C1). All other tools and forms were readily available in the public domain or created specifically for this project.

Approval was obtained from the Chief Executive Officer of the hospital, as well as the Data Protection Officer, the Ward Manager, and the Neurology Consultants, to enrol the participants in this study. Additionally, permission from the Professional Lead of the Speech and Language Centre and Data Protection Officer of Primary Health Care, was given to follow up with patients who attended community health clinics for speech language therapy. Approval to follow up with patients who were in the rehabilitation hospital was granted by the Research Committee of the hospital, the Data Protection Officer, and the Chief Executive Officer. A sample of the Information letters distributed to these personnel can be found attached in Appendix C2. These were adapted accordingly.

The participants or relatives were given a detailed letter of information and a consent form using regular text (Appendix C3 & C5). An aphasia-friendly letter of information and consent form were given to those participants who had aphasia to better understand what the study involved (Appendix C7 & C9). These were available in both Maltese and English. The intermediary (an onsite nurse) explained what each phase involved. The participants who agreed signed the consent form (Appendix C4, C5, C8 & C10), which was then given to the researcher by the intermediary.

The detailed letters of information and consent forms clearly state that participation in the study will be entirely voluntary, and at no point would potential participants be coerced in any way. Should potential participants refuse to participate, they would continue to receive the same quality of care that they were receiving from the hospital staff.

Participants had the right to withdraw their consent for participation in the study at any time without any form of penalty and without the need to give a reason. Once the data had been collected and participation was over, they still had the right to withdraw from the study. Should participants decide to withdraw from the study, all the information collected would be destroyed. Withdrawal from the study would not affect the quality of care they received from the hospital or any other institution. They could withdraw from the study or request data removal by contacting the researcher by email or telephone.

The detailed letters of information and consent forms also clearly stated that all the data collected would be pseudonymised using code numbers. It would be stored separately from the personal data. All information collected would be password-protected, and no other person except the researcher and the supervisor would have access to it. Under the Data Protection Act, participants had the right to access, rectify, and erase data concerning themselves. Upon completion of the research and publication of results, all personal data would be destroyed, and the data will be stored anonymously.

Pilot Study

A pilot study is “A small-scale test of the methods and procedures to be used on a larger scale …” (Porta, 2008). Leon et al. (2011) noted that pilot studies were commonly conducted to investigate the feasibility of recruitment, assessment, and data analysis prior to conducting the larger study.

For the pilot study, 13 people were recruited. In the second phase, 10 people were assessed as one person died, another refused to proceed with participation,

and another was lost to follow-up. Eight people participated in the final phase because another participant died, and another participant withdrew.

In the first phase of the pilot study, an SLP consented to act as an intermediary between the possible participants and the researcher. However, since the SLT had to cover numerous medical wards, it was difficult for her to approach all potential participants, and most potential participants were missed. To counteract this problem, the nursing officer of the ward was asked to be the intermediary during the main study, as she worked full-time in that ward and was able to approach most of the potential participants.

During the first phase, it was noted that the tools utilised did not clearly reflect the participants' language abilities in the different language domains (i.e., written, auditory receptive, and expressive language). As the tools gave a generic view of these abilities, it was decided that a language assessment would be done to have a clear understanding of the participants' language abilities. Few Maltese language assessments have been specifically developed for the Maltese population. The Language Screening Test for the Elderly (LeST; Delia et al., 2012) is a screening test aimed at Maltese elderly with acquired language difficulties; thus, it was not designed for stroke patients. Although it assesses receptive and expressive language skills, it does not include assessment of the written modality. On the other hand, the Test tal-Afasja Dettaljat (TAD; Aphasia Specialised Division, Speech and Language Department, 2013) is an intensive language assessment consisting of six cognitive tests and 21 language assessments that takes a significant amount of time to administer, and it was not the best option since most participants were still tired and weak after the stroke. Additionally, even though the data were collected for a large cohort, no psychometric data were available in relation to the validity of the

assessment. Therefore, the MAST (Grima, 2015) was utilised in the study. It has a shorter administration time and assesses different language domains.

Finally, the therapy description form had to be completed by the SLPs after each session with the PwA. However, this created an additional load on the already busy schedules and several SLPs did not complete the forms consistently. Therefore, it was decided that one form would be completed after the episode of care.

Table 3.4 demonstrates a concise overview of the demographic details of the subjects in the pilot study whilst Table 3.3 shows a detailed description of the participants' demographic data, based on the DESCRIBE Checklist (Isaacs et al., publication in progress).

Table 3.4

The demographic details of the subjects in the pilot study

Age	Gender		Literate		Handedness		Type of Stroke	
	Male	Female	No	Yes	Right	Left	Ischaemic	Haemorrhagic
Under 40 years	0	1	0	1	1	0	1	0
50-59 years	1	0	0	1	0	1	1	0
60-69 years	2	2	1	3	3	1	3	1
70-79 years	3	1	2	2	3	1	2	2
80-89 years	1	1	1	1	2	0	2	0
90-99 years	1	0	0	1	1	0	1	0
Total	8 61.5%	5 38.5%	4 30.7%	9 69.3%	10 76.9%	3 23.1%	10 76.9%	3 23.1%

Table 3.5

Demographic details of the participants in the pilot study

Code	Age	Sex	Education Level	Handedness	Primary Language	Language Status	History of Previous stroke	Stroke type	Lesion Hemisphere
P01	17	Female	secondary	Right	Maltese	Maltese and English	n/a	Ischaemic	Left
P02	73	Male	primary	Right	Maltese	Maltese only	n/a	Ischaemic	Left
P03	79	Male	university	Left	Maltese	Maltese and English	n/a	Ischaemic	Left
P04	69	Female	secondary	Right	Maltese	Maltese and English	n/a	Ischaemic	Left
P05	85	Female	primary	Right	Maltese	Maltese	n/a	Ischaemic	Right
P06	66	Male	secondary	Right	Maltese	Maltese and English	Yes (Left)	Haemorrhagic	Right
P07	65	Male	secondary	Left	Maltese	Maltese only	n/a	Ischaemic	Right
P08	65	Female	secondary	Right	Maltese	Maltese and English	n/a	Ischaemic	Left
P09	72	Female	secondary	Right	Maltese	Maltese and English	n/a	Haemorrhagic	Right
P10	94	Male	secondary	Right	Maltese	Maltese and English	n/a	Ischaemic	Left
P11	73	Male	primary	Right	Maltese	Maltese only	n/a	Haemorrhagic	Right
P12	88	Male	secondary	Right	Maltese	Maltese and English	n/a	Ischaemic	Left
P13	59	Male	post- secondary	Left	Maltese	Maltese and English	n/a	Ischaemic	Left

Validity and Reliability

In this research, attention was paid to the accuracy of the results, along with the rigour of the study. This was attained through psychometric measures of validity and reliability (Lobiondo-Wood & Haber, 2013).

Validity. Validity refers to "the extent to which a concept is accurately measured in a quantitative study" (Heale & Twycross, 2015). The literature outlines various types of validity (Oluwatayo, 2012). These can be listed as follows: predictive validity, concurrent validity, content validity, criterion-related invalidity, internal validity, external validity, construct validity, face validity, systemic validity, theoretical validity, jury validity, consequential validity, cultural validity, interpretive validity, descriptive validity, evaluative validity, statistical conclusion validity, and translation validity. Sürücü and Maslakçl (2020) noted that the two types of validity that are generally accepted to have particular importance in the literature are content validity and construct validity.

Face Validity. Face validity aims to determine whether an event truly represents what it intends to represent (Shah et al., 2018). It increases clarity, understandability, and congruence while reducing unhappiness and dissatisfaction among individuals who may use the tools (Streiner et al., 2015, p. 79). Consequently, as face validity aims to check whether each domain's elements are reasonable, appropriate, and pertinent to the users of the measure on a daily basis (Holden, 2010), the pilot study served to assess face validity.

Content Validity. The content validity of a tool is construed as the degree to which criteria are relevant to and representative of their targeted construct (Fetters et al., 2013). Content validity is crucial since it established what is being measured thus, it is required that both relevance and representativeness should be assessed

(Dixon & Johnson, 2019).It is performed by an expert or academic staff member. They ensure that the purpose of each statement is appropriate for the measuring instrument, that the statements are clear, readable, and not ambiguous, and that the difficulty of each item is appropriate for the level of the participants. Since the researcher designed the therapy satisfaction form, content validity was achieved by giving the form to two SLPs They were informed of the aim of the study and asked to evaluate the tool and provide feedback on whether the questions were targeted to answer the research question.

Diversely, all the tools utilised in this study were already validated tools, as they were intended to be used by all the countries involved in the I-PRAISE project (Ali et al., 2021).

Concurrent Validity. the strength of the relationship between test performance and a key criteria variable (Urbina, 2004). The focus is on the similarity of the results obtained from both measuring instruments and the extent to which they correlate. Data is compared utilising the Spearman (non-parametric equivalent to Pearson statistics) (Bowling, 2014).

In this study, performance on different assessments was compared; the ASRS and MAST scores were compared as they show the aphasia severity of PwA and the mRS score were compared with the Participation, Activity and Wellbeing Sections of the TOMs since they both illustrate the dependence in the daily activities of people. Table 3.7 shows that both the MAST score and the ASRS positively and significantly correlate as the correlation coefficient is positive and the P-value is less than the 0.05 level of significance. The resulting correlation coefficient is 0.972 which is very close to 1 indicating a strong positive correlation between the two variables.

Table 3.6

Spearman's correlation between MAST & ASRS

			ASRS (Phase 1)
Spearman's rho	MAST Total score (Phase1)	Correlation Coefficient	0.97
		P-value	<0.00
		Sample size	11

Figure 3.1 illustrates that the strong positive correlation is also a linear relationship. The correlation coefficient does not imply any relationship but that there is no linear relationship. The relationship should be linear because ideally one score is equal to the other.

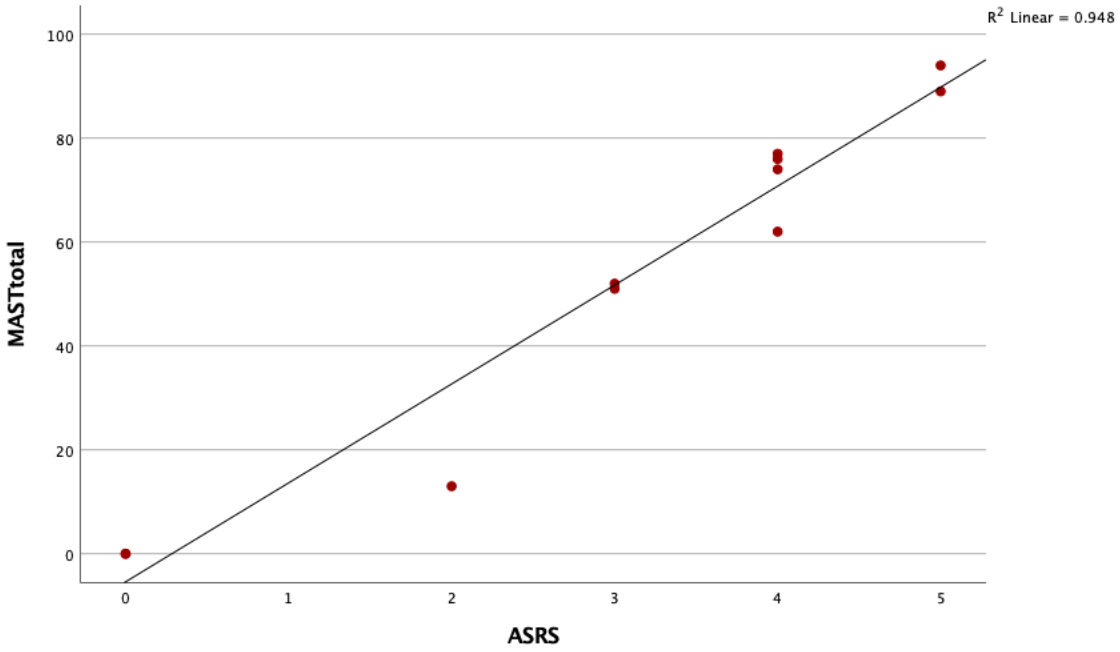


Figure 3.1: Scatter plot of correlation between MAST & ASRS

Similarly, in Table 3.7 both the mRS score and the TOMs demonstrate that there is a significant correlation between the two as the P-value is smaller than the 0.05 level of significance however the correlation coefficient is negative and closer to -0.5 indicating that the relationship is less linear.

Table 3.7

Spearman's correlation between mRS & TOM Wellbeing, Participation and Activity

			TOM wellbeing (Phase 1)	TOM participation (Phase 1)	TOM activity (Phase1)
Spearman's rho	mRS (Phase1)	Correlation Coefficient	-0.62	-0.62	-0.77
		P-value	0.03	0.04	0.00
		Sample size	11	11	11

The scatter plot below (Figure 3.2) shows the linear negative relationship between the mRS and TOM wellbeing, participation, and activity, signifying that the higher the mRS score the lower the TOMs score.

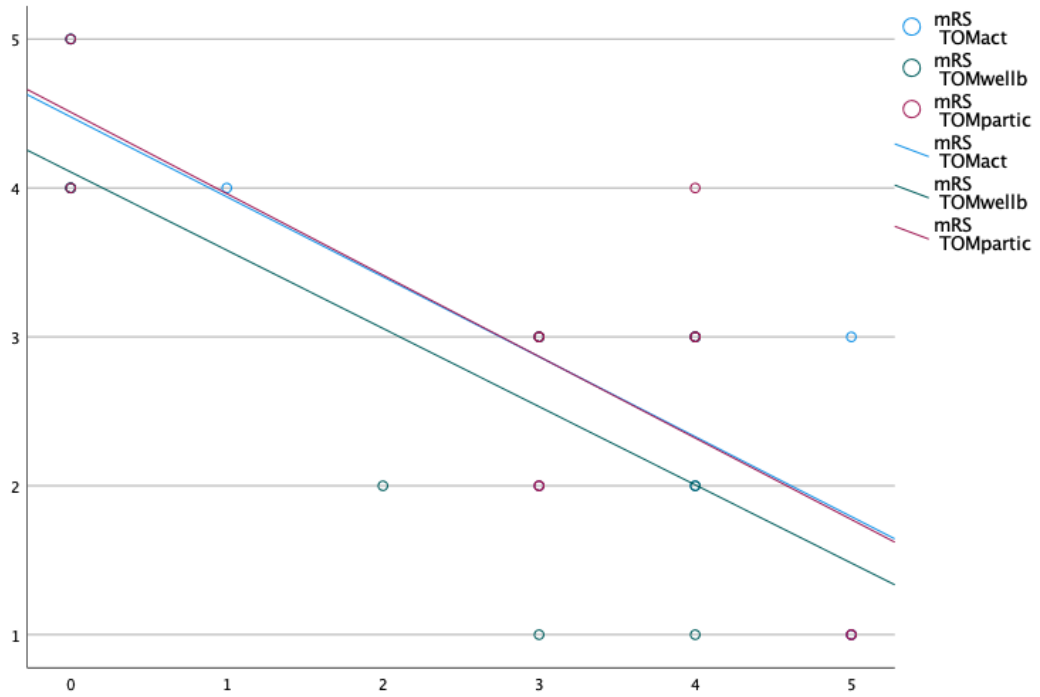


Figure 3.2: Overlay scatter plot between mRS & TOM Wellbeing, Participation and Activity

Reliability. Reliability relates to the consistency of the measure, whether it can be replicated at a certain point in time. The three attributes of reliability are (a) homogeneity, (b) stability and (c) equivalence (Heale & Twycross, 2015). Test–retest and parallel or alternate-form reliability testing are used to assess stability. Inter-rater reliability is used to determine equivalence. Internal consistency (homogeneity) is measured using item-to-total correlation, split-half reliability, the Kuder-Richardson coefficient, and Cronbach's alpha (Lobiondo-Wood & Haber, 2013). Moreover, reliability ensures that the test has no errors as the more measurement errors, the less reliable the test (McMillan & Schumacher 2006; Fraenkel & Wallen, 2003).

Test-retest reliability. It assumes that an individual's score in distribution should be the same over that period (Revelle & Condon, 2017). Reliability is predicted by utilising the Pearson correlation coefficient or comparing the data using the t-test (Oluwatayo, 2012). Albeit the literature reporting different opinions concerning the interpretation of the data collected, the general view is that a correlation value of 0.80 and higher indicates that the measuring instrument provides test-retest reliability (Whiston, 2013). Sürücü and Maslakçı, (2020) noted that despite literature providing a lack of consensus regarding the time difference between the two tests to determine test-retest reliability, it is believed that if the tests are performed with an interval of 1-2 weeks or 10-15 days generates favourable results. The test-retest technique is based on two assumptions (Wells, 2003). The first and most important assumption is that the feature being tested does not change over time (the 'testing effect') (Engel & Schutt, 2013) The second assumption is that the time interval is long enough but short enough that the respondents' recollections of taking the exam the first time do not affect their scores on future test administrations, a phenomenon known as the 'memory effect.'

As spontaneous language recovery is common in the first few days after a stroke, as Wilson and colleagues (2019) found that during the first two weeks following a stroke, overall language function improved significantly and gradually, owing mostly to the recovery of expressive language with minimal SLT input. Thus, the test-retest could not be done with an interval of 1-2 weeks (Sürücü and Maslakçı, 2020). Since the TOMs, ASRS and mRS scores aimed to capture the participants' impairment at that time, the ‘memory effect’ was not an issue as they had to remember nothing. Thus, the abovementioned scores were retested after 3 days. They were analysed using the Wilcoxon Signed Rank Test (the non-parametric equivalent to paired t-test) to evaluate their stability. This non-parametric test was utilised since the sample size is small hence the power of the tests is very weak. The probability of not committing a Type II error is called the power of a hypothesis test which is affected by sample size among other factors (Steinberg, 2011). Table 3.6 shows that all the test utilised are reliable as the P-values exceed the 0.05 level of significance.

Table 3.8

Wilcoxon Signed Rank Test

		Sample Size	Mean Rank	Sum of Ranks	P-value
TOMimp(RT) – TOMimp	Negative Ranks	2	2.00	4.00	0.56
	Positive Ranks	1	2.00	2.00	
	Ties	8			
	Total	11			
TOMact(RT) – TOMact	Negative Ranks	2	2.00	4.00	0.56
	Positive Ranks	1	2.00	2.00	
	Ties	8			
	Total	11			
TOMwellb(RT) – TOMwellb	Negative Ranks	1	1.00	1.00	0.65
	Positive Ranks	1	2.00	2.00	
	Ties	9			
	Total	11			
TOMpart(RT) – TOMpart	Negative Ranks	2	1.50	3.00	0.15
	Positive Ranks	0	0.00	0.00	
	Ties	9			
	Total	11			
ASRS(RT) - ASRS	Negative Ranks	2	1.50	3.00	0.15
	Positive Ranks	0	0.00	0.00	
	Ties	9			
	Total	11			
mRS(RT) - mRS	Negative Ranks	1	1.00	1.00	0.31
	Positive Ranks	0	0.00	0.00	
	Ties	10			
	Total	11			

Internal consistency. Internal consistency consists of measuring the degree to which the items of a test produce similar scores. Gliem and Gliem (2003) note that when using Likert-type scales it is imperative to calculate and report Cronbach's alpha coefficient for internal consistency reliability for any scales or subscales one may be using. Therefore, internal consistency was performed for the Therapy Satisfaction Form which was developed by the researcher. The 3 items given to the patients and the 3 items given to their relatives were included where the Cronbach's Alpha which was calculated on SPSS 28 as being 0.962. George and Mallery (2003) note that a Cronbach's alpha coefficient over 0.9 signifies excellent reliability.

Inter-rater reliability. Equivalence is tested through inter-rater reliability. It aims to assess the degree to which different raters agree in the assessment marking. This was done by a trained SLP who was present for data collection. Both the staff and the researcher scored the MAST, ASRS, TOMs and the mRS and both scores were compared. This was done for 30% of the participants. Intra-class correlation two-way mixed model was conducted using the SPSS.

Table 3.9

Intra class correlation coefficient

		Intra-class correlation	95% Confidence Interval
MAST total score (Phase 1)		0.999	0.995 to 1.000
MAST comprehension score (Phase 1)		0.996	0.987 to 0.999
MAST expression core (Phase 1)		0.998	0.993 to 1.000
TOM impairment (Phase 1)	Single	0.943	0.802 to 0.984
TOM activity (Phase 1)	measure	0.962	0.866 to 0.990
TOM wellbeing (Phase 1)		0.682	0.175 to 0.903
TOM participation (Phase 1)		0.970	0.891 to 0.992
ASRS (Phase 1)		0.974	0.908 to 0.993
mRS (Phase 1)		0.972	0.890 to 0.993

The intra-class correlation is a value between 0 and 1, where values below 0.5 indicate poor reliability, between 0.5 and 0.75 moderate reliability, between 0.75 and 0.9 good reliability, and any value above 0.9 indicates excellent reliability (Koo &

Li, 2016). Table 3.9 shows that all the intra-class correlation coefficient values are over 0.9 with the exception of TOM wellbeing. This shows overall high reliability.

Methodological Limitations

The limitations of a study include those characteristics of the research design and methodology that could have affected the results of the research. Price and Murnan (2004) explained that these included anything that could affect generalisability, anything that interfered with data collection, and where there were unanticipated challenges. As with any research, this study has some methodological limitations, which are outlined in this section.

i. *Participant Recruitment:* In October 2018, participant recruitment was initiated. The plan was to recruit the first ten participants for the pilot study and the rest of the participants of that six-month period for the actual study. During the six months, the intermediary approached only 20 participants, and 13 agreed to participate in the study. This number was deemed too small to conduct the research.

Prior to starting the data collection, it was estimated that around 50 participants would be eligible to participate in the study. Based on the previous year's statistics, 294 new patients were admitted to the stroke unit (Lomax, personal communication, March 6, 2018). Approximately 147 stroke patients were to have been recruited during six months. As mentioned in the previous section, about one-third of people with stroke have aphasia, resulting in 50 participants being eligible to participate in this study. Therefore, it was decided that the 13 participants would be included in the pilot study, and participant recruitment for the actual study would start again. A new

intermediary was asked to help with the study, and the data collection for the main study commenced in October 2019.

ii. *Participant attrition:* As this was a longitudinal study, it was very demanding for the subjects in terms of time and extended commitment. As the researcher aimed to rely on the same subjects, there was a possibility that some of them would no longer be able to participate for various reasons, such as changes in contact details, refusal, incapacity, and even death, which cut down the usable data to be drawn to formulate the conclusions. To overcome this limitation, the researcher focused on obtaining detailed contacts to avoid losing people to follow-up. Additionally, follow-ups done in Phases 2 and 3 were kept as short as possible, and the researcher offered the participants the opportunity to choose the location where they felt it best for them to meet for these follow-ups.

iii. *COVID-19*: The first case of COVID-19 in Malta was reported at the beginning of March 2020, and a short time later, no students and researchers were allowed to go to the state hospital; thus, Phase 1, participant recruiting, was cut short by one month. Phase 2 was planned to start in April 2020. As most of the participants were vulnerable people (>65 years), it was deemed best to avoid the visits. Instead, the researcher conducted phone interviews with the participants or relatives, depending on the severity of the aphasia. The MAST (Grima, 2015) could not be carried out as planned, as it was impossible to conduct a language session on the phone. The possibility of a video call was considered; however, when asking the first few participants, they did not all

have internet access, and it was decided to keep uniformity and use only phone calls for Phase 2. For Phase 3, online video calls were made so that the MAST assessment could be re-administered. The assessment was shown to the participants through the shared-screen option.

iv. *Researcher obtrusiveness*: This was not problematic in the language assessment, as it was difficult to distort their language abilities. However, this might have affected other assessment measures regarding the outcome and quality of life, as participants might have felt the need to 'look good' or want to please others. This is also known as 'response bias' which was minimised by putting the participants at ease and conveying a non-judgmental attitude.

Data Analysis

The quantitative data gathered in this study were analysed using the Statistical Package for the Social Sciences (SPSS 28). The analysis included the following:

- Normality testing, looking at the Shapiro-Wilk test and the Kolmogorov-Smirnov test. Most statistical analyses are based on the assumption that the population from which the samples are taken is normally distributed (Field, 2009; Pallant, 2007). This is important because if this assumption does not hold, the results do not reflect reality (Field, 2009; Oztuna et al., 2006).
- The Kruskal-Wallis test is a rank-based nonparametric test that can be used to determine whether there are statistically significant differences between two or more groups of independent variables on a continuous or ordinal dependent variable.

- The chi-square test for independence compares two variables in a contingency table to see if they are related.
- Spearman's rank-order correlation is a non-parametric test utilised to measure the strength and direction of the association between two ranked variables.

The following table illustrates the variables analysed in the next chapter.

Table 3.10

Variables available for data analysis

Independent Variables	
Variables	Levels
Gender	Male, Female
Age	40-49 years 50-59 years 60-69 years 70-79 years 80-89 years 90-99 years
Level of Education	Primary, Secondary, Post-Secondary, Tertiary
Language use	Monolingual, bilingual, multilingual
Handedness	Left, Right
Stroke type	Ischaemic, Haemorrhagic
Side of stroke lesion	Left, Right, Both
Thrombolysis	No, Yes
Thrombectomy	No, Yes
The ASRS (Goodglass et al., 2000) in Phase 1	Score of 0-5, according to severity
The MAST score (Grima, 2015) in Phase 1	Score of 1- 100, according to severity
Therapy type	Semantic Processing, Phonological Processing, Constraint-Induced Language Therapy, Melodic Intonation Therapy, Gestural Therapy, Pragmatic Therapy Approach, Combination of several therapy approaches
SLT dosage	number in minutes
Therapy type	One-to-one therapy, Group therapy
Dependent Variables	
The MAST score (Grima, 2015) The ASRS (Goodglass et al., 2000) The TOMs (Enderby & John, 2015) mRS (Rankin, 1957) The EQ-5D-5L (EuroQol Group, 2009)	

Other data which was collected but are not include in the previous table include patient and carer SLT services satisfaction and the support services and resource utilisation accessed post-stroke.

Conclusion

This chapter has outlined the research design, methodology and tools utilised to collect data in relation to the research questions named in Chapter 2. In the following chapter, the results obtained from this study are presented along with the analysis of the data.

Chapter 4

Data Analysis

Chapter Overview

This chapter presents the participants' scores for the different outcomes that made up the dependent variables in this study (see Table 3.10). The scores were gathered after the stroke occurred (Phase 1; *N* = 44), six months post-stroke (Phase 2; *N* = 37) and one-year post-stroke (Phase 3; *N* = 30). The following section discusses the normality tests that were conducted in the study, taking into account the independent variables (see Table 3.10). The SPSS 28 was utilised for data analysis, and all tests were two-sided. Continuous data were obtained in terms of median (interquartile range [IQR]) values and categorical data as N (%). A p-value of ≤ 0.05 was considered significant for each outcome. The p-value reflects the data's degree of compatibility with the null hypothesis (Di Leo & Sardinelli, 2020).

The chapter then presents the analysis results according to the research questions (RQs) given below:

1) In a sample of people with aphasia living in Malta, do demographic factors influence outcomes at six months and one year after stroke?
2) In a sample of people with aphasia living in Malta, do stroke related factors influence outcomes at six months and one year after stroke?
3) In a sample of people with aphasia living in Malta, does initial aphasia severity influence outcomes at six months and one year after stroke?
4) In a sample of people with aphasia living in Malta, do type, timing, frequency, and intensity of SLT influence outcomes at six months and one year after stroke?
5) In a sample of people with aphasia living in Malta, how do they and their carers perceive SLT services provided in Malta?

6) In a sample of people with aphasia, what community support services and/or organisations, if any, are accessed post-stroke?

Normality Testing

Before conducting any form of inferential statistics, it is important to conduct normality testing. The two popular tests for checking for normality are the (1) Shapiro-Wilk test and the (2) Kolmogorov-Smirnov test.

They test for the following hypothesis:

H_0: variables follow a normal distribution

H_1: variables do not follow a normal distribution

Normality testing was performed for every independent factor with the various outcomes at all Phases. Tables E1 – E28 (kindly refer to Appendix E) shows that both the Kolmogorov- Smirnov and the Shapiro Wilk tests yielded P-values (approximately 0) which are less than the 0.05 level of significance indicating that the distributions do not closely follow the normal distribution curve. For this reason, non-parametric tests rather than parametric tests were utilised to analyse the data. Additionally, since there are several outliers which cannot be removed, using non-parametric tests yields a more robust result (Kotz et al., 2006).

Computed Variables

Based on the data collected, the following new variables were computed to check for changes in the outcomes with each subsequent phase:

- Changes in the first six months post stroke = Phase 2 scores minus Phase 1 scores

- Changes between six- and 12-months post stroke = Phase 3 scores minus Phase 2 scores
- Changes in the first 12 months post stroke = Phase 3 scores minus Phase 1 scores

These changes were calculated for the TOM scores (Enderby & John, 2015), MAST scores (Grima, 2015), ASRS scores (BDAE-3, Goodglass et al., 2000) and EQ-5D-5L (2009). The newly computed variables were considered dependent factors and analysed in relation to each independent factor.

Outcomes

The outcomes for each participant in each Phase are supplementary in the Appendix D, Table D1.A non-parametric Friedman's test of difference was conducted amongst repeated measures on the dependent variables (refer to Table 3.10 in Chapter 3) to determine whether **the scores** differ significantly in Phase 2 and Phase 3. These were not conducted for the MAST scores and EQ-5D-5L as they were only administered twice, and the scores were insufficient for comparison and for determining whether there were any significant difference. The tables corresponding to these tests can be found in Appendix F (Tables F1-F5).

The following null and alternative hypothesis were formulated:

H_0: the mean scores of outcomes across all Phases are equal

H_1: the mean scores of outcomes across all Phases are different

These results showed the mean score in each phase is statistically significantly different ($p<0.05$) in the following rendered outcomes:

- TOM impairment: $\chi^2(2) = 43.061$, $p = <0.00$
- TOM activity: $\chi^2(2) = 36.00$, $p = <0.00$

- TOM participation: $\chi^2(2) = 37.63$, $p = <0.00$
- ASRS: $\chi^2(2) = 36.56$, $p = <0.00$

Since all the above *P-values* are less than the 0.05 level of significance, the null hypothesis is rejected which indicates that the mean score in each Phase is statistically different. However, the null hypothesis is accepted in TOM Wellbeing: $\chi^2(2) = 3.90$, $p = <0.14$.

Similarly, the Freidman's was carried out to determine whether **the changes** in the outcomes at Phase 2 and Phase 3 are statistically different. These results showed the mean score in each phase is statistically significant different ($p<0.05$) in the following rendered outcomes:

- Changes in TOM impairment: $\chi^2(2) = 22.40$, $p = <0.00$
- Changes in TOM activity: $\chi^2(2) = 15.46$, $p = <0.00$
- Changes in TOM participation: $\chi^2(2) = 22.32$, $p = <0.00$
- Changes in ASRS: $\chi^2(2) = 23.75$, $p = <0.00$

However, the null hypothesis is accepted in changes in TOM Wellbeing: $\chi^2(2) = 3.35$, $p = <0.18$. These were not conducted for the MAST scores and EQ-5D-5L as they were only administered twice, and the scores were insufficient for comparison and for determining whether there were any significant improvements.

Effect Size

Effect sizes are among the simplest and most crucial summary statistics that can be reported in quantitative experiments. By deciding on the relevant effect size(s), the researcher can also transform an ambiguous research question into a specific, quantitative one (Cumming 2014). Effect sizes should always be reported in

quantitative research for the sake of transparency unless there are valid reasons not to. The American Psychological Association states:

For the reader to appreciate the magnitude or importance of a study's findings, it is almost always necessary to include some measure of effect size in the Results section. (American Psychological Association 2001)

Statistical significance specifies if a result may not be the cause of random variations within the data. Accordingly, the test statistics can be transformed in effect sizes (Fritz et al., 2012, p. 12; Cohen, 2008). To compute the effect size for Kruskal-Wallis test, the following equation was utilised : eta2[H] = (H - k + 1)/(n - k), where H is the value obtained in the Kruskal-Wallis test; k is the number of groups; n is the total number of observations. The percentage of variance in the dependent variable that is explained by the independent variable is calculated using the eta-squared estimate, which assumes values between 0 and 1. The values used for interpretation are typically 0.01- 0.06 (small effect), 0.06- 0.14 (moderate effect), and >= 0.14. (large effect).

RQ1 Analysis: In a sample of people with aphasia living in Malta, do demographic factors influence outcomes at six months and one year after stroke?

The demographic characteristics analysed in this study include: (1) Gender, (2) Age, (3) Handedness, (4) Education and (5) Multilingualism**.** Table 4.1 delineates the descriptive data of the participants and their demographic details.

Table 4.1

Descriptive data of demographic characteristics.

		N	%
Gender	Male	27	61.4%
	Female	17	38.6%
Age	40-49 years	6	13.6%
	50-59 years	2	4.5%
	60-69 years	14	31.8%
	70-79 years	14	31.8%
	80-89 years	7	15.9%
	90-99 years	1	2.3%
Handedness	Right	36	81.8%
	Left	8	18.2%
Education	Primary	20	45.5%
	Secondary	16	36.4%
	Post-Secondary	6	13.6%
	University	2	4.5%
Language Knowledge	Monolingual	17	38.6%
	Bilingual	25	56.8%
	Multilingual	2	4.5%

Gender

As given in Tables E1, E10 and E19 (see Appendix E), the p-values were less than the 0.05 level of significance in both the Kolmogorov–Smirnov and Shapiro–Wilk tests, indicating that the data did not closely follow a normal distribution curve; therefore, non-parametric tests were carried out.

Accordingly, the Kruskal–Wallis test was used to examine whether the populations had equal means for any variable. As can be seen from the results in Table 4.2, no statistical differences based on gender were found between the outcomes at six months post-stroke (p-values > 0.05 level of significance), except in

the EQ-5D-5L scores (p-value = 0.01, higher than 0.05 level of significance). Moreover, the effect is higher than 0.14 highlighting a large size effect. The mean ranks of the male participants were greater than those of the females, indicating that the former scored their health higher. There were no statistical differences between the gender groups in terms of outcomes at 12 months post-stroke, and the p-values were all greater than the 0.05 level of significance.

Additionally, the Kruskal–Wallis test was utilised to check for differences in the means of changes in outcome scores between the two gender groups. All the p-values were greater than the 0.05 level of significance (Table 4.3), highlighting that there were no significant differences in the mean rank.

Table 4.2

Kruskal-Wallis Test between gender & outcomes at 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Male	21	19.57	1.66	0.70	0.01	18	17.42	1.37	0.28	0.01
	Female	16	18.25				12	14.04			
TOM Impairment	Male	21	19.98	1.29	0.51	0.01	18	17.25	1.00	0.11	0.05
	Female	16	17.72				12	12.88			
TOM Activity	Male	21	21.10	1.47	0.16	0.02	18	17.58	0.87	0.08	0.07
	Female	16	16.25				12	12.38			
TOM Participation	Male	21	21.31	1.60	0.12	0.03	18	16.89	0.93	0.21	0.01
	Female	16	15.97				12	13.42			
TOM Wellbeing	Male	21	20.64	1.46	0.26	0.00	18	16.39	1.32	0.47	0.01
	Female	16	16.84				12	14.17			
mRS	Male	21	18.26	1.21	0.24	0.02	18	14.83	1.20	0.59	0.02
	Female	16	19.97				12	16.50			
EQ-5D-5L	Male	21	21.13	19.57	0.01	0.15	18	15.50	10.64	0.19	0.01
	Females	16	12.90				12	11.45			
MAST Total Score	Male			n/a			18	16.50	18.70	0.44	0.01
	Females						12	14.00			
MAST Comprehension Score	Male			n/a			18	15.94	7.95	0.73	0.01
	Females						12	14.29			
MAST Expression Score	Male			n/a			18	16.31	12.25	0.53	0.01
	Females						12	14.29			

Table 4.3

Kruskal-Wallis Test between gender & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Male	21	18.45	1.45	0.70	0.01	18	15.53	0.92	0.71	0.03	18	16.72	1.36	0.58	0.02
	Female	16	19.72				12	16.65				12	15.00			
TOM Impairment	Male	21	15.98	0.73	0.27	0.11	18	18.34	0.71	0.30	0.00	18	14.53	0.91	0.20	0.02
	Female	16	22.97				12	15.18				12	18.33			
TOM Activity	Male	21	18.64	0.75	0.80	0.02	18	16.34	0.61	0.76	0.03	18	14.72	1.23	0.53	0.02
	Female	16	19.47				12	15.46				12	16.67			
TOM Participation	Male	21	18.64	0.75	0.80	0.02	18	13.83	0.95	0.16	0.03	18	13.81	1.37	0.18	0.02
	Female	16	19.47				12	18.00				12	18.04			
TOM Wellbeing	Male	21	19.10	1.33	0.94	0.02	18	14.31	1.26	0.28	0.00	18	14.31	1.79	0.56	0.02
	Female	16	18.88				12	17.29				12	17.29			
mRS	Male	21	20.33	0.54	0.30	0.00	18	15.33	0.49	0.88	0.32	18	15.72	0.71	0.84	0.03
	Female	16	17.25				12	15.75				12	15.17			
EQ-5D-5L	Male				n/a		18	11.82	11.33	0.06	0.08				n/a	
	Female						12	17.70								
MAST Total Score	Male				n/a			n/a				18	12.72	20.09	0.03	0.12
	Female											12	19.67			
MAST Comprehension Score	Male				n/a			n/a				18	13.31	9.82	0.09	0.06
	Female											12	18.79			
MAST Expression Score	Male				n/a			n/a				18	13.22	12.06	0.08	0.07
	Female											12	18.92			

Age

Age was not a relevant factor determining stroke outcomes in Phase 1, as all p-values were greater than the 0.05 level of significance (Table, E2, Appendix E). No statistical differences were found between participants of different ages in terms of the outcomes at six months and 12 months post-stroke; as shown in Table 4.4, all p-values were greater than 0.05.

Regarding changes in outcomes post-stroke, no difference was noted in the TOM scores based on participants' age group; all p-values were greater than 0.05. However, the p-value of the changes in the total MAST scores in the first-year post-stroke was less than 0.05, thus, a post-hoc test was conducted. The adjusted p-value (Table G2 in Appendix G) were more than 0.05, which means that none of the pairwise comparisons revealed significant differences in improvement except between these two age groups 60-69 years – 40-49 years where the p-value is 0.05. As observed in Table 4.5, the mean value of the changes in outcomes of those 40-49 years old (μ=23.20) is higher than of those between 60-69 years (μ=9.06) signifying that the latter group had significantly less changes in the improvement of outcomes.

The p-value for changes in MAST comprehension (Table 4.5) was less than the criterion of 0.05; therefore, a post-hoc test was carried out. The results showed a statistically significant difference ($p < 0.05$) between the changes in MAST comprehension scores in the first-year post stroke for the following age groups: 60–69 years and 40–49 years ($p = 0.02$ when adjusted by the Bonferroni correction); participants of 40–49 years had a higher mean rank and showed better improvements than those of 60–69 years.

Table 4.4

Kruskal-Wallis test between age and outcomes at 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
	Age	N	Mean	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	40-49 years	6	3.83	1.66	0.19	0.14	5	5.20	1.37	0.18	0.16
	50-59 years	2	2.50				2	3.00			
	60-69 years	11	3.82				9	5.33			
	70-79 years	10	3.60				9	4.56			
	80-89 years	7	2.57				6	4.00			
	90-99 years	1	6.00				0	--			
TOM Impairment	40-49 years	6	3.67	1.29	0.13	0.11	5	4.60	1.06	0.05	0.21
	50-59 years	2	2.50				2	3.50			
	60-69 years	11	4.27				9	4.80			
	70-79 years	10	3.60				9	4.00			
	80-89 years	7	2.86				6	3.60			
	90-99 years	1	5.00				0	--			
TOM Activity	40-49 years	6	3.67	1.47	0.11	0.12	5	4.60	0.87	0.24	0.04
	50-59 years	2	3.00				2	4.00			
	60-69 years	11	4.27				9	4.56			
	70-79 years	10	3.90				9	4.44			
	80-89 years	7	2.29				6	3.40			
	90-99 years	1	5.00				0	--			
TOM Participation	40-49 years	6	3.67	1.60	0.20	0.07	5	4.80	0.93	0.10	0.13
	50-59 years	2	3.00				2	3.50			
	60-69 years	11	4.27				9	4.78			
	70-79 years	10	3.60				9	4.33			
	80-89 years	7	2.29				6	3.80			
	90-99 years	1	4.00				0	--			
TOM Wellbeing	40-49 years	6	3.83	1.46	0.45	0.01	5	4.20	1.32	0.42	0.02
	50-59 years	2	3.00				2	4.00			
	60-69 years	11	4.36				9	4.56			
	70-79 years	10	3.50				9	3.22			
	80-89 years	7	3.29				6	4.00			
	90-99 years	1	4.00				0	--			

EQ-5D-5L	40-49 years	6	75.00	19.57	0.23	0.10	5	87.00	10.64	0.64	0.07
	50-59 years	2	65.00				2	86.00			
	60-69 years	11	81.45				9	89.25			
	70-79 years	10	77.40				9	84.44			
	80-89 years	7	52.80				6	81.50			
	90-99 years	1	89.00				0	--			
mRS	40-49 years	6	18.83	1.21	0.20	0.30	5	15.50	1.20	0.50	0.02
	50-59 years	2	31.50				2	23.50			
	60-69 years	11	14.41				9	9.50			
	70-79 years	10	16.80				9	15.17			
	80-89 years	7	28.00				6	22.50			
	90-99 years	1	4.50				0	-			
MAST Total Score	40-49 years				n/a		5	86.40	18.70	0.37	0.01
	50-59 years						2	72.00			
	60-69 years						9	83.11			
	70-79 years						9	77.78			
	80-89 years						6	63.00			
	90-99 years						0	--			
MAST Comprehension Score	40-49 years				n/a		5	36.80	7.95	0.68	0.07
	50-59 years						2	33.00			
	60-69 years						9	34.56			
	70-79 years						9	32.89			
	80-89 years						6	28.60			
	90-99 years						0	--			
MAST Expression Score	40-49 years				n/a		5	49.60	12.25	0.41	0.00
	50-59 years						2	39.00			
	60-69 years						9	48.56			
	70-79 years						9	44.89			
	80-89 years						6	36.40			
	90-99 years						0	--			

Table 4.5

Kruskal-Wallis Test between age & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
	Years	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	40-49	6	20.75	1.45	0.93	0.50	5	18.20	0.92	0.73	0.55	5	14.00	1.36	0.65	0.70
	50-59	2	20.50				2	10.00				2	12.00			
	60-69	11	18.23				9	17.72				9	19.33			
	70-79	10	17.30				9	14.44				9	14.11			
	80-89	7	19.50				6	15.92				6	16.83			
	90-99	1	27.50				0					0				
TOM Impairment	40-49	6	24.33	0.73	0.66	0.06	5	19.00	0.71	.026	0.06	5	19.40	0.91	0.76	0.74
	50-59	2	14.50				2	24.00				2	18.50			
	60-69	11	17.32				9	18.20				9	14.90			
	70-79	10	17.35				9	13.90				9	14.11			
	80-89	7	20.21				6	18.20				6	17.20			
	90-99	1	22.50				0					0				
TOM Activity	40-49	6	20.58	0.75	0.63	0.69	5	17.90	0.61	0.64	0.53	5	16.20	1.23	0.85	0.70
	50-59	2	17.25				2	22.00				2	18.75			
	60-69	11	18.86				9	16.20				9	13.11			
	70-79	10	22.35				9	13.28				9	15.67			
	80-89	7	14.93				6	16.20				6	17.50			
	90-99	1	9.50				0					0				

TOM Participation	40-49	6	20.58	0.75	0.63	0.69	5	18.00	0.95	0.45	0.63	5	18.80	1.37	0.56	0.71
	50-59	2	17.25				2	13.25				2	8.00			
	60-69	11	18.86				9	14.22				9	16.28			
	70-79	10	22.35				9	13.06				9	13.67			
	80-89	7	14.93				6	20.06				6	17.10			
	90-99	1	9.50				0					0				
TOM Wellbeing	40-49	6	22.50	1.33	0.73	0.49	5	17.10	1.26	0.67	0.68	5	17.00	1.79	0.97	0.49
	50-59	2	11.25				2	19.75				2	14.50			
	60-69	11	19.18				9	15.33				9	14.83			
	70-79	10	20.55				9	12.78				9	14.72			
	80-89	7	15.71				6	17.40				6	17.00			
	90-99	1	19.00				0					0				
mRS	40-49	6	13.08	0.54	0.31	0.07	5	14.50	0.49	0.12	0.09	5	11.33	0.71	0.15	0.06
	50-59	2	23.25				2	9.50				2	13.00			
	60-69	11	19.27				9	11.38				9	13.00			
	70-79	10	18.00				9	19.50				9	17.72			
	80-89	7	24.50				6	18.50				6	21.50			
	90-99	1	14.50				0					0				
EQ-5D-5L	40-49			n/a			5	19.20	11.33	0.40	0.65			n/a		
	50-59						2	23.00								
	60-69						9	12.19								
	70-79						9	9.00								
	80-89						6	20.13								
	90-99						0									

MAST Total Score	40-49	n/a	n/a	5	23.20	20.09	0.04	0.75
	50-59			2	20.50			
	60-69			9	9.06			
	70-79			9	15.17			
	80-89			6	18.00			
	90-99			0				
MAST Comprehension Score	40-49	n/a	n/a	5	24.00	9.82	0.02	0.81
	50-59			2	16.50			
	60-69			9	8.56			
	70-79			9	15.94			
	80-89			6	18.30			
	90-99			0				
MAST Expression Score	40-49	n/a	n/a	5	20.50	12.06	0.37	0.66
	50-59			2	19.25			
	60-69			9	12.61			
	70-79			9	13.06			
	80-89			6	18.60			
	90-99			0				

Handedness

The Kruskal–Wallis test was employed to check for differences in mean ranks. As Tables E2, E11 and E20 (Appendix E) show the p-values were less than the 0.05 level of significance in both the Kolmogorov–Smirnov test and the Shapiro–Wilk test, indicating that the data did not closely follow a normal distribution curve. Therefore, non-parametric tests were used.

The following null and alternative hypotheses were formulated:

H_0: Outcomes are equal across all PwA despite their handedness.

H_1: Outcomes are significantly different for right-handed and left-handed PwA.

Handedness was not revealed to be a relevant factor in the differences in the stroke outcomes in Phase 1, as all p-values were greater than the 0.05 level of significance (Table E2 in the Appendix E).

No differences were found between the medians of the outcomes of right-handed and left-handed PwA at 6 months post-stroke, and all the p-values were greater than the 0.05 level of significance (Table 4.6). However, the p-value (0.04) for EQ-5D-5L at six months post-stroke was less than 0.05, indicating a significant difference between the medians. The left-handed PwA had a higher mean rank (25.90) than the right-handed PwA (16.05). The effect size value is 0.09 which is considered as moderate effect.

Furthermore, the difference in the median values of right-handed and left-handed PwA for improvement in outcomes was not significant; all p-values were greater than the 0.05 level of significance (Table 4.7).

Table 4.6

Kruskal-Wallis Test between handedness & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Right	30	20.32	0.11	0.11	0.00	25	16.21	1.37	0.75	0.02
	Left	7	13.36				5	14.90			
TOM Impairment	Right	30	19.07	1.29	0.93	0.02	25	15.62	1.00	0.85	0.03
	Left	7	18.71				5	14.90			
TOM Activity	Right	30	18.75	1.47	0.76	0.02	25	15.30	0.87	0.75	0.03
	Left	7	20.07				5	16.50			
TOM Participation	Right	30	18.65	1.60	0.67	0.02	25	15.58	0.93	0.89	0.03
	Left	7	20.50				5	15.20			
TOM Wellbeing	Right	30	18.78	1.46	0.79	0.02	25	15.88	1.32	0.57	0.02
	Left	7	19.93				5	13.60			
mRS	Right	30	18.85	1.21	0.85	0.02	25	15.52	1.20	0.90	0.03
	Left	7	19.64				5	15.90			
EQ-5D-5L	Right	30	16.05	19.57	0.04	0.09	25	13.37	10.64	0.32	0.00
	Left	7	25.90				5	17.63			
MAST Total Score	Right			n/a			25	80.67	18.70	0.69	0.03
	Left						5	73.92			
MAST Comprehension Score	Right			n/a			25	33.89	7.95	0.82	0.03
	Left						5	32.50			
MAST Expression Score	Right			n/a			25	46.78	12.25	0.52	0.02
	Left						5	42.25			

Table 4.7

Kruskal-Wallis Test between handedness & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Right	30	20.37	1.45	0.08	0.05	25	15.96	0.92	0.95	0.03	25	16.50	1.36	0.46	0.01
	Left	7	13.14				5	16.20				5	13.40			
TOM Impairment	Right	30	10.30	0.73	0.35	0.04	25	17.59	0.71	0.41	0.01	25	15.92	0.91	0.91	0.03
	Left	7	22.0				5	14.33				5	16.33			
TOM Activity	Right	30	19.10	0.75	0.90	0.02	25	16.30	0.61	0.21	0.01	25	16.18	1.23	0.83	0.03
	Left	7	18.57				5	11.50				5	12.10			
TOM Participation	Right	30	19.10	0.75	0.90	0.02	25	16.30	0.95	0.22	0.01	25	15.58	1.37	0.33	0.00
	Left	7	18.57				5	12.10				5	15.10			
TOM Wellbeing	Right	30	19.00	1.33	1.00	0.02	25	15.58	1.26	0.89	0.03	25	15.72	1.79	0.74	0.03
	Left	7	19.00				5	15.10				5	14.40			

mRS	Right	30	18.88	0.54	0.87	0.02	25	14.90	0.49	0.32	0.01	25	15.34	0.71	0.79	0.03
	Left	7	19.50				5	18.50				5	16.30			
EQ-5D-5L	Right			n/a			25	15.04	11.33	0.10	0.02			n/a		
	Left						5	8.00								
MAST Total Score	Right			n/a					n/a			25	15.02	20.09	0.50	0.02
	Left											5	17.90			
MAST Comprehension Score	Right			n/a					n/a			25	14.74	9.82	0.29	0.00
	Left											5	19.30			
MAST Expression Score	Right			n/a					n/a			25	15.76	12.06	0.71	0.03
	Left											5	14.20			

Monolingual/Bilingual/Multilingual

Language Knowledge was not found to be a factor determining the outcomes of stroke in Phase 1, as all p-values (Table E5 in Appendix E were above the requirement of 0.05.

The p-values obtained in the Kolmogorov–Smirnov and Shapiro–Wilk tests were less than the 0.05 level of significance (Table E5, E14 & E23 in Appendix E), indicating that the distributions did not closely follow the normal curve. Therefore, the non-parametric Kruskal–Wallis test was employed to examine the differences in mean values. The following null and alternative hypotheses were formulated:

H_0: Outcomes are equal across all PwA with different language knowledge.

H_1: Outcomes are significantly different across all PwA with different language knowledge.

The p-values were greater than the 0.05 level of significance (Table 4.8); thus, the null hypothesis was accepted, indicating that no statistically significant difference was found in the outcome scores of participants with different levels of language knowledge. Similarly, no statistically significant differences were found in the scores for changes of outcomes between the different phases depending on the participants' language knowledge ($p > 0.05$) (see Table 4.9).

Table 4.8

Kruskal-Wallis Test between Monolingual/Bilingual/Multilingual & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Monolingual	15	15.30	0.11	0.20	0.01	12	16.88	1.37	0.58	0.02
	Bilingual	20	21.70				16	14.69			
	Multilingual	2	19.75				2	20.75			
TOM Impairment	Monolingual	15	17.57	1.29	0.77	0.04	12	15.42	1.00	0.98	0.07
	Bilingual	20	20.08				16	15.44			
	Multilingual	2	19.00				2	16.50			
TOM Activity	Monolingual	15	18.13	1.47	0.55	0.02	12	14.54	0.87	0.86	0.05
	Bilingual	20	20.30				16	16.09			
	Multilingual	2	12.50				2	16.50			
TOM Participation	Monolingual	15	19.23	1.60	0.72	0.04	12	14.08	0.93	0.46	0.02
	Bilingual	20	19.40				16	15.88			
	Multilingual	2	13.25				2	21.00			
TOM Wellbeing	Monolingual	15	20.30	1.46	0.81	0.04	12	16.92	1.32	0.74	0.04
	Bilingual	20	18.18				16	14.53			
	Multilingual	2	17.50				2	14.75			

mRS	Monolingual	15	21.40	1.21	0.37	0.00	12	16.59	1.20	0.52	0.33
	Bilingual	20	16.80				16	14.21			
	Multilingual	2	23.00				2	20.50			
EQ-5D-5L	Monolingual	15	19.13	19.57	0.58	0.22	12	17.94	10.64	0.17	0.06
	Bilingual	20	17.13				16	11.81			
	Multilingual	2	11.50				2	13.74			
MAST Total Score	Monolingual			n/a			12	13.42	18.70	0.24	0.00
	Bilingual						16	15.94			
	Multilingual						2	24.50			
MAST Comprehension Score	Monolingual			n/a			12	13.42	7.95	0.35	0.00
	Bilingual						16	15.94			
	Multilingual						2	24.40			
MAST Expression Score	Monolingual			n/a			12	13.79	12.25	0.32	0.00
	Bilingual						16	15.75			
	Multilingual						2	23.75			

Table 4.9

Kruskal-Wallis Test between Monolingual/Bilingual/Multilingual & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Monolingual	15	16.30	1.45	0.13	0.05	12	19.19	0.92	0.06	0.13	12	17.85	1.36	0.07	0.11
	Bilingual	20	19.85				16	12.56				16	13.19			
	Multilingual	2	30.75				2	22.75				2	26.50			
TOM Impairment	Monolingual	15	19.07	0.73	0.31	0.01	12	18.42	0.71	0.53	0.02	12	17.00	0.91	0.46	0.01
	Bilingual	20	17.98				16	15.53				16	14.53			
	Multilingual	2	28.75				2	21.00				2	21.25			
TOM Activity	Monolingual	15	16.83	0.75	0.53	0.02	12	16.42	0.61	0.80	0.05	12	14.63	1.23	0.49	0.02
	Bilingual	20	20.30				16	15.28				16	15.31			
	Multilingual	2	22.25				2	19.00				2	22.25			
TOM Participation	Monolingual	15	16.83	0.75	0.53	0.02	12	14.13	0.95	0.26	0.02	12	13.88	1.37	0.25	0.02
	Bilingual	20	20.30				16	15.44				16	15.56			
	Multilingual	2	22.25				2	24.25				2	24.75			
TOM Wellbeing	Monolingual	15	16.83	1.33	0.12	0.06	12	15.38	1.26	0.92	0.06	12	14.75	1.79	0.21	0.04
	Bilingual	20	19.27				16	15.34				16	14.81			
	Multilingual	2	32.50				2	17.50				2	25.50			

mRS	Monolingual	15	22.67	0.54	0.12	0.06	12	16.32	0.49	0.83	0.06	12	19.23	0.71	0.13	0.07
	Bilingual	20	16.70				16	14.79				16	13.38			
	Multilingual	2	14.50				2	17.00				2	13.00			
EQ-5D-5L	Monolingual			n/a			12	13.39	11.33	0.38	0.01			n/a		
	Bilingual						6	13.28								
	Multilingual						2	22.50								
MAST Total Score	Monolingual			n/a					n/a			12	15.08	20.09	0.18	0.05
	Bilingual											16	14.44			
	Multilingual											2	26.50			
MAST Comprehension Score	Monolingual			n/a					n/a			12	13.46	9.82	0.13	0.07
	Bilingual											16	15.29			
	Multilingual											2	27.00			
MAST Expression Score	Monolingual			n/a					n/a			12	16.88	12.06	0.28	0.12
	Bilingual											16	12.97			
	Multilingual											2	27.50			

Education

The results revealed that education was not a relevant factor affecting the consequences of stroke in Phase 1, as the p-values were greater than the criterion of 0.05 (Table E4).

As Table E13 and E22(see Appendix E) demonstrates, p-values were less than the 0.05 level of significance in both the Kolmogorov–Smirnov and Shapiro–Wilk tests, indicating that the distributions did not closely follow the normal curve. Therefore, the non-parametric Kruskal–Wallis test was utilised. The following null and alternative hypotheses were formulated:

H_0: Outcomes are equal across all PwA with different education levels.

H_1: Outcomes are significantly different across all PwA with different education levels.

The p-values in this test were greater than the 0.05 level of significance (Table 4.10), and the null hypothesis was accepted, indicating no statistically significant difference in the outcome scores based on education level.

Table 4.10

Kruskal-Wallis Test between education levels & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Primary	16	3.83	0.11	0.13	0.08	13	15.04	1.37	0.30	0.01
	Secondary	13	2.50				13	18.95			
	Post-Secondary	6	3.82				6	10.90			
	University	2	6.00				2	20.75			
TOM Impairment	Primary	16	3.67	1.29	0.14	0.07	13	14.31	1.00	0.33	0.00
	Secondary	13	2.50				13	18.90			
	Post-Secondary	6	2.86				6	11.40			
	University	2	5.00				2	16.50			
TOM Activity	Primary	16	3.67	1.47	0.52	0.02	13	14.69	0.87	0.20	0.07
	Secondary	13	3.00				13	19.10			
	Post-Secondary	6	2.29				6	10.00			
	University	2	5.00				2	16.50			
TOM Participation	Primary	16	3.67	1.60	0.39	0.05	13	14.77	0.93	0.39	0.00
	Secondary	13	3.00				13	17.25			
	Post-Secondary	6	2.29				6	11.70			
	University	2	4.00				2	21.00			

TOM Wellbeing	Primary	16	3.83	1.46	0.65	0.04	13	14.88	1.32	0.60	0.04
	Secondary	13	3.00				13	18.10			
	Post-Secondary	6	3.29				6	12.20			
	University	2	4.00				2	14.75			
mRS	Primary	16	19.47	1.21	0.23	0.03	13	16.96	1.20	0.34	0.01
	Secondary	13	15.08				13	11.70			
	Post-Secondary	6	23.33				6	17.30			
	University	2	27.75				2	20.50			
EQ-5D-5L	Primary	16	75.00	19.57	0.53	0.08	13	13.83	10.64	0.84	0.00
	Secondary	13	65.00				13	14.90			
	Post-Secondary	6	52.80				6	10.50			
	University	2	89.00				2	15.75			
MAST Total Score	Primary			n/a			13	13.27	18.70	0.11	0.11
	Secondary						13	18.75			
	Post-Secondary						6	10.90			
	University						2	25.25			
MAST Comprehension Score	Primary			n/a			13	14.46	7.95	0.38	0.00
	Secondary						13	18.10			
	Post-Secondary						6	11.00			
	University						2	20.50			
MAST Expression Score	Primary			n/a			13	12.92	12.25	0.08	0.13
	Secondary						13	19.05			
	Post-Secondary						6	11.10			
	University						2	25.50			

In terms of changes in outcomes with respect to education level, not all the p-values were less than the 0.05 level of significance (Table 4.11); therefore, the null hypothesis was rejected. The p-values for changes in outcomes in the first six months post-stroke were less than the 0.05 level of significance for both TOM activity and participation ($p = 0.04$).

Dunn's multiple comparison test was conducted after the Kruskal–Wallis test to examine which groups differed significantly with regard to TOM activity and participation. These results showed a statistically significant difference ($p < 0.05$) between changes in the first six months for the following education levels: secondary and postsecondary ($p = 0.01$). The mean rank of the TOM activity score was significantly higher for participants with a postsecondary level of education than those with a secondary level of education. The rest of the pairwise comparison yielded p-values greater than the 0.05 criterion, indicating that the differences between the other education levels were not significant (see Table G6 in Appendix G).

Similarly, the results demonstrated a statistically significant difference ($p < 0.05$) between the changes in TOM participation scores based on education level (Table 4.9); therefore, a post-hoc analysis was conducted. Statistical differences were observed between the secondary and postsecondary education groups ($p = 0.01$), with the latter having much better outcomes than the former. Kindly refer to Table G8 in Appendix G).

Table 4.11

Kruskal-Wallis Test between education levels & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Primary	16	17.31	1.45	0.63	0.03	13	15.07	0.92	0.11	0.11	13	15.07	1.36	0.10	0.11
	Secondary	13	18.65				10	13.20				10	12.70			
	Post-Secondary	6	22.67				5	19.50				5	21.00			
	University	2	23.75				2	27.75				2	26.50			
TOM Impairment	Primary	16	15.16	0.73	0.12	0.08	13	18.39	0.71	0.10	0.12	13	13.57	0.91	0.08	0.13
	Secondary	13	21.15				10	13.00				10	15.15			
	Post-Secondary	6	21.33				5	18.20				5	19.80			
	University	2	28.75				2	28.25				2	27.75			
TOM Activity	Primary	16	17.88	0.75	0.04	0.15	13	16.39	0.61	0.22	0.05	13	14.77	1.23	0.17	0.07
	Secondary	13	15.15				10	13.30				10	12.30			
	Post-Secondary	6	26.67				5	16.20				5	21.10			
	University	2	30.00				2	26.25				2	22.25			

TOM Participation	Primary	16	17.88	0.75	0.04	0.15	13	15.81	0.95	0.22	0.05	13	13.27	1.37	0.25	0.04
	Secondary	13	15.15				10	11.85				10	14.85			
	Post-Secondary	6	26.67				5	20.00				5	18.90			
	University	2	30.00				2	19.00				2	24.75			
TOM Wellbeing	Primary	16	19.00	1.33	0.26	0.02	13	14.69	1.26	0.12	0.10	13	14.62	1.79	0.37	0.00
	Secondary	13	18.12				10	12.75				10	14.80			
	Post-Secondary	6	16.42				5	22.30				5	15.20			
	University	2	32.50				2	17.50				2	25.50			
mRS	Primary	16	23.25	0.54	0.09	0.01	13	16.42	0.49	0.44	0.01	13	20.04	0.71	0.20	0.25
	Secondary	13	16.19				10	17.00				10	13.80			
	Post-Secondary	6	15.25				5	12.50				5	10.70			
	University	2	14.50				2	9.50				2	6.50			
EQ-5D-5L	Primary			n/a			13	14.83	11.33	0.38	0.00			n/a		
	Secondary						10	10.95								
	Post-Secondary						5	18.83								
	University						2	17.00								

MAST Total Score	Primary	n/a	n/a	13	14.85	20.09	0.22	0.05
	Secondary			10	12.45			
	Post-Secondary			5	19.90			
	University			2	24.00			
MAST Comprehension Score	Primary	n/a	n/a	13	17.19	9.82	0.07	0.15
	Secondary			10	9.95			
	Post-Secondary			5	18.90			
	University			2	23.75			
MAST Expression Score	Primary	n/a	n/a	13	14.42	12.06	0.31	0.02
	Secondary			10	13.15			
	Post-Secondary			5	20.30			
	University			2	22.25			

RQ 2 Analysis: In a sample of people with aphasia living in Malta, do stroke related factors influence outcomes at six months and one year after stroke?

Stroke type, lesion site, hemisphere affected, previous stroke, thrombolysis, mechanical thrombectomy and initial stroke severity were the stroke characteristics analysed in this study. Inferential analysis was performed to determine whether these stroke-related factors influenced post-stroke outcomes. Table 4.12 delineates the descriptive data and demographic details of the participants.

Table 4.12: Descriptive data of stroke characteristics.

		N	%
Stroke type	Ischaemic	37	84.1%
	Haemorrhagic	7	15.9%
Lesion site	Occlusion of Vertebral Artery	2	5.0%
	Posterior Occlusion	5	12.5%
	Left MCA	7	17.5%
	Right MCA	4	10.0%
	Multiple locations	16	40.0%
	Haemorrhage	6	15%
Hemisphere affected	Left	26	59.1%
	Right	16	36.4%
	Both	2	4.5
Previous stroke	Yes	9	20.5%
	No	35	79.5%
Thrombolysis	Yes	14	31.8%
	No	30	68.2%
Mechanical Thrombectomy	Yes	10	22.7%
	No	34	77.3%

Stroke Type

As given in Table E6 (see Appendix E), all p-values for stroke type were above the 0.05 criterion; therefore, this was not a significant factor affecting stroke outcomes in Phase 1**.**

Firstly, the p-values in the Kolmogorov–Smirnov and Shapiro–Wilk tests were less than the 0.05 level of significance (Table E15 & E24), indicating that the data distributions did not closely follow the normal curve. Accordingly, the Kruskal–Wallis non-parametric test was conducted, and the following null and alternative hypotheses were formulated:

H_0: Outcomes are equal for the two stroke types across all PwA.

H_1: Outcomes are significantly different for the two stroke types across all PwA.

The results of the tests (Table 4.13) did not reveal any statistically significant difference in the outcomes of ischaemic and haemorrhagic stroke in any phase. The p-values were all greater than the 0.05 level of significance; thus, the null hypothesis was accepted.

Table 4.13

Kruskal-Wallis Test between stroke types & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Ischaemic	32	19.30	1.66	0.66	0.02	27	15.52	1.37	0.42	0.03
	Haemorrhagic	5	17.10				3	19.25			
TOM Impairment	Ischaemic	32	19.70	1.29	0.29	0.00	27	15.17	1.00	0.49	0.01
	Haemorrhagic	5	14.50				3	18.50			
TOM Activity	Ischaemic	32	19.44	1.47	0.51	0.01	27	15.63	0.87	0.79	0.03
	Haemorrhagic	5	16.20				3	14.33			
TOM Participation	Ischaemic	32	19.03	1.60	0.96	0.02	27	15.35	0.93	0.74	0.03
	Haemorrhagic	5	18.80				3	16.83			
TOM Wellbeing	Ischaemic	32	19.08	1.46	0.90	0.02	27	14.96	1.32	0.28	0.00
	Haemorrhagic	5	18.05				3	20.33			
mRS	Ischaemic	32	17.95	1.21	0.12	0.03	27	15.72	0.37	0.66	0.02
	Haemorrhagic	5	25.70				3	13.50			
EQ-5D-5L	Ischaemic	32	17.78	19.57	0.64	0.02	27	13.62	10.64	0.53	0.02
	Haemorrhagic	5	15.38				3	16.25			
MAST Total Score	Ischaemic			n/a			27	15.28	18.70	0.67	0.03
	Haemorrhagic						3	17.50			
MAST Comprehension Score	Ischaemic			n/a			27	15.69	7.95	0.72	0.03
	Haemorrhagic						3	13.83			
MAST Expression Score	Ischaemic			n/a			27	15.20	12.25	0.58	0.02
	Haemorrhagic						3	18.17			

Furthermore, the following hypotheses were formulated regarding changes in outcomes based on stroke type.

H_0: Changes in outcomes are equal across all PwA with different stroke types.

H_1: Changes in outcomes are significantly different across all PwA with different stroke types.

As shown in Table 4.14, most of the p-values were greater than the 0.05 level of significance, signifying that there was no difference between the outcomes of between the outcomes of ischaemic and haemorrhagic stroke type. However, the p-value for TOM activity ($p = 0.05$) and TOM participation in the first six months post stroke ($p = 0.05$). Therefore, the null hypothesis was rejected. Notably, the means of the outcomes in the first six months post stroke was higher for ischaemic stroke (20.27) than for haemorrhagic stroke (10.90). Furthermore, there is a significant difference between changes in mRS outcomes in the first 6 months post-stroke as the p-value is less than 0.05 criterion. Those who have suffered a haemorrhagic stroke had greater improvement in the first six months than those who had an ischaemic stroke as the mean rank of the latter is lower than that of the haemorrhagic stroke.

Table 4.14

Kruskal-Wallis Test between stroke type & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Ischaemic	32	18.55	1.45	0.48	0.01	27	15.94	0.92	0.92	0.03	27	15.59	1.36	0.50	0.02
	Haemorrhagic	5	21.90				3	16.38				3	18.75			
TOM Impairment	Ischaemic	32	19.45	0.73	0.46	0.01	27	16.30	0.71	0.14	0.03	27	15.96	0.91	0.94	0.03
	Haemorrhagic	5	16.10				3	24.00				3	16.33			
TOM Activity	Ischaemic	32	20.27	0.75	0.05	0.08	27	15.36	0.61	0.17	0.02	27	16.30	1.23	0.12	0.05
	Haemorrhagic	5	10.90				3	22.00				3	8.33			
TOM Participation	Ischaemic	32	20.27	0.75	0.05	0.08	27	15.94	0.95	0.36	0.00	27	15.89	1.37	0.45	0.01
	Haemorrhagic	5	10.90				3	11.50				3	12.00			
TOM Wellbeing	Ischaemic	32	19.72	1.33	0.28	0.00	27	15.52	1.26	0.96	0.03	27	15.61	1.79	0.82	0.03
	Haemorrhagic	5	14.40				3	15.33				3	14.50			
mRS	Ischaemic	32	17.52	0.54	0.01	0.15	27	16.17	0.49	0.14	0.04	27	15.06	0.71	0.34	0.00
	Haemorrhagic	5	28.50				3	9.50				3	19.50			

EQ-5D-5L	Ischaemic	n/a	27	13.04	11.33	0.13	0.04			n/a		
	Haemorrhagic		3	19.50								
MAST Total Score	Ischaemic	n/a	n/a					27	15.59	20.09	0.86	0.03
	Haemorrhagic							3	14.67			
MAST Comprehension Score	Ischaemic	n/a	n/a					27	16.22	9.82	0.17	0.02
	Haemorrhagic							3	9.00			
MAST Expression Score	Ischaemic	n/a	n/a					27	15.33	12.06	0.75	0.03
	Haemorrhagic							3	17.00			

Lesion Location

Stroke site was not found to be a significant factor in predicting stroke outcomes in Phase 1, as all of the p-values were greater than 0.05 (Table E7 in Appendix E).

The Kolmogorov–Smirnov and Shapiro–Wilk tests (Table E17 & E29 in Appendix E) both yielded p-values less than 0.05, indicating that the data did not closely follow a normal distribution curve, necessitating the employment of a non-parametric test. The Kruskal–Wallis test was used to construct the null and alternative hypotheses as follows:

H_0: Outcomes are equal across all PwA irrespective of lesion location.

H_1: Outcomes are significantly different across all PwA depending on lesion location.

There was no significant difference in stroke outcomes depending on lesion location, as shown in Table 4.15. Since all of the p-values were greater than the 0.05 level of significance, the null hypothesis was accepted.

Table 4.15

Kruskal-Wallis Test between lesion location & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Occlusion of Vertebral Artery	2	23.75	1.66	0.09	0.01	2	19.25	1.37	0.17	0.05
	Posterior Occlusion	5	26.00				4	17.88			
	Left MCA	7	9.50				5	6.40			
	Right MCA	4	17.88				4	13.38			
	Multiple Infarcts	13	19.23				11	15.64			
	Haemorrhagic	4	16.13				2	19.25			
TOM Impairment	Occlusion of Vertebral Artery	2	25.25	1.29	0.57	0.02	2	21.00	1.00	0.07	0.13
	Posterior Occlusion	5	22.20				4	18.25			
	Left MCA	7	13.79				5	6.40			
	Right MCA	4	20.00				4	15.50			
	Multiple Infarcts	13	17.77				11	14.09			
	Haemorrhagic	4	15.25				2	21.00			
TOM Activity	Occlusion of Vertebral Artery	2	18.50	1.47	0.28	0.00	2	21.50	0.87	0.08	0.14
	Posterior Occlusion	5	25.40				4	18.50			
	Left MCA	7	11.79				5	6.70			
	Right MCA	4	21.88				4	18.50			
	Multiple Infarcts	13	17.58				11	13.68			
	Haemorrhagic	4	16.88				2	15.50			

TOM Participation	Occlusion of Vertebral Artery	2	18.50	1.60	0.47	0.02	2	19.50	0.93	0.04	0.01
	Posterior Occlusion	5	21.40				4	16.63			
	Left MCA	7	11.43				5	6.40			
	Right MCA	4	22.13				4	19.50			
	Multiple Infarcts	13	18.38				11	13.77			
	Haemorrhagic	4	19.63				2	19.50			
TOM Wellbeing	Occlusion of Vertebral Artery	2	22.25	1.46	0.46	0.02	2	17.25	1.32	0.13	0.06
	Posterior Occlusion	5	23.40				4	19.88			
	Left MCA	7	12.14				5	9.20			
	Right MCA	4	16.88				4	9.38			
	Multiple Infarcts	13	18.85				11	14.86			
	Haemorrhagic	4	17.75				2	22.50			
mRS	Occlusion of Vertebral Artery	2	6.00	1.21	0.51	0.02	2	9.50	1.20	0.38	0.01
	Posterior Occlusion	5	12.50				4	9.75			
	Left MCA	7	16.40				5	15.30			
	Right MCA	4	8.13				4	10.13			
	Multiple Infarcts	13	13.22				11	12.38			
	Haemorrhagic	4	11.83				2	4.00			
EQ-5D-5L	Occlusion of Vertebral Artery	2	13.75	19.57	0.82	0.03	2	10.75	10.64	0.26	0.10
	Posterior Occlusion	5	16.60				4	13.88			
	Left MCA	7	12.40				5	3.67			
	Right MCA	4	20.88				4	16.25			
	Multiple Infarcts	13	17.42				11	13.78			
	Haemorrhagic	4	15.17				2	16.00			

MAST Total Score	Occlusion of Vertebral Artery	n/a	2	20.25	18.70	0.09	0.06
	Posterior Occlusion		4	20.63			
	Left MCA		5	6.10			
	Right MCA		4	11.25			
	Multiple Infarcts		11	15.73			
	Haemorrhagic		2	17.25			
MAST Comprehension Score	Occlusion of Vertebral Artery	n/a	2	22.00	7.95	0.37	0.08
	Posterior Occlusion		4	19.25			
	Left MCA		5	9.20			
	Right MCA		4	13.88			
	Multiple Infarcts		11	14.32			
	Haemorrhagic		2	13.00			
MAST Expression Score	Occlusion of Vertebral Artery	n/a	2	19.75	12.25	0.08	0.06
	Posterior Occlusion		4	20.38			
	Left MCA		5	6.80			
	Right MCA		4	9.50			
	Multiple Infarcts		11	16.00			
	Haemorrhagic		2	18.50			

To assess whether lesion location affects outcome changes, the following hypotheses were constructed based on the Kruskal–Wallis test:

H_0: Changes in outcomes are equal across all PwA irrespective of lesion location.

H_1: Changes in outcomes are significantly different across all PwA depending on lesion location.

All p-values in Table 4.16 were above the 0.05 threshold, indicating that there was no notable change in outcome changes based on lesion location. Therefore, the null hypothesis was accepted. However, the p-value for improvement in the MAST expression score was less than the 0.05 criterion of significance ($p = 0.019$). However, the effect size is 0.03 indicating that the difference is negligible, even if it is statistically significant. Post-hoc analysis was carried out (Table G10 in Appendix G). The significant change was noted between Left MCA and Right MCA, with the latter showing less improvement (lower mean).

Table 4.16

Kruskal-Wallis Test between lesion location & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Occlusion of Vertebral Artery	2	15.00	1.45	0.30	0.02	2	14.00	0.92	0.58	0.05	2	12.00	1.36	0.10	0.03
	Posterior Occlusion	5	18.20				5	11.38				4	11.50			
	Left MCA	7	12.43				7	15.80				6	12.20			
	Right MCA	4	13.75				4	10.00				4	7.50			
	Multiple Infarcts	13	22.23				11	16.95				11	19.64			
	Haemorrhagic	4	19.50				2	18.67				2	19.33			
TOM Impair-ment	Occlusion of Vertebral Artery	2	14.00	0.73	0.27	0.03	2	15.25	0.71	0.81	0.07	2	11.00	0.91	0.33	0.01
	Posterior Occlusion	5	11.40				5	15.20				4	8.75			
	Left MCA	7	22.93				7	13.29				6	17.92			
	Right MCA	4	14.00				4	15.25				4	11.75			
	Multiple Infarcts	13	19.81				11	17.41				11	17.23			
	Haemorrhagic	4	17.75				2	22.00				2	17.00			
TOM Activity	Occlusion of Vertebral Artery	2	9.00	0.75	0.05	0.13	2	13.25	0.61	0.88	0.07	2	13.50	1.23	0.11	0.16
	Posterior Occlusion	5	11.90				5	16.63				4	9.00			
	Left MCA	7	24.14				7	13.25				6	20.70			
	Right MCA	4	16.25				4	13.25				4	13.00			
	Multiple Infarcts	13	21.23				11	15.41				11	16.23			
	Haemorrhagic	4	10.63				2	20.00				2	4.50			

TOM Partici-pation	Occlusion of Vertebral Artery	2	13.50	0.75	0.05	0.13	2	16.50	0.95	0.51	0.06	2	18.00	1.37	0.43	0.09
	Posterior Occlusion	5	9.00				5	11.75				4	7.75			
	Left MCA	7	20.70				7	18.80				6	16.80			
	Right MCA	4	13.00				4	13.50				4	12.50			
	Multiple Infarcts	13	16.23				11	14.91				11	16.55			
	Haemorrhagic	4	4.50				2	7.00				2	11.50			
TOM Wellbeing	Occlusion of Vertebral Artery	2	18.25	1.33	0.05	0.04	2	10.00	1.26	0.30	0.02	2	13.50	1.79	0.62	0.03
	Posterior Occlusion	5	18.50				5	10.00				4	14.00			
	Left MCA	7	15.86				7	19.00				6	12.70			
	Right MCA	4	14.25				4	10.75				4	9.75			
	Multiple Infarcts	13	21.62				11	16.00				11	17.50			
	Haemorrhagic	4	13.00				2	16.00				2	14.00			
mRS	Occlusion of Vertebral Artery	2	8.50	0.54	0.10	0.13	2	18.00	0.49	0.31	0.03	2	13.50	0.72	0.50	0.04
	Posterior Occlusion	5	19.50				5	7.00				4	13.50			
	Left MCA	7	9.30				7	11.40				6	9.30			
	Right MCA	4	14.00				4	15.25				4	15.25			
	Multiple Infarcts	13	10.17				11	11.13				11	9.75			
	Haemorrhagic	4	19.50				2	7.00				2	13.50			
EQ-5D-5L	Occlusion of Vertebral Artery			n/a			2	13.00	1.33	.44				n/a		
	Posterior Occlusion						5	15.75								
	Left MCA						7	17.83								
	Right MCA						4	9.50								
	Multiple Infarcts						11	10.39								
	Haemorrhagic						2	17.00								

MAST Total Score	Occlusion of Vertebral Artery	n/a	n/a	2	13.00	20.09	0.25	0.08
	Posterior Occlusion			4	8.00			
	Left MCA			6	21.10			
	Right MCA			4	11.38			
	Multiple Infarcts			11	15.45			
	Haemorrhagic			2	13.50			
MAST Compr-ehensio n Score	Occlusion of Vertebral Artery	n/a	n/a	2	12.00	9.82	0.26	0.06
	Posterior Occlusion			4	10.75			
	Left MCA			6	21.60			
	Right MCA			4	17.63			
	Multiple Infarcts			11	12.86			
	Haemorrhagic			2	9.50			
MAST Expres-sion Score	Occlusion of Vertebral Artery	n/a	n/a	2	16.75	12.06	0.01	0.03
	Posterior Occlusion			4	7.25			
	Left MCA			6	22.80			
	Right MCA			4	5.50			
	Multiple Infarcts			11	15.91			
	Haemorrhagic			2	16.25			

Stroke History

Having a previous stroke experience was not a significant factor determining stroke outcomes in Phase 1, as all p-values were above the 0.05 threshold (Table E9).

The p-values were less than the 0.05 level of significance in both the Kolmogorov–Smirnov and Shapiro–Wilk tests (Table E20 & E31), indicating that the data did not closely follow a normal distribution curve, necessitating the use of a non-parametric test. Accordingly, the Kruskal–Wallis test was conducted, and the following null and alternative hypotheses were formulated for the same:

H_0: Outcomes are equal across all PwA irrespective of whether participants had previous stroke experiences.

H_1: Outcomes are significantly different across all PwA depending on whether the participants had previous stroke experiences.

The test findings (Table 4.17) revealed no substantial difference in outcomes across all phases of PwA whether participants had a history of stroke. All p-values were above the 0.05 level of significance, so the null hypothesis was accepted. Furthermore, no statistically significant difference was found in the changes of post-stroke outcomes depending on whether the participants had previous stroke occurrences, as all p-values were greater than 0.05 (Table 4.18)

Table 4.17

Kruskal-Wallis Test between stroke history & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	6	18.08	1.66	0.81	0.02	4	13.00	1.37	0.52	0.02
	No	31	19.18				26	15.88			
TOM Impairment	Yes	6	17.17	1.29	0.63	0.02	4	15.13	1.00	0.92	0.03
	No	31	19.35				26	15.56			
TOM Activity	Yes	6	16.00	1.47	0.44	0.01	4	11.13	0.87	0.24	0.01
	No	31	19.58				26	16.17			
TOM Participation	Yes	6	13.33	1.60	0.14	0.03	4	16.75	0.93	0.72	0.03
	No	31	20.10				26	15.31			
TOM Wellbeing	Yes	6	15.17	1.46	0.31	0.00	4	13.88	1.32	0.67	0.02
	No	31	19.74				26	15.75			
mRS	Yes	6	22.17	1.21	0.41	0.01	4	17.25	1.20	0.65	0.02
	No	31	18.39				26	15.23			
EQ-5D-5L	Yes	6	18.83	19.57	0.85	0.02	4	12.17	10.64	0.67	0.02
	No	31	17.38				26	14.23			
MAST Total Score	Yes			n/a			4	11.13	18.70	0.28	0.00
	No						26	16.17			
MAST Comprehension Score	Yes			n/a			4	8.00	7.95	0.06	0.08
	No						26	16.65			
MAST Expression Score	Yes			n/a			4	13.00	12.25	0.54	0.03
	No						26	15.88			

Table 4.18

Kruskal-Wallis Test between stroke history & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Yes	6	24.33	1.45	0.15	0.02	4	15.25	0.92	0.85	0.03	4	21.25	1.36	0.19	0.02
	No	31	17.97				26	16.11				26	16.11			
TOM Impairment	Yes	6	17.17	0.73	0.60	0.04	4	16.60	0.71	0.91	0.03	4	15.25	0.91	0.84	0.03
	No	31	19.35				26	17.07				26	16.11			
TOM Activity	Yes	6	15.83	0.75	0.39	0.00	4	18.38	0.61	0.53	0.02	4	16.25	1.23	0.84	0.03
	No	31	19.61				26	15.65				26	15.38			
TOM Participation	Yes	6	15.38	0.75	0.39	0.00	4	18.38	0.95	0.13	0.04	4	15.83	1.37	0.11	0.05
	No	31	19.61				26	15.65				26	19.61			
TOM Wellbeing	Yes	6	14.50	1.33	0.23	0.01	4	17.50	1.26	0.56	0.02	4	14.38	1.79	0.77	0.03
	No	31	19.87				26	15.19				26	15.67			
mRS	Yes	6	23.25	0.54	0.21	0.01	4	13.25	0.49	0.51	0.02	4	15.50	0.71	1.00	0.03
	No	31	18.18				26	15.85				26	15.50			

EQ-5D-5L	Yes	n/a	4	16.17	11.33	0.61	0.02			n/a		
	No		26	13.73								
MAST Total Score	Yes	n/a	n/a					4	15.50	20.09	1.00	0.03
	No							26	15.50			
MAST Comprehension Score	Yes	n/a	n/a					4	17.13	9.82	0.69	0.03
	No							26	15.25			
MAST Expression Score	Yes	n/a	n/a					4	12.06	12.06	0.97	0.03
	No							26	15.52			

Thrombolysis

Thrombolysis was not proven to be a critical factor influencing stroke outcomes in Phase 1, as all of the p-values (Table in Appendix E10) were above the 0.05 level of significance. However, the mean rank of all outcomes was higher in those participants who did not undergo thrombolysis, indicating that those patients had worse outcomes.

Both the Kolmogorov–Smirnov and Shapiro–Wilk tests of outcomes in Phase 2 and 3 had p-values less than 0.05, suggesting that the distributions did not closely follow a normal curve (Tables E21 & E32). Therefore, the non-parametric Kruskal–Wallis test was employed for the analysis, and the null and alternative hypotheses were constructed as follows:

H_0: Outcomes are equal across all PwA irrespective of whether the participants underwent thrombolysis.

H_1: Outcomes are significantly different across all PwA depending on whether the participants underwent thrombolysis.

According to the findings (Table 4.19), there was no significant difference in outcomes in all phases of PwA based on whether the patients underwent thrombolysis. All of the p-values were greater than the 0.05 level of significance, so the null hypothesis was accepted. The exception is the mRS outcomes one-year post-stroke as the p-value is lower than 0.05 criterion. Those having thrombolysis had better outcomes (21.61) than those who did not (12.88).

As Table 4.20 shows, there was no statistically significant difference in outcome changes, as the p-values of all outcomes were greater than the 0.05 criterion

Table 4.19

Kruskal-Wallis Test between thrombolysis & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	12	14.95	1.66	0.48	0.01	9	13.13	1.37	0.70	0.01
	No	25	17.31				21	14.37			
TOM Impairment	Yes	12	16.18	1.29	0.88	0.01	9	13.00	1.00	0.64	0.01
	No	25	16.67				21	14.42			
TOM Activity	Yes	12	15.64	1.47	0.69	0.02	9	13.81	0.87	0.93	0.03
	No	25	16.95				21	14.08			
TOM Participation	Yes	12	15.59	1.60	0.68	0.01	9	13.06	0.93	0.64	0.00
	No	25	16.98				21	14.39			
TOM Wellbeing	Yes	12	17.32	1.46	0.70	0.02	9	17.25	1.32	0.14	0.00
	No	25	16.07				21	12.63			
mRS	Yes	12	22.29	1.12	0.18	0.02	9	21.61	1.20	0.00	0.20
	No	25	17.42				21	12.88			
EQ-5D-5L	Yes	12	16.06	19.57	0.82	0.02	9	10.83	10.64	0.62	0.02
	No	25	15.26				21	12.41			
MAST Total Score	Yes			n/a			9	12.31	18.70	0.47	0.01
	No						21	14.71			
MAST Comprehension Score	Yes			n/a			9	10.88	7.95	0.18	0.02
	No						21	15.32			
MAST Expression Score	Yes			n/a			9	13.00	12.25	0.67	0.02
	No						21	14.42			

Table 4.20

Kruskal-Wallis Test between thrombolysis & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Yes	12	19.04	1.45	0.98	0.02	9	16.39	0.92	0.87	0.03	9	18.33	1.36	1.36	0.00
	No	25	18.98				21	15.84				21	15.05			
TOM Impairment	Yes	12	18.50	0.73	0.82	0.02	9	17.33	0.71	0.86	0.03	9	18.50	0.91	0.91	0.01
	No	25	19.24				21	16.81				21	14.81			
TOM Activity	Yes	12	21.50	0.75	0.29	0.00	9	18.50	0.61	0.23	0.01	9	19.28	1.23	1.23	0.05
	No	25	17.80				21	14.81				21	13.88			
TOM Participation	Yes	12	21.50	0.75	0.29	0.00	9	16.17	0.95	0.76	0.03	9	17.94	1.37	1.37	000
	No	25	17.80				21	15.21				21	14.45			
TOM Wellbeing	Yes	12	23.50	1.33	0.06	0.06	9	15.83	1.26	0.87	0.03	9	20.67	1.79	1.79	0.14
	No	25	16.84				21	15.36				21	13.29			

mRS	Yes	12	18.88	0.54	0.95	0.02	9	17.83	0.49	0.26	0.00	9	17.72	0.71	0.31	0.00
	No	25	19.06				21	14.50				21	14.55			
EQ-5D-5L	Yes			n/a			9	14.43	11.33	0.86	0.03			n/a		
	No						21	13.85								
MAST Total Score	Yes			n/a			n/a					9	18.83	20.09	0.17	0.02
	No											21	14.07			
MAST Comprehension Score	Yes			n/a			n/a					9	16.06	9.82	0.82	0.03
	No											21	15.26			
MAST Expression Score	Yes			n/a			n/a					9	18.72	12.06	0.18	0.02
	No											21	14.15			

Mechanical Thrombectomy

As all the p-values (Table E11 in Appendix E) were above the 0.05 level of significance, undergoing a mechanical thrombectomy was not shown to be a factor determining stroke outcomes in Phase 1.

P-values less than 0.05 for both the Kolmogorov–Smirnov and Shapiro–Wilk tests (Table E22 & E33 in Appendix E) indicated that the data in Phase 2 and Phase 3 did not closely follow a normal distribution curve, necessitating the use of a non-parametric test. The null and alternative hypotheses were developed using the Kruskal–Wallis test as follows:

H_0: Outcomes are equal across all PwA irrespective of whether the participants underwent mechanical thrombectomy.

H_1: Outcomes are significantly different across all PwA depending on whether the participants underwent mechanical thrombectomy.

No significant differences in post-stroke outcomes were found (Table 4.21), and all of the p-values were greater than the 0.05 level of significance. Therefore, the null hypothesis was accepted.

Similarly, the following hypotheses were formulated for outcome changes based on whether the participants had undergone mechanical thrombectomy:

H_0: Changes in outcomes are the same across all PwA irrespective of whether the participants underwent mechanical thrombectomy.

H_1: Changes in outcomes are significantly different across all PwA depending on whether the participants underwent mechanical thrombectomy.

There was no significant difference in outcome changes depending on whether the participants underwent mechanical thrombectomy, as all p-values were greater than the 0.05 criteria (Table 4.22)

Table 4.21

Kruskal-Wallis Test between mechanical thrombectomy & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	8	14.00	1.66	0.12	0.03	5	11.90	1.37	0.29	0.00
	No	29	20.38				25	16.22			
TOM Impairment	Yes	8	15.88	1.29	0.33	0.00	5	11.40	1.00	0.21	0.02
	No	29	19.86				25	16.32			
TOM Activity	Yes	8	15.31	1.47	0.25	0.00	5	13.50	0.87	0.54	0.02
	No	29	20.02				25	15.90			
TOM Participation	Yes	8	17.06	1.60	0.55	0.05	5	10.30	0.93	0.09	0.03
	No	29	19.53				25	16.54			
TOM Wellbeing	Yes	8	20.25	1.46	0.69	0.02	5	17.40	1.32	0.57	0.02
	No	29	18.66				25	14.35			
mRS	Yes	8	23.19	1.24	0.20	0.01	5	20.83	1.20	0.08	0.07
	No	29	17.84				25	14.17			
EQ-5D-5L	Yes	8	19.67	19.57	0.55	0.01	5	11.17	10.64	0.51	0.02
	No	29	17.04				25	12.41			
MAST Total Score	Yes			n/a			5	9.70	18.70	0.10	0.05
	No						25	16.66			
MAST Comprehension Score	Yes			n/a			5	9.50	7.95	0.09	0.06
	No						25	16.58			
MAST Expression Score	Yes			n/a			5	10.10	12.25	0.13	0.04
	No						25	16.58			

Table 4.22

Kruskal-Wallis Test between mechanical thrombectomy & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Yes	8	17.38	1.45	0.60	0.02	5	19.50	0.92	0.31	0.00	5	19.40	1.36	0.34	0.00
	No	29	19.45				25	15.33				25	15.35			
TOM Impairment	Yes	8	18.50	0.73	0.86	0.02	5	17.86	0.71	0.77	0.03	5	18.50	0.91	0.40	0.01
	No	29	19.14				25	16.77				25	15.40			
TOM Activity	Yes	8	25.56	0.75	0.03	0.09	5	18.58	0.61	0.38	0.00	5	21.20	1.23	0.09	0.06
	No	29	17.19				25	15.38				25	14.36			
TOM Participation	Yes	8	25.56	0.75	0.03	0.09	5	15.00	0.95	0.88	0.03	5	17.10	1.37	0.64	0.02
	No	29	17.19				25	15.60				25	15.18			
TOM Wellbeing	Yes	8	24.31	1.33	0.09	0.05	5	17.10	1.26	0.60	0.02	5	20.20	1.79	0.16	0.03
	No	29	17.53				25	15.18				25	14.56			
mRS	Yes	8	15.06	0.54	0.16	0.02	5	17.00	0.49	0.58	0.02	5	14.33	0.71	0.67	0.03
	No	29	20.09				25	15.13				25	15.79			

EQ-5D-5L	Yes	n/a	5	9.67	11.33	0.31			n/a		
	No		25	14.54							
MAST Total Score	Yes	n/a	n/a				5	19.10	20.09	0.31	0.00
	No						25	14.62			
MAST Comprehension Score	Yes	n/a	n/a				5	15.40	9.82	0.97	0.03
	No						25	15.52			
MAST Expression Score	Yes	n/a	n/a				5	19.90	12.06	0.22	0.01
	No						25	14.62			

Initial Stroke Severity

The Shapiro-Wilk test of normality was conducted to determine whether initial stroke severity data is normally distributed. The results indicate that the null hypothesis is rejected ($p = 0.01$) and conclude that data is not normally distributed

The Kruskal-Wallis test demonstrates that initial stroke severity is crucial in determining stroke outcomes in Phase 1, as all of the p-values were below the 0.05 level of significance (Table __ in Appendix).

As all P-values yielded a negative result, a negative relationship was observed, as shown in Figure 4.1, illustrating that the higher the NIHSS score, the worse the outcomes.

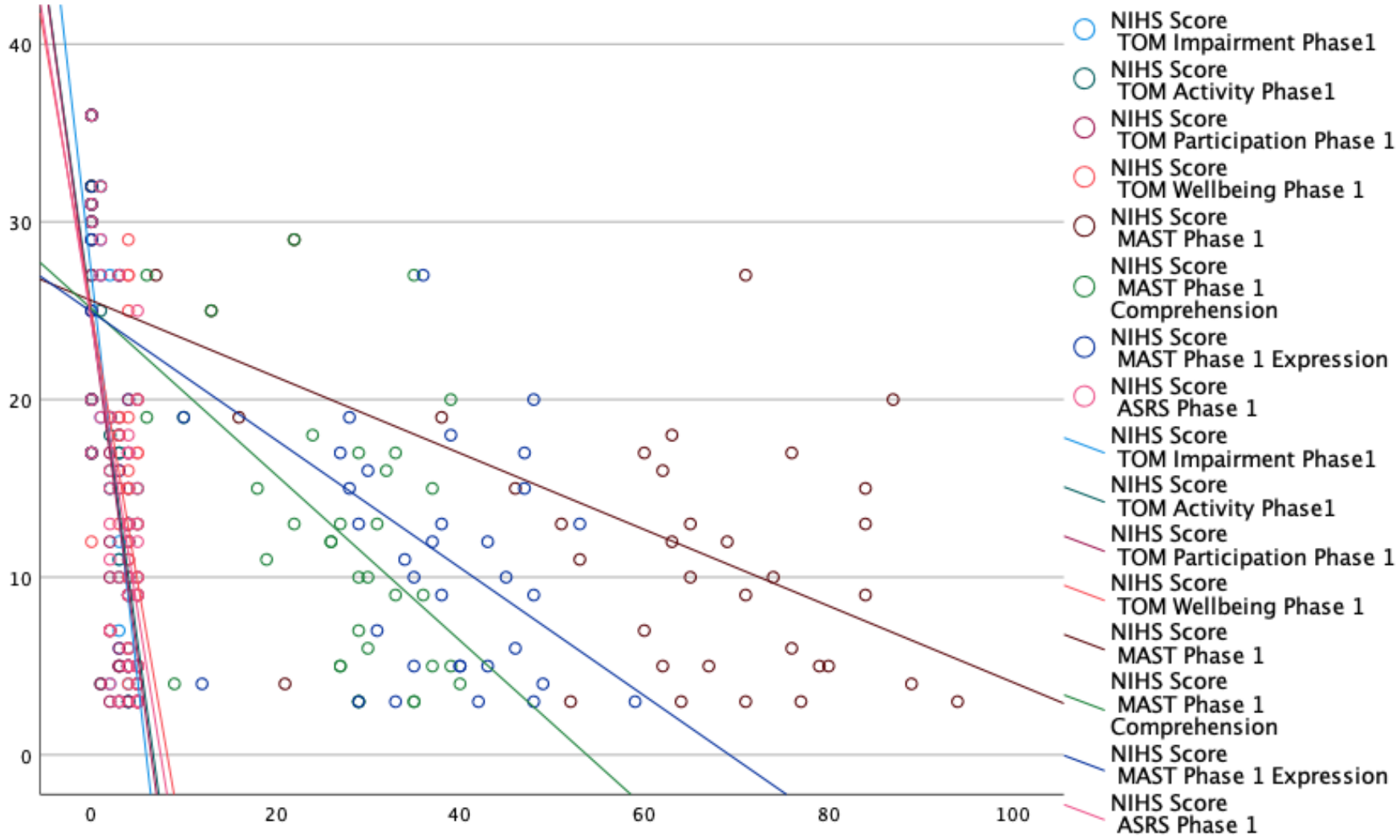


Figure 4.1: The negative relationship between the NIHSS and outcomes in Phase 1

The correlation between the NIHSS score and outcomes 6 months and 12 months post-stroke was assessed using the Spearman's Correlation test. The non-parametric test was utilised as the data does not follow the normal distribution curve (refer to Table E34 in Appendix E).

Table 4.23 shows a negative and significant relationship between the NIHSS score and outcomes 6 months and 12 months post-stroke as all P-values are less than the 0.05 level of significance. The higher the NIHSS scores the lower the other outcomes are.

Table 4.23

Spearman's Correlation between the NIHSS score and outcomes 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke	Outcomes 12 months post-stroke
ASRS	Correlation Coefficient	-0.62	-0.51
	P-value	0.00	0.00
TOM Impairment	Correlation Coefficient	-0.63	-0.66
	P-value	0.00	0.00
TOM Activity	Correlation Coefficient	-0.69	-0.56
	P-value	0.00	0.00
TOM Participation	Correlation Coefficient	-0.71	-0.53
	P-value	0.00	0.00
TOM Wellbeing	Correlation Coefficient	-0.51	-0.39
	P-value	0.00	0.03
mRS	Correlation Coefficient	0.67	0.66
	P-value	<0.00	<0.00
EQ-5D-5L	Correlation Coefficient	-0.49	-0.41
	P-value	0.00	0.03
MAST Total Score	Correlation Coefficient	n/a	-0.48
	P-value		0.00
MAST Comprehension Score	Correlation Coefficient	n/a	-0.44
	P-value		0.01
MAST Expression Score	Correlation Coefficient	n/a	-0.46
	P-value		0.01

In addition, Spearman's correlation test was carried out to determine whether initial stroke severity significantly affects outcome improvement. The p-value for improvement in ASRS was greater than the 0.05 criterion, indicating that there was no significant relationship between initial stroke severity and stroke outcomes. However, the p-values for changes in the other outcomes within the first year after the stroke were less than the 0.05 level of significance, indicating a positive statistical difference between NIHSS and improvement in these outcomes. The higher the NIHSS score, the greater the changes. Similarly, the p-values for outcome changes between six- and 12-months post stroke were lower than the 0.05 criterion for TOM activity, participation, wellbeing and EQ-5D-5L, denotating a significant relationship between improvement and initial stroke severity.

Table 4.24

Spearman's Correlation between NIHSS & changes in outcomes

		Changes in the first 6 months post-stroke	Changes between 6 months & 12 months post-stroke	Changes in 12 months post-stroke
ASRS	Correlation Coefficient	0.00	0.32	0.22
	P-value	0.99	0.07	0.21
TOM Impairment	Correlation Coefficient	0.33	0.32	0.56
	P-value	0.04	0.06	<0.00
TOM Activity	Correlation Coefficient	0.28	0.39	0.69
	P-value	0.08	0.02	<0.00
TOM Participation	Correlation Coefficient	0.28	0.73	0.53
	P-value	0.08	<0.00	0.00
TOM Wellbeing	Correlation Coefficient	0.06	0.40	0.36
	P-value	0.70	0.02	0.04
mRS	Correlation Coefficient	-0.06	-0.09	-0.12
	P-value	0.71	0.63	0.50

EQ-5D-5L	Correlation Coefficient	n/a	0.43	n/a
	P-value		0.02	
MAST Total Score	Correlation Coefficient	n/a	n/a	0.59
	P-value			<0.00
MAST Comprehension Score	Correlation Coefficient	n/a	n/a	0.48
	P-value			0.00
MAST Expression Score	Correlation Coefficient	n/a	n/a	0.62
	P-value			<0.00

RQ3 Analysis: In a sample of people with aphasia living in Malta, does initial aphasia severity influence outcomes at six months and one year after stroke?

During Phase 1, the following scores were collected to determine the language severity of the PwA post stroke: (1) best language score (BLS) (from the NIHSS), (2) ASRS and (3) MAST total language score.

BLS. The Spearman's Correlation test was used to determine the relationship between the BLS score and outcomes six and twelve months after the stroke. Since the data does not fit the normal distribution curve, the non-parametric test was used (refer to Table E35 in Appendix E).

As observed in Table 4.25, the relationship between BLS and outcomes was negative and significant, as all p-values were less than the 0.05 level of significance, indicating that the higher the BLS score in Phase 1, the lower the outcomes in the following two phases. However, no significant relationship was found between BLS and the TOM wellbeing outcome at 12 months post stroke, as the p-value (0.11) was greater than the 0.05 level of significance.

A significant correlation can be noted between the BLS and changes in TOM impairment, TOM activity, MAST Toral Score and MAST Expression Score after 12 months post-stroke as the p-values are less than the 0.05 level of significance (Table 4.26). Contrastingly, a substantial relationship can be discerned amongst BLS and changes in TOM participation and TOM wellbeing between the sixth- and twelfth-month post-stroke as Table 4.26 shows their p-values less than 0.05 significance criterion.

Table 4.25

Spearman's Correlation between the BLS score and outcomes 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke	Outcomes 12 months post-stroke
ASRS	Correlation Coefficient	-0.51	-0.73
	P-value	0.00	0.00
TOM Impairment	Correlation Coefficient	-0.59	-0.73
	P-value	0.00	0.00
TOM Activity	Correlation Coefficient	-0.64	-0.66
	P-value	0.00	0.00
TOM Participation	Correlation Coefficient	-0.59	-0.81
	P-value	0.00	0.00
TOM Wellbeing	Correlation Coefficient	-0.44	-0.29
	P-value	0.00	0.11
mRS	Correlation Coefficient	0.53	0.63
	P-value	<0.00	<0.00
EQ-5D-5L	Correlation Coefficient	-0.42	-0.57
	P-value	0.01	0.00
MAST Total Score	Correlation Coefficient	n/a	-0.73
	P-value		0.00
MAST Comprehension Score	Correlation Coefficient	n/a	-0.62
	P-value		0.00
MAST Expression Score	Correlation Coefficient	n/a	-0.66
	P-value		0.00

Table 4.26

Spearman's Correlation between BLS & changes in outcomes

		Changes in the first 6 months post-stroke	Changes between 6 months & 12 months post-stroke	Changes in 12 months post-stroke
ASRS	Correlation Coefficient	-0.02	-0.06	0.00
	P-value	0.88	0.71	1.00
TOM Impairment	Correlation Coefficient	0.16	0.11	0.38
	P-value	0.33	0.53	0.03
TOM Activity	Correlation Coefficient	0.12	0.03	0.54
	P-value	0.45	0.83	0.00
TOM Participation	Correlation Coefficient	0.12	0.36	0.24
	P-value	0.45	0.05	0.18
TOM Wellbeing	Correlation Coefficient	-0.15	0.42	0.21
	P-value	0.36	0.02	0.26
EQ-5D-5L	Correlation Coefficient	n/a	0.06	n/a
	P-value		0.76	

mRS	Correlation Coefficient	0.20	0.28	0.26
	P-value	0.53	0.12	0.16
MAST Total Score	Correlation Coefficient	n/a	n/a	0.47
	P-value			0.00
MAST Comprehension Score	Correlation Coefficient	n/a	n/a	0.23
	P-value			0.21
MAST Expression Score	Correlation Coefficient	n/a	n/a	0.54
	P-value			0.00

ASRS. To determine the relationship between the BLS score and outcomes six and twelve months after the stroke, the Spearman's Correlation test was used. The non-parametric test was used because the data did not conform to the normal distribution curve (refer to Table E39 in Appendix E).

As displayed in Table 4.27, a positive and significant association was found between the ASRS in Phase 1 and outcomes at six months and 12 months post-stroke, with p-values less than 0.05 level of significance. Similarly, Table 4.28 highlights a significant relationship between the BLS scores in Phase 1 and the changes in the following outcomes:

- ASRS outcomes in the first 6 months and in changes of ASRS outcomes after a year post-stroke
- TOM impairment between the sixth and twelfth months and in changes of TOM impairment outcomes after a year post-stroke
- TOM activity in the first 6 months, TOM activity between the sixth and twelfth months and in changes of TOM impairments outcomes after a year post-stroke
- TOM participation in the first 6 months, TOM participation between the sixth and twelfth months and in changes of TOM participation outcomes after a year post-stroke
- TOM wellbeing between the sixth and twelfth months and in changes of TOM wellbeing outcomes after a year post-stroke
- MAST Total Score, MAST Comprehension scores and MAST Expression Score after one-year post-stroke

All the p-values of the above-mentioned changes in outcomes is less than the 0.05 criterion. The relationship is a negative one signifying that the higher the ASRS score, the less changes in outcomes.

Table 4.27

Spearman's Correlation between the ASRS score in Phase 1 and outcomes 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke	Outcomes 12 months post-stroke
ASRS	Correlation Coefficient	0.61	0.58
	P-value	0.00	0.00
TOM Impairment	Correlation Coefficient	0.76	0.71
	P-value	0.00	0.00
TOM Activity	Correlation Coefficient	0.79	0.72
	P-value	0.00	0.00
TOM Participation	Correlation Coefficient	0.68	0.56
	P-value	0.00	0.00
TOM Wellbeing	Correlation Coefficient	0.57	0.38
	P-value	0.00	0.03
mRS	Correlation Coefficient	-0.83	-0.73
	P-value	<0.00	<0.00
EQ-5D-5L	Correlation Coefficient	0.52	0.46
	P-value	0.00	0.01
MAST Total Score	Correlation Coefficient	n/a	0.59
	P-value		0.00
MAST Comprehension Score	Correlation Coefficient	n/a	0.73
	P-value		0.01
MAST Expression Score	Correlation Coefficient	n/a	0.50
	P-value		0.01

Table 4.28

Spearman's Correlation between ASRS in Phase 1 & changes in outcomes

		Changes in the first 6 months post-stroke	Changes between 6 months & 12 months post-stroke	Changes in 12 months post-stroke
ASRS	Correlation Coefficient	-0.48	-0.32	-0.66
	P-value	0.00	0.07	<.000
TOM Impairment	Correlation Coefficient	-0.12	-0.53	-0.58
	P-value	0.45	0.00	<0.00
TOM Activity	Correlation Coefficient	-0.35	-0.49	-.71
	P-value	0.03	0.00	<.00
TOM Participation	Correlation Coefficient	-0.35	-0.58	-0.60
	P-value	0.03	<0.00	<.000
TOM Wellbeing	Correlation Coefficient	-0.04	-0.62	-0.44
	P-value	0.80	<0.00	0.01
mRS	Correlation Coefficient	-0.16	0.10	0.00
	P-value	0.34	0.59	0.98
EQ-5D-5L	Correlation Coefficient	n/a	-0.26	n/a
	P-value		<0.17	
MAST Total Score	Correlation Coefficient	n/a	n/a	-0.59
	P-value			<0.00
MAST Comprehension Score	Correlation Coefficient	n/a	n/a	-0.33
	P-value			0.04
MAST Expression Score	Correlation Coefficient	n/a	n/a	-.68
	P-value			<.00

MAST Score. The Spearman's Correlation test was used to assess the link between the BLS score and outcomes six and twelve months after the stroke. Because the data did not fit the normal distribution curve, the non-parametric test was applied (refer to Table E39 in Appendix E).

The p-values (all <.05) in Table 4.29 demonstrates a positive and significant relationship was found between the MAST scores in Phase 1 and all outcomes at six- and 12-months post stroke. The higher the MAST scores after the stroke the better the outcomes.

Table 4.30 shows a negative significant relationship between the MAST scores in Phase 1 and the changes in the following outcomes:

- TOM impairment In the first 6 months and in changes of TOM impairment outcomes after a year post-stroke
- TOM activity in the first 6 months, TOM activity between the sixth and twelfth months and in changes in TOM impairments outcomes after a year post-stroke
- TOM participation in the first 6 months, TOM participation between the sixth and twelfth months and in changes of TOM participation outcomes after a year post-stroke
- TOM wellbeing between the sixth and twelfth months and in changes of TOM wellbeing outcomes after a year post-stroke
- MAST Total Score, MAST Comprehension scores and MAST Expression Score after one-year post-stroke
- EQ-5D-5L between the sixth- and twelfth-month post-stroke

The association is negative, indicating that the greater the MAST score, the less variation in outcomes.

Table 4.29

Spearman's Correlation between the MAST score and outcomes 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke	Outcomes 12 months post-stroke
ASRS	Correlation Coefficient	0.79	0.77
	P-value	0.00	0.00
TOM Impairment	Correlation Coefficient	0.74	0.77
	P-value	0.00	0.00
TOM Activity	Correlation Coefficient	0.82	0.76
	P-value	0.00	0.00
TOM Participation	Correlation Coefficient	0.74	0.63
	P-value	0.00	0.00
TOM Wellbeing	Correlation Coefficient	0.66	0.61
	P-value	0.00	0.00
mRS	Correlation Coefficient	-0.54	-0.78
	P-value	<0.00	<0.00
EQ-5D-5L	Correlation Coefficient	0.55	0.63
	P-value	0.00	0.00
MAST Total Score	Correlation Coefficient	n/a	0.78
	P-value		<0.00
MAST Comprehension Score	Correlation Coefficient	n/a	0.72
	P-value		<0.00
MAST Expression Score	Correlation Coefficient	n/a	0.74
	P-value		<0.00

Table 4.30

Spearman's Correlation between MAST in Phase 1 & changes in outcomes

		Changes in the first 6 months post-stroke	Changes between 6 months & 12 months post-stroke	Changes in 12 months post-stroke
ASRS	Correlation Coefficient	-0.17	-0.24	-0.31
	P-value	0.29	0.18	0.08
TOM Impairment	Correlation Coefficient	-0.41	-0.27	-0.67
	P-value	0.01	0.12	<0.00
TOM Activity	Correlation Coefficient	0.49	0.30	-0.82
	P-value	0.00	0.09	<0.00
TOM Participation	Correlation Coefficient	-0.49	-0.63	-0.64
	P-value	0.00	<0.00	<0.00
TOM Wellbeing	Correlation Coefficient	-0.09	-0.66	-0.35
	P-value	0.58	<0.00	0.05

mRS	Correlation Coefficient	0.11	-0.12	0.01
	P-value	0.49	0.52	0.94
EQ-5D-5L	Correlation Coefficient	n/a	-0.24	n/a
	P-value		0.02	
MAST Total Score	Correlation Coefficient	n/a	n/a	-0.83
	P-value			<0.00
MAST Comprehension Score	Correlation Coefficient	n/a	n/a	-0.64
	P-value			<0.00
MAST Expression Score	Correlation Coefficient	n/a	n/a	-0.18
	P-value			<0.00

RQ4 Analysis: In a sample of people with aphasia living in Malta, do type, timing, frequency, and intensity of SLT influence outcomes at six months and one year after stroke?

The following factors were analysed to address this research question: whether participants received therapy for aphasia, the SLT approach used, total time of therapy received and the delivery approach. The setting was not analysed as all the SLPs who participated did one-to-one sessions and none did any group sessions. The raw data for each participant is found in Table D2 in Appendix D.

Received therapy for aphasia. P-values less than 0.05 for the Kolmogorov-Smirnov and Shapiro-Wilk tests (Tables E40 and E4 in Appendix E) indicated that the data in Phases 2 and 3 did not closely follow a normal distribution curve, requiring the employment of a non-parametric test. The Kruskal-Wallis test was used to develop the null and alternative hypotheses as follows:

H_0: Changes in outcomes are the same across all PwA irrespective of whether they received aphasia therapy

H_1: Changes in outcomes are significantly different across all PwA depending on whether the participants received aphasia therapy.

Table 4.31 demonstrates that those PwA who received aphasia therapy had significantly better outcomes at 6 months posts-stroke as the p-values of the ASRS, TOM impairment, activity and participation are less than the 0.05 level of significance. Moreover, the effect size of the latter outcomes is considered moderate to high effect size. However, this was not observed in the outcomes after 12 months poststroke as all p-values are less than 0.05 criterion except for the TOM impairment.

Aphasia therapy did not significantly affect the changes in outcomes as the p-values are greater than the 0.05 level of significance with the exception of the changes of TOM participation between the sixth and twelfth month after the stroke. The p-value is 0.05 with the Kruskal-Wallis Effect Size showing moderate effect size.

Table 4.31

Kruskal-Wallis Test between aphasia therapy & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	27	15.81	0.45	0.01	0.12	20	14.71	1.37	0.43	0.01
	No	10	25.50				10	17.33			
TOM Impairment	Yes	27	16.38	1.31	0.04	0.16	20	13.64	1.00	0.04	0.09
	No	10	24.00				10	19.83			
TOM Activity	Yes	27	16.21	0.14	0.02	0.08	20	14.76	0.87	0.44	0.01
	No	10	24.45				10	17.22			
TOM Participation	Yes	27	17.56	1.63	0.36	0.10	20	14.33	0.93	0.19	0.02
	No	10	20.95				10	18.22			
TOM Wellbeing	Yes	27	16.04	1.68	0.01	0.00	20	14.67	1.32	0.40	0.01
	No	10	24.90				10	17.44			
EQ-5D-5L	Yes	27	15.78	18.49	0.27	0.00	20	12.94	10.83	0.60	0.02
	No	10	19.80				10	14.56			
MAST Total Score	Yes			n/a			20	14.45	18.70	0.31	0.00
	No						10	17.94			
MAST Comprehension Score	Yes			n/a			20	14.36	7.95	0.27	0.00
	No						10	18.17			
MAST Expression Score	Yes			n/a			20	14.57	12.25	0.37	0.00
	No						10	17.67			

Table 4.32

Kruskal-Wallis Test between aphasia therapy & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Yes	27	17.87	1.46	0.53	0.01	20	17.60	0.86	0.03	0.02	20	16.40	1.3	0.37	0.00
	No	10	20.15				10	10.61				10	13.39			
TOM Impairment	Yes	27	18.94	0.74	0.64	0.02	20	18.00	0.72	0.28	0.00	20	17.50	0.91	0.11	0.05
	No	10	17.35				10	14.33				10	12.33			
TOM Activity	Yes	27	19.08	0.76	0.56	0.01	20	17.50	0.61	0.10	0.05	20	17.62	1.23	0.03	0.01
	No	10	17.00				10	12.33				10	10.56			
TOM Participation	Yes	27	19.08	0.76	0.56	0.02	20	16.81	0.95	0.05	0.07	20	19.50	1.37	0.20	0.02
	No	10	17.00				10	12.44				10	15.90			
TOM Wellbeing	Yes	27	16.86	1.35	0.34	0.00	20	16.19	1.26	0.44	0.01	20	18.86	1.79	0.17	0.03
	No	10	12.33				10	13.89				10	12.33			
EQ-5D-5L	Yes			n/a			20	14.97	8.42	0.17	0.02			n/a		
	No						10	10.72								
MAST Total Score	Yes			n/a				n/a				20	17.31	20.09	0.08	0.07
	No											10	11.28			
MAST Comprehension Score	Yes			n/a				n/a				20	17.31	9.82	0.08	0.07
	No											10	11.28			
MAST Expression Score	Yes			n/a.				n/a				20	17.43	12.06	0.06	0.08
	No											10	11.00			

Therapeutic Approach. The p-values for the Kolmogorov-Smirnov and Shapiro-Wilk tests less than 0.05 criterion (Appendix E Tables E40 and E) indicating that the data in Phases 2 and 3 did not closely follow a normal distribution curve, requiring the employment of a non-parametric test.

The Kruskal-Wallis test was used to develop the null and alternative hypotheses as follows:

H_0: Outcomes are the same across all PwA irrespective of the therapeutic approach given.

H_1 Outcomes are significantly different across all PwA depending on the therapeutic approach given.

Then null hypothesis is accepted as all p-values are higher than the 0.05 level of significance highlighting that the therapeutic approach did not statistically affect outcomes at 6 months and 12 months post-stroke (Table 4.33).

Similarly, Table 4.34 shows that there is no significant relationship between therapeutic approach and changes in outcomes as all p-values are greater than the .05 criterion.

Table 4.33

Kruskal-Wallis Test between therapeutic approach & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Communication Strategies	3	11.83	1.79	0.43	0.00	3	8.17	1.56	0.13	0.00
	Semantic Processing	8	15.69				7	13.19			
	CILT	6	12.07				3	13.88			
	Functional Communication	2	19.25				3	13.25			
	Lexical Processing	1	5.00				4	2.00			
	MIT	6	14.25				1	7.50			
TOM Impairment	Communication Strategies	3	11.67	1.37	0.47	0.01	3	9.50	1.09	0.22	0.08
	Semantic Processing	8	15.56				7	13.06			
	CILT	6	15.29				3	13.25			
	Functional Communication	2	13.50				3	13.25			
	Lexical Processing	1	4.00				4	3.50			
	MIT	6	12.38				1	5.75			
TOM Activity	Communication Strategies	3	11.00	1.61	0.56	0.03	3	10.83	0.98	0.71	0.08
	Semantic Processing	8	15.25				7	11.94			
	CILT	6	15.21				3	12.25			
	Functional Communication	2	16.50				3	12.25			
	Lexical Processing	1	6.25				4	4.75			
	MIT	6	11.00				1	10.00			

TOM Participation	Communication Strategies	3	9.38	1.73	0.56	0.03	3	10.83	1.04	0.37	0.01
	Semantic Processing	8	15.81				7	11.63			
	CILT	6	14.36				3	13.50			
	Functional Communication	2	17.00				3	11.50			
	Lexical Processing	1	6.75				4	2.75			
	MIT	6	11.75				1	11.50			
TOM Wellbeing	Communication Strategies	3	13.00	1.60	0.13	0.11	3	12.50	1.47	0.07	0.02
	Semantic Processing	8	17.63				7	14.69			
	CILT	6	13.36				3	7.00			
	Functional Communication	2	17.25				3	13.75			
	Lexical Processing	1	3.25				4	7.25			
	MIT	6	9.13				1	3.00			
EQ-5D-5L	Communication Strategies	3	6.00	20.25	0.17	0.08	3	4.83	12.43	0.27	0.00
	Semantic Processing	8	14.07				7	12.08			
	CILT	6	15.75				3	9.63			
	Functional Communication	2	11.00				3	7.50			
	Lexical Processing	1	1.00				4	1.00			
	MIT	6	10.50				1	6.25			
MAST Total Score	Communication Strategies			n/a			3	7.83	21.07	0.40	0.05
	Semantic Processing						7	11.69			
	CILT						3	12.75			
	Functional Communication						3	17.00			
	Lexical Processing						4	5.00			
	MIT						1	9.50			

MAST Comprehension Score	Communication Strategies	n/a	3	7.50	8.66	0.58	0.04
	Semantic Processing		7	11.81			
	CILT		3	13.50			
	Functional Communication		3	14.75			
	Lexical Processing		4	7.25			
	MIT		1	8.00			
MAST Expression Score	Communication Strategies	n/a	3	8.50	13.78	0.30	
	Semantic Processing		7	12.19			
	CILT		3	12.50			
	Functional Communication		3	17.00			
	Lexical Processing		4	3.75			
	MIT		1	8.25			

Table 4.34

Kruskal-Wallis Test between therapeutic & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size	N	Mean	Std Dev	*P-value*	Kruskal-Wallis Effect Size
ASRS	Communication Strategies	3	16.83	1.59	.56	0.03	3	9.33	0.90	0.18	0.11	3	12.50	1.32	0.90	0.14
	Semantic Processing	8	12.44				7	11.94				7	12.19			
	CILT	6	10.14				3	16.63				3	9.25			
	Functional Communication	2	15.25				3	5.75				3	7.50			
	Lexical Processing	1	15.25				4	9.00				4	11.25			
	MIT	6	17.25				1	5.75				1	10.75			
TOM Impair-ment	Communication Strategies	3	12.00	0.83	0.24	0.05	3	15.50	0.77	0.26	0.06	3	13.40	1.01	0.39	0.00
	Semantic Processing	8	12.63				7	12.75				7	10.88			
	CILT	6	16.71				3	11.83				3	13.10			
	Functional Communication	2	3.00				3	16.50				3	4.50			
	Lexical Processing	1	15.50				4	16.50				4	16.50			
	MIT	6	15.50				1	4.83				1	9.00			

TOM Activity	Communication Strategies	3	16.00	0.83	0.71	0.06	3	13.50	0.63	0.47	0.02	3	14.17	1.32	0.68	0.07
	Semantic Processing	8	14.13				7	10.75				7	10.00			
	CILT	6	12.43				3	11.90				3	11.00			
	Functional Communication	2	7.00				3	14.50				3	5.75			
	Lexical Processing	1	12.00				4	14.50				4	13.50			
	MIT	6	16.25				1	4.50				1	13.50			
TOM Partici-pation	Communication Strategies	3	16.00	0.83	0.71	0.08	3	15.00	0.93	0.65	0.07	3	13.83	1.40	0.46	0.01
	Semantic Processing	8	14.13				7	9.25				7	10.25			
	CILT	6	12.43				3	11.75				3	13.88			
	Functional Communication	2	7.00				3	7.75				3	5.00			
	Lexical Processing	1	12.00				4	10.75				4	7.50			
	MIT	6	16.25				1	14.00				1	13.50			
TOM Wellbe ing	Communication Strategies	3	19.50	1.47	0.64	0.04	3	13.17	1.49	0.13	0.14	3	17.00	2.08	0.42	0.00
	Semantic Processing	8	13.25				7	8.56				7	10.25			
	CILT	6	12.57				3	11.00				3	8.00			
	Functional Communication	2	12.50				3	7.50				3	9.00			
	Lexical Processing	1	7.75				4	20.25				4	13,75			
	MIT	6	14.50				1	11.75				1	10.25			

EQ-5D-5L	Communication Strategies	n/a	3	12.67	8.69	0.59	0.09			n/a	
	Semantic Processing		7	7.50							
	CILT		3	8.50							
	Functional Communication		3	11.00							
	Lexical Processing		4	6.70							
	MIT		1	7.00							
MAST Total Score	Communication Strategies	n/a	n/a					3	12.67	22.39	0.31	0.03
	Semantic Processing							7	8.81			
	CILT							3	12.75			
	Functional Communication							3	5.25			
	Lexical Processing							4	18.00			
	MIT							1	12.50			
MAST Compre-hension Score	Communication Strategies	n/a	n/a					3	13.00	10.44	0.10	0.16
	Semantic Processing							7	7.88			
	CILT							3	11.88			
	Functional Communication							3	5.25			
	Lexical Processing							4	19.00			
	MIT							1	16.50			

MAST Expression Score	Communication Strategies	n/a	n/a	3	12.50	13.05	0.85	0.12
	Semantic Processing			7	10.44			
	CILT			3	12.25			
	Functional Communication			3	6.25			
	Lexical Processing			4	13.75			
	MIT			1	10.50			

SLT time. The Spearman's Correlation test was used to examine the link between the total SLT time and outcomes six and twelve months after the stroke. The non-parametric test was used since the data did not fit the normal distribution curve (refer to Table E42 in Appendix E).

Table 4.35 depicts of a positive relationship between therapy time and the outcomes at 6 months and 12 months post-stroke. A favourable and significant relationship was observed between the number of sessions and ASRS, TOM impairment and TOM activity outcome scores (Table 4.34). The other outcomes' relationships were not significant despite their correlation coefficients being positive.

Correspondingly, the total number of therapy time had no significant affect in the improvement between each phase as the p-values are more than the .05 level of significance. Yet, there seems to be significant relationship between the time and the improvement in the first 6 months of the TOM impairment, activity and participation as the p-values are less than .05 level of significance (Table 4.36).

Table 4.35

Spearman's Correlation between SLT time and outcomes 6 months and 12 months post-stroke

		Outcomes 6 months post-stroke	Outcomes 12 months post-stroke
ASRS	Correlation Coefficient	0.48	0.20
	P-value	0.01	0.34
TOM Impairment	Correlation Coefficient	0.55	0.31
	P-value	0.00	0.13
TOM Activity	Correlation Coefficient	0.40	0.19
	P-value	0.04	0.36
TOM Participation	Correlation Coefficient	0.46	0.30
	P-value	0.01	0.14
TOM Wellbeing	Correlation Coefficient	0.21	0.24
	P-value	0.29	0.25
EQ-5D-5L	Correlation Coefficient	0.27	0.29
	P-value	0.20	0.20
MAST Total Score	Correlation Coefficient	n/a	0.25
	P-value		0.22
MAST Comprehension Score	Correlation Coefficient	n/a	0.21
	P-value		0.30
MAST Expression Score	Correlation Coefficient	n/a	0.22
	P-value		0.29

Table 4.36

Spearman's Correlation between SLT time & changes in outcomes

		Changes in the first 6 months post-stroke	Changes between 6 months & 12 months post-stroke	Changes in 12 months post-stroke
ASRS	Correlation Coefficient	0.16	0.19	0.02
	P-value	0.40	0.39	0.92
TOM Impairment	Correlation Coefficient	0.49	0.35	0.05
	P-value	0.01	0.11	0.81
TOM Activity	Correlation Coefficient	0.49	0.35	0.17
	P-value	0.01	0.11	0.44
TOM Participation	Correlation Coefficient	0.49	0.15	0.02
	P-value	0.01	0.50	0.90
TOM Wellbeing	Correlation Coefficient	0.03	0.05	0.02
	P-value	0.86	0.82	0.90
EQ-5D-5L	Correlation Coefficient	n/a	0.56	n/a
	P-value		0.01	
MAST Total Score	Correlation Coefficient	n/a	n/a	0.01
	P-value			0.94
MAST Comprehension Score	Correlation Coefficient	n/a	n/a	0.00
	P-value			0.97
MAST Expression Score	Correlation Coefficient	n/a	n/a	0.20
	P-value			0.38

SLP experience. The p-values in the Kolmogorov–Smirnov and Shapiro–Wilk tests (Table in Appendix E43 & E46) were less than 0.05, suggesting that the data did not closely follow a normal distribution curve. This necessitated the use of a non-parametric test. Accordingly, the following null and alternative hypotheses were constructed using the Kruskal–Wallis test:

H0: Regardless of the delivery approach, the outcomes are the same across PwA.

H1: Depending on the delivery approach, the outcomes are considerably different across PwA.

As demonstrated in Table 4.36, no significant differences in outcomes were found with respect to the therapy delivery approach. All of the p-values where greater than the 0.05 level of significance, so the null hypothesis was accepted**.** Similarly, the delivery approach was found to have no statistically significant effect on outcome improvement, as most of the p-values were greater than the 0.05 significance threshold (Table 4.32). However, the p-values for improvement in ASRS, TOM impairment and TOM activity between six and 12 months after a stroke were less than the 0.05 level of significance. Additionally, the effect size of these p-values is considered high. A large effect size means that the findings have practical significance.

Dunn's multiple comparisons test was carried out as a post-hoc analysis to determine which pairs in the sample showed significant differences with regard to improvement between six and 12 months of TOM impairment, activity and ASRS. These results showed a statistically significant difference ($p < 0.05$) between improvement in TOM impairment and the following groups:

- Qualified SLPs with more than five years of experience and qualified SLPs with 3–5 years of experience ($p = 0.02$); the latter had the higher mean rank, indicating better improvement.
- Qualified SLPs with more than five years of experience and qualified SLPs with less than two years of experience ($p = 0.02$); the latter had the higher mean rank.

There was a non-significant difference ($p > 0.05$) between the improvement scores for TOM activity in the first six months and the following groups:

- Qualified SLPs with 3–5 years of experience and qualified SLPs with less than two years of experience ($p = 0.50$)

Additionally, the results showed a statistically significant difference ($p < 0.05$) between improvement in TOM activity at six and 12 months post stroke and the following groups:

- Qualified SLPs with more than five years of experience and qualified SLPs with 3–5 years of experience ($p = 0.02$); the latter had the higher mean rank.
- Qualified SLPs with more than five years of experience and qualified SLPs with less than two years of experience ($p = 0.02$); the latter had the higher mean rank.

There was a non-significant difference ($p > 0.05$) between improvement in TOM activity in the first 6 months and the following groups:

- Qualified SLPs with 3–5 years of experience and qualified SLPs with less than two years of experience ($p = 0.50$)

The results also showed a statistically significant difference ($p < 0.05$) between improvement in ASRS in the first 6–12 months and the following groups:

- Qualified SLPs with more than five years of experience and qualified SLPs with less than two years of experience (p = 0); the latter had the higher mean rank.

There was a non-significant difference (p > 0.05) between improvement in TOM activity in the first six months and the following groups:

- Qualified SLPs with less than five years of experience and qualified SLPs with 3–5 years of experience (p = 0.16)
- Qualified SLPs with 3–5 years of experience and qualified SLPs with less than two years of experience (p = 0.07)

Table 4.37

Kruskal-Wallis Test between delivery approach & outcomes

		Outcomes 6 months post-stroke					Outcomes 12 months post-stroke				
		N	Mean Rank	Std. Dev	P-Value	Kruskal-Wallis Effect Size	N	Mean Rank	Std. Dev	P-Value	Kruskal-Wallis Effect Size
ASRS	Qualified SLP with <2 years of experiences	6	15.25	1.79	0.67	0.05	5	13.70	1.56	0.44	0.02
	Qualified SLP with 3 – 5 years of experience	10	12.55				8	10.88			
	Qualified SLP with 5< years of experience	10	12.00				8	9.44			
TOM Impairment	Qualified SLP with <2 years of experiences	6	15.00	1.37	0.54	0.03	5	12.50	1.09	0.79	0.08
	Qualified SLP with 3 – 5 years of experience	10	11.15				8	10.81			
	Qualified SLP with 5< years of experience	10	13.72				8	10.25			
TOM Activity	Qualified SLP with <2 years of experiences	6	15.00	1.61	0.49	0.02	5	12.20	0.98	0.85	0.09
	Qualified SLP with 3 – 5 years of experience	10	11.00				8	10.38			
	Qualified SLP with 5< years of experience	10	13.89				8	10.88			

TOM Participation	Qualified SLP with <2 years of experiences	6	13.42	1.73	0.71	0.05	5	13.90	1.04	0.35	0.00
	Qualified SLP with 3 – 5 years of experience	10	11.60				8	9.31			
	Qualified SLP with 5< years of experience	10	14.28				8	10.88			
TOM Wellbeing	Qualified SLP with <2 years of experiences	6	13.75	1.60	0.77	0.06	5	9.10	1.47	0.66	0.06
	Qualified SLP with 3 – 5 years of experience	10	13.75				8	12.13			
	Qualified SLP with 5< years of experience	10	11.67				8	11.06			
EQ-5D-5L	Qualified SLP with <2 years of experiences	6	11.92	20.25	0.91	0.08	5	9.60	12.43	0.84	0.09
	Qualified SLP with 3 – 5 years of experience	10	11.94				8	8.14			
	Qualified SLP with 5< years of experience	10	10.75				8	9.60			
MAST Total Score	Qualified SLP with <2 years of experiences	n/a					5	13.10			0.05
	Qualified SLP with 3 – 5 years of experience						8	9.63	21.07	0.61	
	Qualified SLP with 5< years of experience						8	11.06			

MAST Comprehension Score	Qualified SLP with <2 years of experiences	n/a	5	12.20	8.66	0.82	0.09
	Qualified SLP with 3 – 5 years of experience		8	10.06			
	Qualified SLP with 5< years of experience		8	11.19			
MAST Expression Score	Qualified SLP with <2 years of experiences	n/a	5	13.30	13.78	0.62	0.05
	Qualified SLP with 3 – 5 years of experience		8	10.00			
	Qualified SLP with 5< years of experience		8	10.56			

Table 4.38

Kruskal-Wallis Test between delivery & changes in outcomes

		Changes in the first 6 months post-stroke					Changes between 6 months & 12 months post-stroke					Changes in 12 months post-stroke				
		N	Mean	Std Dev.	P-value	Kruskal-Wallis Effect Size	N	Mean	Std Dev.	P-value	Kruskal-Wallis Effect Size	N	Mean	Std Dev.	P-value	Kruskal-Wallis Effect Size
ASRS	Qualified SLP with <2 years of experiences	6	11.67				5	22.17				5	16.83			
	Qualified SLP with 3 – 5 years of experience	10	11.71	1.45	0.59	0.02	8	14.00	0.92	0.01	0.25	8	12.64	1.36	0.46	0.01
	Qualified SLP with 5< years of experience	10	14.63				8	9.68				8	11.50			
TOM Impairment	Qualified SLP with <2 years of experiences	6	11.00				5	18.83				5	13.17			
	Qualified SLP with 3 – 5 years of experience	10	12.29	0.73	0.62	0.03	8	15.93	0.71	0.01	0.23	8	14.50	0.91	0.57	0.03
	Qualified SLP with 5< years of experience	10	14.50				8	9.43				8	11.36			

TOM Activity	Qualified SLP with <2 years of experiences	6	15.67	0.75	0.23	0.02	5	18.83	0.61	0.01	0.23	5	12.17	1.23	0.28	0.01
	Qualified SLP with 3 – 5 years of experience	10	16.86				8	15.93				8	15.86			
	Qualified SLP with 5< years of experience	10	11.63				8	9.43				8	10.89			
TOM Participation	Qualified SLP with <2 years of experiences	6	15.67	0.75	0.23	0.02	5	14.67	0.95	0.49	0.02	5	13.67	1.37	0.52	0.02
	Qualified SLP with 3 – 5 years of experience	10	16.86				8	14.29				8	14.64			
	Qualified SLP with 5< years of experience	10	11.63				8	11.14				8	11.18			
TOM Wellbeing	Qualified SLP with <2 years of experiences	6	16.83	1.33	0.47	0.01	5	9.33	1.26	0.56	0.00	5	11.00	1.79	0.90	0.06
	Qualified SLP with 3 – 5 years of experience	10	15.14				8	11.93				8	13.14			
	Qualified SLP with 5< years of experience	10	12.16				8	13.46				8	12.50			

EQ-5D-5L	Qualified SLP with <2 years of experiences	n/a	5	12.33	11.33	0.28	0.00	n/a				
	Qualified SLP with 3 – 5 years of experience		8	12.67								
	Qualified SLP with 5< years of experience		8	8.82								
MAST Total Score	Qualified SLP with <2 years of experiences	n/a	n/a					5	10.00			
	Qualified SLP with 3 – 5 years of experience							8	13.00	20.09	0.80	0.05
	Qualified SLP with 5< years of experience							8	12.79			
MAST Comprehension Score	Qualified SLP with <2 years of experiences	n/a	n/a					5	12.83			
	Qualified SLP with 3 – 5 years of experience							8	11.07	9.82	0.81	0.50
	Qualified SLP with 5< years of experience							8	13.14			

MAST Expression Score	Qualified SLP with <2 years of experiences	n/a	n/a	5	10.50	12.06	0.55	0.03
	Qualified SLP with 3 – 5 years of experience			8	14.86			
	Qualified SLP with 5< years of experience			8	11.75			

RQ5 Analysis: In a sample of people with aphasia living in Malta, how to do they and their carers perceive SLT services provided in Malta?

This data was collected during Phase 3, specifically one year post stroke,

Overall Satisfaction with Speech Therapy Services

The following question was asked in the Therapy Satisfaction Form:

1) *How satisfied are you with the **speech language therapy services** provided?*

The participants and their relatives rated their satisfaction with the speech therapy services. The following table and figure 4.2 present the descriptive results for this question.

Table 4.39

Descriptive Data regarding Overall Satisfaction of SLT services

	Patients' Satisfaction		Relatives' Satisfaction	
	Frequency	Percentage	Frequency	Percentage
Not at all satisfied	1	3.8%	2	7.7%
Slightly satisfied	1	3.8%	1	3.8%
Moderately satisfied	8	30.8%	5	19.2%
Very satisfied	11	42.3%	13	50%
Extremely satisfied	5	19.2%	5	19.2%
Total	26	100%	26	100%

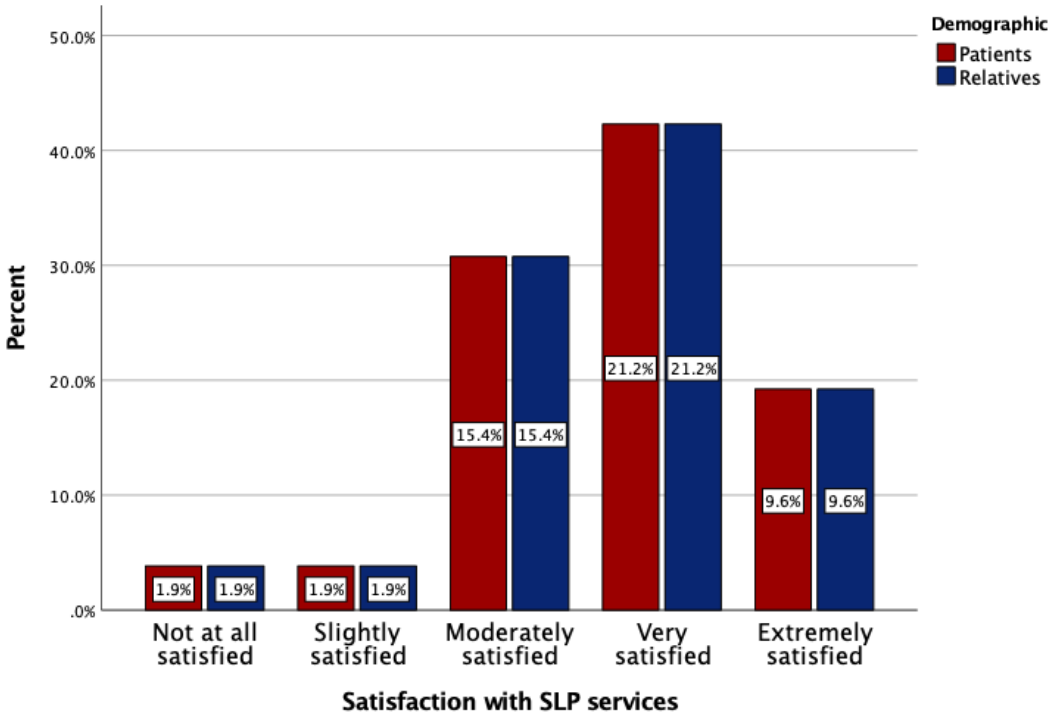


Figure 4.2 : Bar graph depicting Overall Satisfaction of SLT services

A chi-square test of independence was performed to examine the relationship between the patients' and relatives' satisfactory scores. The result was significant, $\chi^2(16\ N = 26) = 49.31$, $p = < 0$, indicating that the satisfaction levels of the PwA and their relatives were significantly associated.

Overall Satisfaction with Speech Therapy Frequency

The following question was asked in the Therapy Satisfaction Form:

2) *How satisfied are you with the **frequency of the speech and language therapy** provided?*

The participants and their relatives rated their satisfaction with the frequency of speech therapy. Table 4.40 shows the descriptive results for this question whilst Figure 4.3 illustrates these results.

Table 4.40

Descriptive Data regarding satisfaction of SLT frequency

	Patients' Satisfaction		Relatives' Satisfaction	
	Frequency	Percentage	Frequency	Percentage
Not at all satisfied	2	7.7%	2	7.7%
Slightly satisfied	6	23.1%	5	19.2%
Moderately satisfied	8	30.8%	8	30.8%
Very satisfied	6	23.1%	8	30.8%
Extremely satisfied	4	15.4%	3	11.5%
Total	26	100%	26	100%

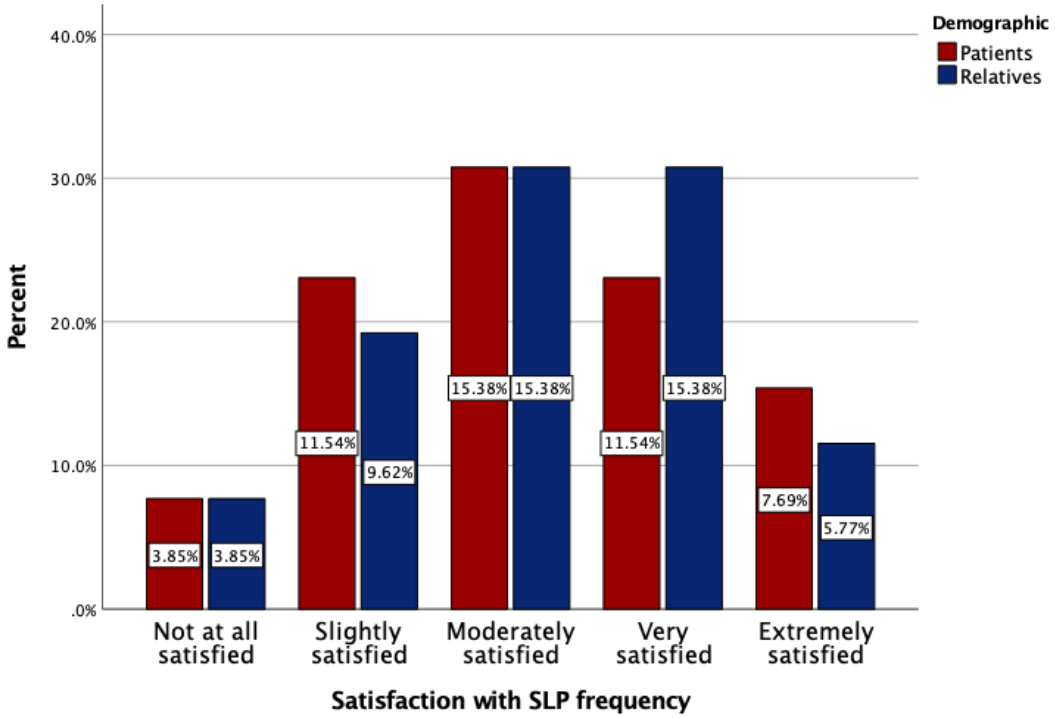


Figure 4.3: Bar graph depicting satisfaction with SLT services.

A chi-square test of independence was performed to examine the relationship between the patients' and relatives' satisfactory scores. The result was significant;

$\chi^2(16\ N=26) = 57.79$, $p = < 0$. The similarities in their satisfaction levels can be seen in Figure 4.3.

Overall Satisfaction with Speech Therapy Type

The following question was asked in the Therapy Satisfaction Form:

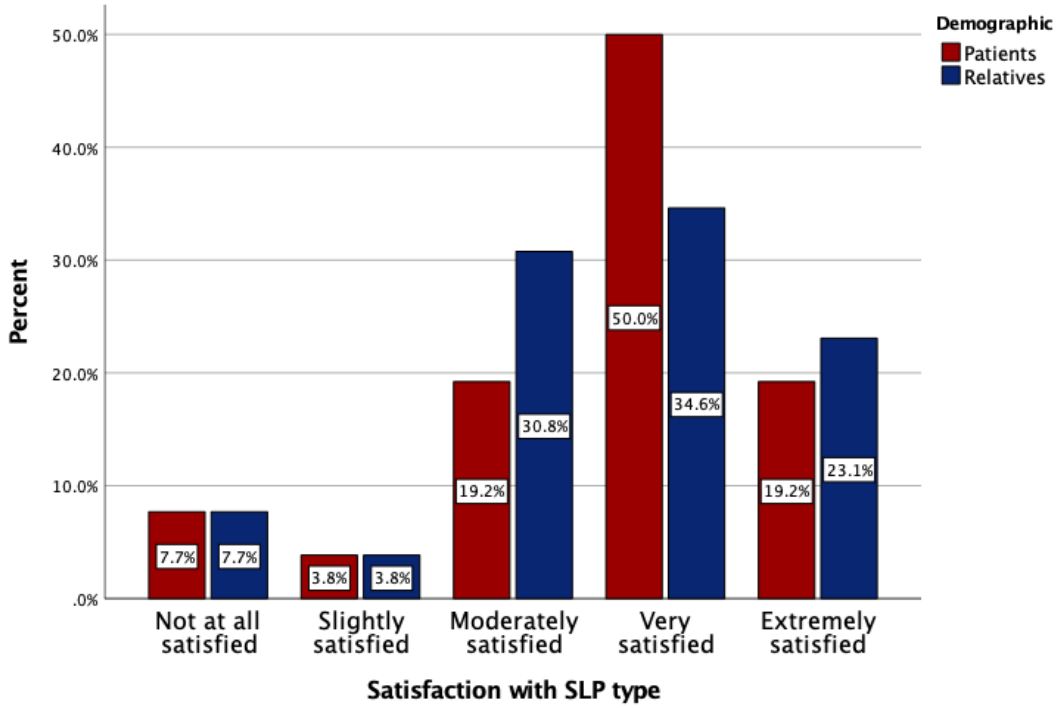
3) How satisfied are you with the ***type of speech and language therapy*** provided?

The participants and their relatives rated their satisfaction with the type of speech therapy administered. Table 4.41 summarises their responses, and Figure 4.4 exhibits a clustered graph of the data provided in Table 4.41.

Table 4.41

Descriptive Data regarding satisfaction of SLT therapeutic approach

	Patients' Satisfaction		Relatives' Satisfaction	
	Frequency	Percentage	Frequency	Percentage
Not at all satisfied	2	7.7%	2	7.7%
Slightly satisfied	1	3.8%	1	3.8%
Moderately satisfied	5	19.2%	8	30.8%
Very satisfied	13	50.0%	9	34.6%
Extremely satisfied	5	19.2%	6	23.1%
Total	26	100%	26	100%



.Figure 4.4: Bar graph depicting satisfaction with SLT approach used

A chi-square test of independence was performed to examine the relation between the patients' and relatives' satisfactory scores. The relation between these variables was significant, $\chi^2(16\ N=26) = 44.85$, $p = <0.00$.

RQ6 Analysis: In a sample of people with aphasia, what community support services and/or organisations, if any, are accessed post-stroke?

Data to address this research question were obtained via the Support Services and Resource Utilisation Form in Phase 3 (Appendix B8). This section provides a summary of the findings, beginning with the descriptive statistics of each question analysed.

The most common reason for hospitalisation (was another stroke.

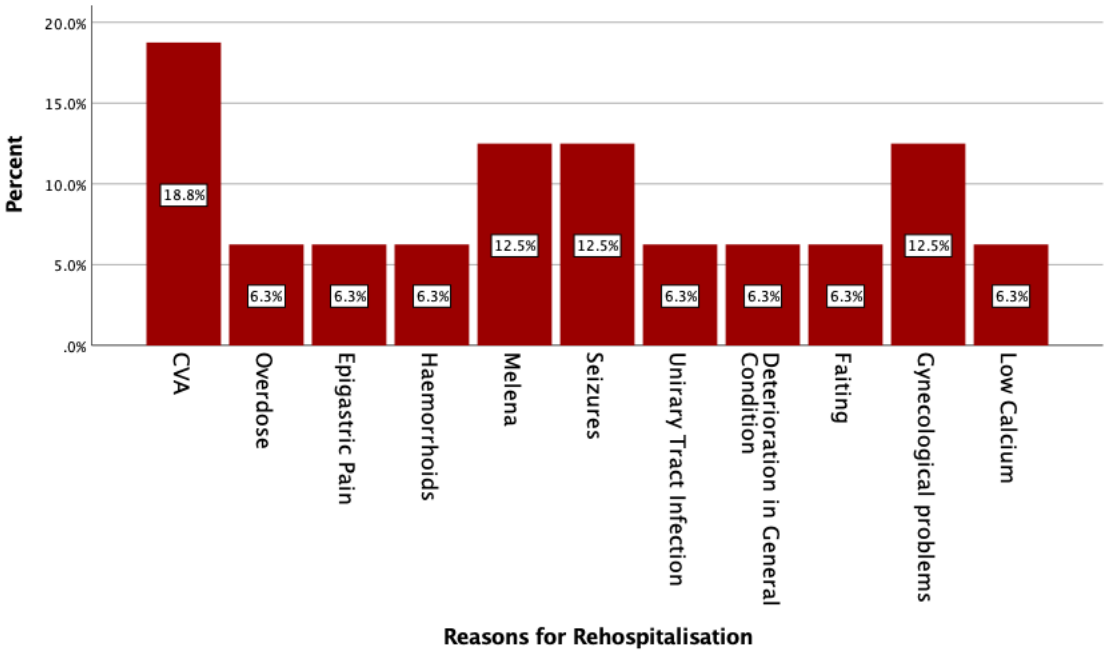


Figure 4.5: Reason for rehospitalizations

For the first-year post stroke, 66.67% of the participants reported accessing support services after their discharge from the general hospital, while 33.33% did not access any services. Table 4.49 illustrates the services utilised by the participants.

Table 4.42

Services Utilised post-stroke

	Yes	No
Meals on wheels	80%	20%
Home care services	86.67%	13.33%
Aids and equipment	86.67%	13.33%
Legal and Financial Aid	0%	100%
Mobility and Transport Aid	16.67%	83.33%
Carer Support Resource	80%	20%

None of the participants attended a day centre or a support group after their discharge from the hospital. Of all the participants, 83.33% were already retired, 13.33% ended up going to work after being discharged, and 13.33% had to retire due to stroke comorbidities. Moreover, 80% of the participants returned to their place of living after stroke, while 20% had to be admitted to a residential home due to the stroke and comorbidities.

Summary of results

The study found no significant gender-based outcome differences at 6- and 12-months post-stroke. Male participants reported slightly higher rankings. Age-wise, no overall differences were observed, but participants aged 40-49 showed better language function recovery than those aged 60-69. Handedness had no significant impact, but left-handed stroke survivors reported higher ranking. Language knowledge showed no significant connections to outcomes. While education levels

generally did not affect outcomes, those with post-secondary/university education had higher rankings for TOMS activity and participation gains at 6 months.

No significant associations were noted between the type of stroke and outcomes at 6- and 12-months post-stroke. Prior stroke occurrences did not significantly affect outcomes. Thrombolysis and mechanical thrombectomy showed no notable outcome differences. Similarly, outcomes were no significant differences between 6- and 12-months post-stroke with or without mechanical thrombectomy. The initial severity of the stroke, as measured by NIHSS scores, significantly influenced outcomes at both 6- and 12-months post-stroke.

Significant differences were observed at 6 months post-stroke for individuals receiving therapy, particularly in ASRS, TOM impairment, and TOM participation. The specific therapy approach used by SLPs showed no significant association with outcomes. The number of therapy sessions attended had a notable impact at 6 months post-stroke. SLP experience did not significantly correlate with outcomes, but a connection emerged between changes in ASRS, TOM impairment, activity, and delivery approach.

Conclusion

In this chapter, the independent factors outlined in Chapter 3 (Table 3.10) were analysed in relation to the outcomes at six months and twelve months after the stroke. These results are discussed in the following chapter in light of the literature whilst considering the research questions put forward in Chapter 2.

Chapter 5

DISCUSSION

Chapter Overview

This chapter provides the interpretation of the results, which are discussed in light of the existing research. This chapter is divided into six subsections that answer the six research questions.

RQ 1: In a sample of people with aphasia living in Malta, do demographic factors influence outcomes at six months and one year after stroke?

The demographic characteristics analysed in this study are gender, age, number of languages spoken, educational level and handedness.

Gender. As shown in Tables 4.2 and 4.3, male and female PwA showed no significant difference in terms of outcomes at 6- and 12-months post stroke or in terms of changes at these time periods. Although several studies have reported worse outcomes in females (Gall et al., 2012; Appelros et al., 2009), the findings of this study are in line with those of recent studies, which showed no significant correlation between sex and outcomes post stroke (Watila & Balarbe, 2015; Plowman et al., 2012; Inatomi et al., 2008; Lazar et al., 2008).

Table 4.2 shows that the mean ranks of all the outcomes at 6- and 12-months post stroke are higher in males than in females, although this difference is not significant. Phan and colleagues (2017) have observed that worse outcomes post stroke are associated with the female gender more than with the male gender. Meanwhile, Gall et al. (2012) have reported that despite the literature findings suggesting that females have worse long-term functional outcomes post stroke, this difference is greatly reduced when confounding factors are taken into account.

Compared with men, women may be more likely to report partial recovery and a larger need for assistance, and they tend to display a depressive mood despite having a high ADL function (Chong et al., 2006). Moreover, women may have higher expectations for recovery or may display worse coping mechanisms, which may result in worse self-reporting outcomes (Donnellan et al., 2006).

Age. In this study, the group data sets are still small therefore, this should be kept in mind. A small sample size may not have the (statistical) power to expose small effects which possibly resulting in a type II error (Jones et al., 2003).

No significant differences in outcomes were observed at 6- and 12-months post stroke in relation to the PwA's ages (Table 4.4). Contrarily, most studies have reported better outcomes in younger patients (Everink et al., 2016; Louis et al., 2009).

Table 4.5 shows that the changes in TOMs and ASRS outcomes at 6 and 12 months did not significantly differ.

Nonetheless, there seems to be a significant difference amongst different age groups in terms of the improvements in MAST scores, in MAST comprehension and expression scores within the first 12 months post-stroke, and in EQ-5D-5L scores between 6 and 12 months. Table 4.5 displayed that 40-49-year-old participants had significantly higher mean ranks than those participants of 60-69 years old. Correspondingly, several studies have shown that young people are more likely to improve their language function than older patients (RELEASE, 2021; Lask et al., 2001; Sands et al., 1969). According to Meinzer et al. (2011), such an observation may be explained by the changes in brain plasticity that occur with age.

Handedness. No significant association was observed between handedness and the outcomes at 6- and 12-months post stroke. Similarly, no significant

differences in terms of changes in outcomes were observed between the right-handed and left-handed PwA, as all the p-values in Table 4.7 are >0.05. This finding is consistent with a literature review, wherein handedness, when evaluated as an independent factor, does not affect recovery from aphasia (Plowman et al., 2011).

By contrast, the p-value (0.04) for the EQ-5D-5L score at 6 months was <0.05, indicating a significant difference in the self-reported EQ-5D-5L scores between the left- and right-handed participants. The left-handed PwA had a higher mean rank than the right-handed PwA. A possible explanation for this result is that most of the participants are right-handed (N=30) (only 7 were left-handed) and thus their dominant hand was affected, limiting their ADLs. Taub et al. (2013) have demonstrated that improvements in upper limb extremities positively influence patients' perception of what activities they can do, which in turn enhances their QOL. Additionally, an observational study has revealed that incomplete motor recovery of the upper and lower extremities is the biggest predictor of a worse QOL (Franceschini et al., 2010).

Monolingual/Bilingual/Multilingual. No significant association was observed between the outcomes at 6- and 12-months post stroke and the language knowledge of the PwA, as all p-values in Table 4.8 are >0.05. Similarly, no statistical differences were observed between the improvements at 6 and 12 months in relation to the PwA's language knowledge***.*** Studies have shown that multilingual PwA demonstrate better recovery post stroke (Alladi et al., 2016). Likewise, Lahiri et al. (2020) concluded that bilingualism favours aphasia recovery post stroke, but this trend was not observed in this study. The prognosis of multilingual PwA is a challenging topic because brain lesions do not necessarily affect L1 and L2 in the same way (Van der Linden et al., 2018; Verreyt et al., 2013). Moreover, Kuzmina et al. (2019) have

deduced that the recovery for each language depends on numerous factors, such as the age of language acquisition, frequency of language exposure, linguistic similarity between one's languages and premorbid proficiency. As this was not the focus of this current study, the latter factors were not explored in depth. The question posed to the participants was a generic one thus this may have influenced the results.

Education. Several studies have reported that investigations on the effects of educational level on functional outcome post stroke in developed countries are scarce (Nichols-Larsen et al., 2005; Putman et al., 2007). Table 4.10 highlights that there is no significant association between education levels and the outcomes at 6- and 12-months post stroke. Likewise, Connor and colleagues (2001) and Watila and Balarabe (2015) have reported that there is no significant correlation between educational achievement and aphasia prognosis. Meanwhile, Hills and Tippet (2014) found that education levels impact language recovery. They concluded that better language recovery from chronic aphasia is associated with years of schooling.

No significant association was observed between education levels and changes in outcomes (Table 4.11), except for improvement in TOMS activity and participation at 6 months**.** The mean ranks for both outcomes were significantly higher in PwA with a post-secondary and university education level than in those with secondary education. A meta-analysis study analysing data on education and incidence of depression post-stroke reveals that high education attainment is associated with a lower risk of depression after stroke (Backhouse et al., 2018). Therefore, taking this study into consideration, those having secondary level might be feeling depressed which may explain why they scored significantly lower in TOM activity and participation. Moreover, some studies have reported a greater

participation amongst PwA with higher education levels than amongst their counterpart (Trygged et al, 2011).

A study by Wan et al (2006) used the Neurobehavioral Cognitive Status Examination (NCSE or Cognistat) to quantify its impacts in order to predict the functional outcomes of stroke survivors. The Functional Independence Measure (FIM, Hamilton et al.,1987; Granger & Hamilton, 1990) (self-care, mobility, cognition) scores on admission and discharge, age, years of education, and length of hospitalization were entered together with the NSCE scores into a factor analysis in order to examine relevant factors influencing the functional outcome of clients with stroke. Three factors emerged using a criterion with an eigenvalue of >1. The last factor involves patients' age and years of education and of NCSE factor II (integrated cognition). In light of the above, this factor can be referred to as an overlearning factor, which ensures mastery of higher cortical skills, is strongly associated with better education, and may change with age (Wan et al.,2006; Giambra et al.,1995; Schaie & Wallis, 1991).

RQ2: In a sample of people with aphasia living in Malta, do stroke related factors influence outcomes at six months and one year after stroke?

The stroke related factors analysed in this study are: stroke type, stroke history, thrombolysis, mechanical thrombectomy and initial stroke severity.

Stroke Type. No significant association was observed between stroke types and the outcomes at 6- and 12-months post stroke, and no significant differences in improvements were noted between these periods. This result is inconsistent with previous findings showing that patients with a haemorrhagic stroke have better functional outcomes than those with a non-haemorrhagic stroke (Perna & Temple,

2015; Paulucci et al., 2003). Other studies have also reported that people with a haemorrhagic stroke had greater improvement, but their progress was slow (Kelly et al., 2003; Ween et al., 1996). A possible reason for this disparity is that the study included very few PwA suffering from a haemorrhagic stroke (N=7).

Stroke History. No significant association was observed between the outcomes at 6- and 12-months post stroke and the previous stroke experienced by the PwA, as the p-values in Table 417. are all >0.05. Similarly, no significant differences in improvements were observed between the time periods and between PwA with and without a previous stroke. Congruently, Pedersen et al. (1997) have deduced that PwA with a recurrent stroke recover equally well and equally fast as those patients who have had their first stroke, unless the recurrence occurred on the opposite side of the first stroke, wherein functional recovery would be less likely. On the contrary, Wang et al. (2016) have reported that recurrent stroke after discharge exerts a relatively great impact on 90-day poor functional outcomes.

Thrombolysis. No significant differences were observed between the outcomes at 6 and 12 months post stroke and between the outcomes in relation to the administration of thrombolysis within a few hours after stroke onset (Table 4.19). The improvement in outcomes did not significantly differ between the two time periods. Intravenous thrombolysis with r-tPA (recombinant tissue-type plasminogen activator) is linked to better functional outcomes at 90 days post acute ischemic stroke, but its effect on longer-term outcomes is less understood (Emberson et al., 2014), and studies on long-term outcomes are sparse (Yu et al., 2019; Schmitz et al., 2014).

Mechanical Thrombectomy. Tables 4.21 and 4.22 show that there are no significant differences in outcomes and in improvements between 6- and 12-months

post stroke and between cases with and without thrombectomy. In a recent study, a significant number of patients who had thrombectomy displayed long-term positive outcomes (Fuhrer et al., 2020). Thrombectomy has been linked to improved functional outcomes in patients with acute ischaemic stroke who have proximal anterior circulation, major vascular blockage and salvageable brain tissue (Powers et al., 2019; Jovin et al., 2015). This aspect was not investigated in this study, which could be the reason the current results contradict most findings.

Initial Stroke Severity. Table 4.23 shows that initial stroke severity as measured using the NIHSS significantly affects all the outcomes at 6- and 12-months post stroke. A negative correlation implies that the higher the NIHSS, the worse the outcomes post stroke. Moreover, Table 4.24 shows that despite the varying degrees of improvement in outcomes in the first 6 months and despite the differences in outcomes between 6 and 12 months, the NIHSS reveals the significant improvement in outcomes for the first-year post stroke. Wouters and colleagues (2018) have found that the NIHSS is a good predictor of functional outcomes. The initial severity of stroke is most strongly associated with outcomes 90 days post stroke (Bhaskar et al., 2017). Adams et al. (1999) prognostic score acute ischemic strokehave reported that higher NIHSS scores correlate with high mortality and poor outcomes. They concluded that the NIHSS score highly predicts a patient's likelihood of recovery after a stroke. A score of > or =16 predicts death or serious impairment, whereas a score of or =6 predicts a successful recovery.

RQ 3: In a sample of people with aphasia living in Malta, does initial aphasia severity influence outcomes at six months and one year after stroke?

Initial Aphasia Severity. In this research, initial aphasia severity was measured utilising the Best Language Score (BLS) from the NIHSS, the ASRS

scores and the MAST Language Test. Significant differences in the above-mentioned scores and in different outcomes at both 6- and 12-months post-stroke were observed, as all p-values were <0.05. The worse the initial aphasia severity the worse the outcomes at both 6 months and 12 months post-stroke.

Evidence has consistently shown that a link exists between aphasia and post-stroke dependency (Dul & Drayer, 1994). Furthermore, several studies have shown that aphasia is an indicator of poor prognosis and is associated with more severe physical, cognitive, and social deficits (Pohjasvaara et al., 1998; Tatemichi et al., 1994). A more recent study by Tsouli et al. (2009) has established that severity of post-stroke acute aphasia aids in prognosis of one-year dependence and 10-year mortality. They also found that patients with moderate and severe aphasia had an increased possibility of being dependent one year post stroke by 41% and 56%, respectively. This trend has not been noted in those with mild aphasia. The Nottingham Health Profile has shown significant connections between the degree of aphasia and the social, emotional, mobility and total QOL scores (Franzén-Dahlin et al., 2010). This is in line with this study's conclusions.

Numerous studies have demonstrated that amongst clinical variables, initial aphasia severity is considered the greatest predictor of aphasia (Glize et al., 2017; Lazar et al., 2010; 2001). Kertesz and McCable (2004) have found that the Aphasia Quotient from the Western Aphasia Battery (Kertesz & Poole, 2004) predicted aphasia recovery at 6- and 12-months post stroke, and this finding was replicated in the current study. Lahiri et al. (2020) have observed that the initial aphasia severity remains to be the most important predictor for aphasia recovery post stroke in participants subjected to comparable rehabilitation measures.

RQ4: In a sample of people with aphasia living in Malta, do type, timing, frequency, and intensity of SLT influence outcomes at six months and one year after stroke?

Received Therapy for Aphasia. Significant differences were observed between PwA who received aphasia therapy and those who did not receive any aphasia therapy in terms of ASRS, TOM impairment and TOM participation at 6 months post-stroke. Moreover, no significant differences in improvement were noted in the other outcomes. Contrary to these findings, recent meta-analyses involving numerous smaller studies have proven that SLT efficacy is greatly beneficial to PwA (Brady et al., 2012; 2016; Robey et al., 1998). This disparity could be due to various reasons. For instance, the included number of PwA who did not receive therapy is quite small (N=5) to become sufficiently representative. Additionally, most of the PwA underwent a period of spontaneous recovery post stroke, wherein they had regained some of their language functions. Such a recovery happens mostly within the first 2 weeks in ischaemic stroke and within the first 4–8 weeks in post-haemorrhagic stroke (Sinanović et al., 2011). Even though spontaneous recovery is achieved within the first 12 months, it may still progress beyond this period (Fama et al., 2014). The five PwA who did not receive SLT had mild aphasia; therefore, spontaneous recovery might have led them to display significant improvements.

Therapy Approach. This study established that there was no significant association between the therapy approach used by the SLP and the outcomes at 6- and 12-months post-stroke (Table 4.33). Similarly, no differences were noted between these time periods in terms of improvement (Table 4.34). In the Cochrane Study, Brady et al. (2012) have investigated the effects of various SLT approaches commonly utilised in post-stroke aphasia. They have demonstrated that all

approaches produced similar functional communication outcomes; no one approach has been proven to yield more desirable outcomes compared with the other approaches. Nonetheless, it was concluded that therapist-delivered therapy and group therapy are more effective than computer-mediated therapy and individual therapy correspondingly (Brady et al., 2016). Therapy settings (i.e., individual therapy versus group therapy) could not be analysed in this study, as all the SLP utilised individual therapy.

Speech Language Therapy Dosage. Significant statistical differences in outcomes at 6 months post stroke were observed in relation to the number of sessions attended, whereas no significant differences were noted at 12 months post stroke. Meyer and colleagues (2010) believe that the first 90 days post stroke are the 'window of opportunity' for neuronal changes to occur as part of neuroplasticity. Acute[19] and subacute[20] post-stroke aphasia therapy are believed to harness the benefits of spontaneous recovery through therapeutic activities (Raymer et al., 2008). Several studies have assumed that aphasia remains stable beyond the initial phase of spontaneous recovery, which occurs at around 6 months following the stroke onset, indicating that the aphasia has progressed to the chronic[21] stage (Allen et al., 2012; Breitenstein et al., 2017; Robey, 1998). This aligns with the notion that 'earlier is better' (Godeckeet al. 2012; de JongHagelstein et al. 2011; Bakheit et al. 2007). This study noted significant differences in improvements in TOM impairment. These results strengthen the growing evidence that people with chronic aphasia may

[19] The acute phase lasts for about 2 weeks after the onset of the lesion (Hills et al., 2006; 2005)
[20] The subacute phase lasts up to 6 months post-onset (Hills et al., 2006; 2005)
[21] The chronic phase begins months to years after a stroke and may continue for the remainder of the person's life. (Hills et al., 2006; 2005)

be more fluid in terms of recovery than previously thought (Holland et al., 2017; Hope et al., 2017).

SLP experience. This study found no significant association of outcomes at 6- and 12-months post stroke with the SLP experience. By contrast, a significant association was observed between the changes in ASRS, TOM impairment and TOM activity and the delivery approach at 6- and 12-months post stroke.

In both the changes in TOM impairment and activity, a significant difference was observed between the qualified SLP with >5 years of experience and the qualified SLP with 3-5 years of experience, with the mean being higher in the latter; a significant difference was also observed between the qualified SLP with >5 years of experience and the qualified SLP with <2 years of experience, with the mean being higher in the latter. These observations were in relation to ASRS improvement at 6- and 12-months post stroke.

Between the qualified SLP with >5 years of experience and the qualified SLP with <2 years of experience, the mean was higher in the latter. This could be due to the effect of tenure on job motivation. Although the correlation between tenure and job performance is positive, Ng and Feldman (2010) have found that the strength of association decreases as tenure increases. According to Bartlimiejczuk (2013), the influence of tenure on performance is greatest between 3 and 6 years of employment, and it progressively decreases until 14 years of employment. A longer tenure may result in a loss of ambition for progress, resulting in a drop in work performance (Ng & Feldman, 2013).

RQ5: In a sample of people with aphasia living in Malta, how do they and their carers perceive SLT services provided in Malta?

This explorative survey was constructed based on the existing studies aimed to gather data about SLT service satisfaction amongst PwA and their relatives. The PwA and their relatives reported that overall they were satisfied with the SLT services provided, with the SLT frequency and with the SLT approach utilised. Moreover, studies have reported a favourable experience with language therapy amongst PwA (Grohn et al., 2014; Brown et al., 2010; Hersh, 2009; Jones et al, 2008). On the contrary, in a Hong Kong-based study, PwA rated their overall satisfaction with the current service delivery as follows: 12% were very unsatisfied, 44% were unsatisfied and the remaining 44% were neutral, which signifies their negative experience with the SLT services. Only a few studies on PwA's and their relatives' satisfaction towards SLT services are available.

RQ6: In a sample of people with aphasia, what community support services and/or organisations, if any, are accessed post-stroke?

Rehospitalisation. A systematic review was conducted to determine the prevalent causes and patterns of short- and long-term readmissions amongst stroke patients (Rao et al., 2016). To the researcher's knowledge, only four studies have evaluated the causes of readmissions in stroke patients over the course of 30 days to 5 years. Of these four studies, only one has investigated the common causes of one-year readmissions for haemorrhagic and ischaemic stroke cases (Bravata et al., 2007), similar to this study. Tseng and Lin (2009) have noted that the most prevalent reasons for rehospitalisation include recurrent stroke (26.3%), infections (15.1%), accidents (9.5%), cardiopulmonary disease (9.1%), cancer (3.5%), diabetes (2.2%)

and other causes (32.7%). Likewise, this study found that the most common reason for hospital readmission in the first-year post stroke is recurrent stroke (18.75%). The remaining reasons include melena (12.5%), seizures (12.5%), gynaecological problems (12.5%) and other causes (43.7%). No such findings were mentioned in the above systematic review. This disparity is possibly due to the low number of participants included in this study compared with the 516 patients included in the investigation conducted by Tseng and Lin (2009).

Rehabilitation Services. The gold standard care for recovery post stroke is inpatient rehabilitation, wherein multidisciplinary teams provide therapy in stroke units (National Stroke Foundation, 2010; Dewy et al., 2007). A systematic review has indicated that outpatient rehabilitation within one year post stroke improves ADLs and diminishes deterioration (Legg & Langhorne, 2004).

This study demonstrated that 40% of PwA underwent community rehabilitation after being discharged home from an acute hospital. Meanwhile, 43.3% were admitted to an inpatient rehabilitation hospital. Amongst these PwA, 61.5% were referred to a community rehabilitation after being discharged from a stroke unit of the rehabilitation hospital. Therefore, 66% underwent outpatient rehabilitation in the first-year post stroke. Additionally, 16.6% of the participants were not referred for rehabilitation.

The percentage of participants who underwent community rehabilitation was higher in this study than in an American study, where only 30.7% of the participants accessed outpatient services (Centers for Disease Control and Prevention, 2007). This finding is similar to that of a Canadian study, which showed that despite the availability of outpatient services, only around 60% are referred for outpatient services (Janzen et al., 2019).

A cohort study investigating data from the Australian Stroke Clinical Registry has found that of 8,555 patients, 51.1% were discharged home, 40.2% were admitted to an inpatient rehabilitation centre and 8.3% were discharged to a resial care facility (Lynch et al., 2020). Likewise, this study found that 43.3% of the participants were admitted to an inpatient rehabilitation hospital. Moreover, it was noted that participants were first admitted to an inpatient rehabilitation hospital before being discharged to a residential care facility.

Services Accessed in the Community. This study showed that 80% of the PwA utilised carer support resources after being discharged home, and 86.67% utilised home care services when discharged home. Studies have shown that 25%–46% of carers experienced a significant burden within the first 6 months of caregiving their loved ones following a stroke (Hung et al., 2012, Tooth et al., 2005). Caring entails various physiological, emotional, and social consequences (Hamilton & Adamson, 2013; Larkin et al., 2012), as well as strained relationships, shifts in roles, and loss of autonomy and independence (Quinn et al., 2014; Greenwood & Mackenzie, 2010). It also entails financial repercussions given that many caregivers struggle to continue working whilst caring for their post-stroke partner/relative (Milne & Larkin, 2015).

An effective way to lessen the burden of stroke patients and their relatives is the provision of adaptive devices (Boland et al., 2017), although such equipment is costly. When patients are discharged, they are expected to improve as a result of community rehabilitation (Pollock et al., 2014). Thus, people with stroke can expect that their equipment needs change over time. This study found that 86.67% of the participants used additional aids and equipment provided by the Maltese government such as gutter frames and walking sticks.

Meals on Wheels is another service that is accessible in communities in Malta. Eighty percent of the participants in this study reported using this service. In Charlton et al.'s (2013) study, some of the participants stated that delivery of snacks can potentially alleviate some of their burdens in shopping and food preparation. This service indeed reduced the burden of the participants and the ones caring for them.

Day centres and Support Groups. Social support has been associated with improved functional outcomes in stroke survivors (Glass et al., 1993) and with increased self-efficacy and self-esteem in both PwA and their carers (Morris & Morris, 2012). Furthermore, people who believe they have more social support report better adjustment to new disabilities and to changing roles in daily life (Ch'Ng et al., 2008). Unfortunately, stroke support groups are currently not active in Malta; therefore, none of the participants in this study had accessed a support group after being discharged from the hospital.

This study found that none of the PwA attended any day centre post-stroke, and a possible reason is the COVID-19 pandemic. During the initial days of the pandemic, the local Public Health Authorities (https://legislation.mt/) (through legal notices) implemented a measure where elderly day centres were to close temporarily starting mid-March in 2020. These centres reopened on a rotational basis on 1 June 2020; however, priority for attendance was given to those older persons living with their families and receiving no other services (Fenech et al. 2020); that is, not everyone could attend day centres. In March 2021, another month-long lockdown

was imposed due to a surge in COVID-19 cases. It was not a complete lockdown, but the government ordered all non-essential shops and services to close. The day centres reopened on 25 May 2021. Additionally, people who experienced a stroke may have considered themselves more vulnerable than other adults of similar age. For this reason, they may have avoided group situations, such as gatherings in daycare centres. Furthermore, stroke survivors with mobility issues may have avoided going out unless it was for medical appointments.

Returning to Work. A stroke affects 20%–30% of those aged <65 (Larsen et al., 2016). Returning to work is one of the most important aspects in improving this population's QOL, financial situation and job satisfaction. Returning to work after a stroke is linked to higher self-esteem and better QOL (Arwert et al., 2017; Larsen et al., 2016). This study demonstrated that 20.5% (N=9) of the participants were working prior to having a stroke. Due to participant attrition, only five participants were followed up one-year post-stroke. Of them, four returned to work within the first year, and one participant could not return to work due to hemiplegia. A six-year study (on 174 participants) reported that 48.3% returned to work in the first-year post-stroke, whilst 74.4% returned within six years after stroke onset (Westerlind et al., 2017).

Post-stroke Institutionalisation. Stroke unit care reduces the risk of death and the need for long-term care (Stroke Unit Trialists' Collaboration, 2013). However, admission to long-term care (LTC) following a stroke is prevalent, with approximately 26% of stroke survivors in the United States living in LTC after 6 months (Kelly-Hayes et al., 2003), and 19% of stroke survivors in the United Kingdom requiring LTC admission within 5 years (Luengo-Fernandez et al., 2013). Stroke survivors in

LTC experience from major functional and cognitive disabilities. Concordantly, this study found that 20% of the participants (N=6) were admitted to LTC due to stroke comorbidities, making it difficult for them and their relatives to cope at home.

Chapter Conclusion

This chapter reviewed significant and interesting findings reported in local and international literature to seek answer to the research questions. Note that this study is based on correlational analyses and thus provides no evidence of causality.

Chapter 6

Conclusion

Chapter Overview

This chapter summarizes the imperative findings of this study and considers the implications for clinical practice. The study's limitations are also delineated as well as the recommendations for further study in the field.

Research Findings

This study aimed to investigate the outcomes for PwA 6 months and 12 months a post-stroke by exploring the relationships between (1) demographic data and outcomes for PWA, (2) stroke-related factors and outcomes for PWA and (3) initial aphasia severity and outcomes for PWA. The study also focused on the timing, type and regimen of SLT and how it affects outcomes 6 months and 12 months post-stroke. Moreover, the support services accessed in the community after discharge were also evaluated.

The following are the key findings of this study:

(1) **Demographic Data and Outcomes.** Gender and outcomes did not show any significant relationship at 6 months and 12 months post-stroke. Gender did not impact the changes in these outcomes in the first 6 months and between 6- and 12-months post-stroke. Similarly, no correlation was noted between handedness and outcomes at 6 months and 12 months post-stroke and in the change rates in these periods. However, handedness and the EQ-5D-5L score at 6 months post-stroke demonstrated a significant relationship, where left-handed PwA had a higher mean score than the right-handed participants. No significant difference was observed

between education levels and the outcomes post-stroke. However, a significant difference was noted in the changes in the first 6 months of TOM activity and TOM participation. Increased improvement was noted in participants with tertiary and university education. Age did not significantly affect the outcomes at 6 months and 12 months after the onset of stroke. A significant difference was observed in the improvement rates of the language scores in the first-year post-stroke and in the EQ-5D-5L between the 6th and 12th month after stroke in younger participants having better improvement than older PwA. No difference was noted between language knowledge and outcomes at 6 months and 12 months post-stroke and in the changes observed in the outcomes in the first year post-stroke

(2) **Stroke-related factors.** No significant relationship was noted between stroke type, affected hemisphere, previous stroke, thrombolysis and thrombectomy and the outcomes at 6 months and 12 months post-stroke and in the changes between these periods. Nonetheless, a significant difference was highlighted between initial stroke severity, as reflected in the NIHSS scores, and the outcomes at 6 months and 12 months post-stroke along with the improvement in the initial year after stroke. The more severe the stroke, the poorer the outcomes and the improvement in the first year post-stroke.

(3) **Initial aphasia severity.** A significant relationship was noted between initial aphasia severity and all the outcomes at 6 months and 12 months after the stroke and in the changes made in this period. The more severe the aphasia, the worse are the outcomes.

(4) **Therapy**. A significant difference in ASRS, TOM impairment and TOM participation outcomes at 6 months was observed between those who did not receive and those who received aphasia therapy, with the latter having better

outcomes. In contrast, no correlation was observed at 12 months post-stroke and in the improvement rates during that time. Similarly, no relationship was found between the delivery approach and the outcomes at 6 months and 12 months post-stroke. However, a statistical difference in the changes of ASRS, TOM impairment and participation was noted between the 6th and 12th months post-stroke. PwA receiving therapy by qualified SLPs with 3-5 years and <2 years of experience showed better improvement than those receiving therapy by qualified SLPs with >5 years of experience. No difference was noted in outcomes irrespective of the therapy approach utilised by the SLP. A positive correlation was noted between the number of sessions and the outcomes in the first 6 months. Additionally, a positive significant difference in the improvement of TOM impairment, TOM activity, TOM participation, MAST score, MAST comprehension score and MAST expression scores was observed in the first year after stroke. The more sessions they receive, the better the improvement noted.

(5) **Satisfaction.** The PwA and their relatives reported overall positive satisfaction with the SLT services, frequency and type used with the participants.

(6) **Services utilised.** A total of 27% of the participants were rehospitalised in the first-year post-stroke, with the most common reason being another stroke. This study demonstrated that 40% of PwA received community rehabilitation after being discharged from acute care. Moreover, 43.3% were admitted to in-patient rehabilitation, whereas 16.6% did not receive any rehabilitation. The services accessed after the PwA were discharged include carer support resources, home care services, meals on wheels and additional aids and equipment provided by the Maltese Government. The participants did not attend day centres due to the COVID-19 pandemic or support groups (they are not active in

Malta). Eighty per cent of PwA working before the stroke returned to work within the first-year post-stroke. In this study, 20% of the participants were admitted to LTC due to stroke comorbidities, which made it difficult for them to cope at home

Limitations

Small-scale Study. This work is a pilot study of the iPraise project described in further detail in Chapter 1. The initial phase of the study had to be cut short due to the COVID-19 pandemic. As a result, fewer participants were recruited than planned. This longitudinal study recruited 44 participants, but phase 3 included only 30 participants due to participation attrition. Additionally, the research results cannot be generalised due to the small sample size.

Missing Data. Not all data planned to be gathered were available, which limited the analysis and results. Not all medical files reported the lesion site , and none of these files showed the size of infarct. As a result, these variables could not be analysed. The literature review in Chapter 2 demonstrated that these factors are the most crucial stroke-related factors which are believed to affect the outcomes post-stroke.

Cognitive Screening. A cognitive screening was not performed when recruiting the participants in Phase 1. El Hachioui et al. (2014) investigated the relationship between cognitive abnormalities in aphasia and functional result in the first year after a stroke. Compared with people with resolved aphasia, those with persistent aphasia showed lower cognitive performance and functional outcomes.

Limited Related Research. Research on aphasia outcomes post-stroke in the context of Malta is scarce. Therefore, the literature appraisal in Chapter 2 was

conducted with other international studies that employed populations that were qualitatively different in sample size, age ranges and data collection techniques.

Recommendations for Future Studies

This study illustrated the variables that impact outcomes at 6 months and 12 months post-stroke. Accordingly, future studies could include a larger-scale study by recruiting participants from more wards in general hospitals, not from only one ward as in this study. Thus, more than one researcher would be ideal as such work would be time-consuming. As a result, additional data will be gathered, enabling more statistical analyses, such as Generalised Linear Model. These analyses could not be performed in this small-scale study. Consequently, the results obtained from such research would be more extensive, representative and robust.

Another future study could involve replicating the same methodology design but also including people post-stroke without aphasia as they could be considered as a control group. Data gathered from both groups could be compared to depict how the presence of aphasia post-stroke affects outcomes.

Numerous studies have attempted to examine the language recovery patterns in bilingual aphasia however, there is currently no data on the extent of aphasia recovery in bilingual patients compared to those who only speak one language. Thus, another potential future study could investigate the latter. Locally, such study should be carried out as soon as possible as nowadays, both Maltese and English are being taught in public and church schools thus decreasing the monolingual population.

Focusing on one of this study's research questions would also be interesting to expand. Several items explored in this study could be investigated individually for

an in-depth study. Additional local research on SLT services in Malta is necessary, including dosage, intensity and type of therapy and aphasia outcomes. Future studies could also investigate the SLT services provided in an in-patient rehabilitation hospital and community-based rehabilitation immediately after discharge from a general/acute hospital setting. This intensive study can serve as a springboard for numerous other studies in the area of outcomes for persons with aphasia given that local data is scarce.

Clinical Implications

Corresponding with numerous literature, this study ascertains that clinicians can rely on the initial stroke severity score (NIHSS) and the initial aphasia severity scale to predict outcomes after stroke and counsel patients and their relatives with regards to the prognosis.

This research demonstrates that aphasia severity post-stroke impacts the outcomes at 6 months and 12 months post-stroke. Therefore, SLPs should not only focus on aphasia but also examine beyond language impairment. They should avoid overlooking the overall consequences of aphasia, such as participation and activity.

The total number of SLT sessions received positively correlated with improved outcomes 6 months post-stroke, indicating that PwA must receive high-intensity therapy, especially in the first 6 months. Time is crucial, and therapy should start immediately after the stroke. Thus, an aphasia screening test should be administered when the PwA are stable post-stroke, and therapy should commence immediately.

The significance of having a stroke support group (or aphasia support group) is highlighted in international literature. This study showed that Malta has no stroke

support group currently. Thus, establishing a stroke support group or an aphasia support group would be beneficial to help the PwA and their relatives cope as they attempt reintegrate into society and continue with their life despite the new comorbidities.

Conclusion

This study is the first local longitudinal study that monitored PwA for one-year post-stroke. It provides an overview of the elements that impact outcomes at 6 months and 12 months after a stroke. Initial stroke and initial aphasia severities were linked to outcomes. Additionally, frequent SLT sessions were positively associated with improved outcomes. A high percentage of PwA received in-patient or community-based rehabilitation. However, none attended day centres due to the COVID-19 pandemic, and no support groups were available for this cohort. Additional research is merited to investigate this population further, especially locally, due to lack of available data.

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Appendix A

Supplementary information

A1: Additional Information on Semantic and Phonological Approaches

***Semantic Processing*.** Word retrieval therapy can be partitioned into two methodologies: (1) substitutive and (2) restitutive (Levelt et al., 1999; Dell, 1986). Substitutive approaches activate other intact subsystems, such as the right hemisphere, to compensate for the impairment in language processing in the other hemisphere (e.g. using nonverbal skills). Contrarily, restitutive treatments focus on reactivating and relearning the impaired aspects of language, thus engaging the damaged hemisphere to re-establish language skills that have been lost (i.e. naming). Raymer et al. (1995) implied that the latter approach encourages redevelopment relative to function and is most beneficial during the early stages when the neurophysiologic processes of recovery have tremendous potential.

Lexical Semantic Approach: This approach involves tasks such as auditory word-to-picture matching, written word-to-picture matching, answering yes/no questions, picture and spoken word categorisation, and judging relatedness to a target word given specific images (Nickels & Best, 1996; Marshall et al., 1990). This approach strengthens the semantic activation of specific targets to facilitate word retrieval. These tasks associated with the lexical semantic approach are not solely semantic, as the phonological representation of the target word is given; thus, improvement may be attributed to both the semantic and phonological cues given.

Marshall et al. (1990) recruited PwA who could read aloud names associated with pictures. They were required to read four words and then select one that corresponded to the pictures. These four words were the target word, two semantically related words and an unrelated word. Since the tasks involved both semantic and phonological processing, it was expected that the tasks would

strengthen the links between the two. Data obtained after the therapy showed substantial improvement for treated items; however, this effect was not generalised – unrelated items not seen during therapy did not improve significantly.

Davis and Pring (1991) wanted to identify which aspect of semantic treatment helps with naming. One task involved matching a picture to one of four semantically related written words. In another task that was otherwise similar, the distractor words were completely unrelated to the picture. The final task comprised repetition of the word in the presence of the target picture alone. They hypothesised that if semantics is paramount for improvement, the first two tasks should be more effective than the third exercise, as they activate semantic processing. They also predicted that if therapy is beneficial due to repetition exposure, there should be no difference between the three tasks. Their findings showed that there was significant improvement in the mean of all treatment items in all treatment conditions and for unrelated foils, but surprisingly not for related foils. Therefore, although generalisation occurred, it appeared to occur for unrelated foils.

Semantic Relationships and Contextual Approaches: This semantic treatment is utilised for people with mild to moderate aphasia who have naming difficulties (Visch-Brink et al., 1997). As this treatment centres on written stimuli, it should not be used for PwA with impaired written comprehension skills, as participants are required to choose a written response from various distractors. Visch-Brink et al. (1997) demonstrated that two patients in their study showed improvement in naming nouns and in standardised measures of language. Despite this, the treatment did not appear to be valuable for all aphasic patients in the study. Additionally, the data from this study are yet to be replicated in other patients or in other languages.

Another study investigated the effectiveness of a combination of orthographic cueing and conversational context to improve anomia (Herbert et al., 2003). The study investigated the efficacy of a combination of orthographic cueing and conversational context in six PwA with naming difficulties. This did not specifically train semantic information; however, the tasks engaged semantic retrieval. Improvement in word retrieval in conversational tasks and picture naming was observed.

Semantic Feature Analysis Approaches: Semantic feature analysis (SFA) focuses on ameliorating semantic representation (Boyle, 2004; Boyle & Coehlo, 1995). SFA comprises a 'feature analysis chart' that has the following semantic features for the naming of objects: group, use, action, location, properties and associations (Boyle, 2010). For the naming of verbs, the chart has the following semantic features: subject, purpose of action, part of body or tool needed to carry out the action, description, usual location and associated objects or actions (Wambaugh & Ferguson, 2007). PwA are required to self-generate feature information about the target word. A picture of the target word is placed in the middle of a chart, and the PwA must describe relevant semantic features. Boyle (2010) reviewed the efficacy of SFA by analysing seven studies in which SFA was utilised for confrontation naming of nouns. Results were reported for 17 PwA (some had fluent aphasia whilst others had non-fluent aphasia), 16 of whom improved in picture naming of nouns. This study concluded that SFA improves picture naming of treated items. Another systemic review was carried out by Maddy et al. (2014). They investigated 11 studies with 24 PwA and concluded that SFA aids in improving the confrontational naming of treated items. However, there was limited generalisation to untrained items and conversational speech. Contrarily, Boyle (2004) found that after

utilising SFA, there was also generalisation to untreated items that were not members of the same categories as the treated objects. This indicates that SFA serves as a mediating system for naming non-treated items.

Another study revealed that naming improved in untreated languages of multilingual PwA (Knoph et al., 2015). The researchers hypothesised that the semantic nature of SFA leads to cross-linguistic transfer, which was supported by their findings.

Typicality Treatment Approach: This approach is based on Rosch's (1975) work explaining that atypical exemplars have a different status within a semantic category than typical exemplars. This approach assumes that training atypical items facilitates greater generalisation to untrained items than training typical category exemplars (Kiran & Thompson, 2003) because atypical examples represent a greater variety of semantic attributes within the category than typical examples (Kiran et al., 2007). Kiran and Thompson (2003) found that patients trained on naming atypical exemplars demonstrated generalisation to the naming of direct and typical items. In contrast, individuals given therapy with typical exemplars did not generalise to atypical items. Another study by Kiran et al. (2005) reported that all but one of five participants trained on atypical items demonstrated significant generalisation to untrained items in a category.

Opposingly, Stanczak et al. (2006) observed no generalisation from atypical to typical or from typical to atypical items in PwA with primarily phonological-level deficits. They also found that PwA with both semantic and phonological deficits showed substantial generalisation from atypical to typical items and slight generalisation from typical to atypical items.

Phonological Processing. Since phonology is crucial in language processing, phonologically based treatment approaches were created to address language impairment in aphasia. Some of these therapies also target reading and writing (Beeson et al., 2010; Kiran, 2005; Yampolsky & Waters, 2002; Conway et al., 1998) along with comprehension difficulties (Morris et al., 1996). The majority of phonological treatments target anomia.

Classically, therapy with phonological cueing consists of exhibiting a picture of a target word; the therapist then supports the PwA by presenting a hierarchy of cues, including rhyming cues, first phoneme cues, first syllable cues and/or verbal models that prompt the individual with aphasia to name the target word (Wambaugh, 2003; Davis & Pring, 1991). Orthographic cues are often utilised due to the close relationship between graphemes and their corresponding phonemes. Orthographic cues used include showing the grapheme of the target word, matching graphemes to sounds and/or providing a written model along with the picture stimulus that encourages reading aloud (Best & Nickels, 2000; Miceli et al., 1996).

Contextual Priming: Contextual priming is a method of indirect cueing used with PwA (Renvall et al., 2013; Fisher et al., 2009). It consists of repeatedly naming phonologically related words. The PwA must name a set of three pictures whose names may or may not be phonologically similar at the beginning or the end of the words. No overt cues are given, as the presence or absence of phonological treatment is not explicitly highlighted.

Martin et al. (2004) reported that PwA respond differently to contextual priming according to the nature of the naming disorder, whether semantic or phonological. Other studies dispute this, finding that phonological treatments were

helpful despite the nature of the impairment (Hills & Caramazza, 1994; Raymer et al., 1993).

Phonological Component Analysis: Phonological component analysis (PCA) is based on self-cueing to facilitate word retrieval (Bose, 2013; van Hees et al., 2013). The PwA is asked to name a picture, followed by five phonological components of the target word (i.e. rhyme, the first sound, first sound association, final sound and number of syllables). If the PwA needs guidance, the therapist provides up to three visually presented choices and reads them aloud. This choice elicits a 'more active engagement' (Leonard et al., 2008, p. 398) of the linguistic system and provides deeper insight into the cognitive processing. A study found that more than half of the participants showed great improvement after treatment (Leonard et al., 2008). In accordance, other studies have noted that PCA treatment helps with naming in individuals with chronic non-fluent or fluent aphasia after a left hemisphere stroke (Leonard et al., 2015; van Hees et al., 2013).

Mixed-Cueing Treatment.This approach involves using both phonological and semantic prompts and picture stimuli to facilitate word retrieval. It utilises a cueing hierarchy that first activates semantic aspects of the target word (e.g. cues to state the function/use of the target word) and then progresses to explicitly activate phonological elements of the target word (e.g. providing the first and/or second phonemes) (Linebaugh et al., 2005).

The aforementioned approaches have shown significant acquisition and maintenance treatment effects, but generalisation to untrained items is poor (Bose, 2013; Leonard et al., 2008). Concordantly, further research has explicitly stated that generalisation is not anticipated in purely phonological therapy, as generalisation is unique for each target word (Bose, 2013; Macoir et al., 2012; Davis & Pring, 1991). A

meta-study concluded that phonological treatments resulted in generalisation less often than semantically based treatments (Wisenburn & Mahoney, 2009).

Semantic Approach vs Phonological Approach. Semantic strategies use a variety of task paradigms to improve semantic representations, including the production of semantic features for a target word and semantic feature verification (Boyle, 2010, 2004; Kiran & Thompson, 2003). On the other hand, phonological techniques try to improve representations at the word-form level or linkages from the semantic system to the word form (Maher & Raymer, 2004). Phonological treatment tasks include utilising phonological knowledge via cueing hierarchies and phonological feature development, similar to semantic treatment (Kenall et al., 2008; Madden et al., 2017). There is substantial evidence that both treatment paradigms result in long-term improvements in naming skills in PwA (Wisenburn & Mahoney, 2009; Lorenz & Ziegler, 2009; Nickels, 2002; Kiran & Thompson, 2003; Edmonds et al., 2014; Harnish et al, 2014; Lai et al., 2019; Nardo et al., 2017).

Although both semantic and phonological approaches are beneficial, the exact mechanism by which treatment benefits are triggered in each therapy has long been a source of debate (Lorenz & Ziegler, 2009; Nickels, 2002; Howard, 2000). Impaired word retrieval, according to Nickels (2002), is a symptom that might be caused by a variety of underlying problems. Nickels (2002) contends that there is no cause to suppose that any one treatment model will result in language improvements for all PwA. On the other hand, Howard (2000) claims that the distinction between semantic and phonologically based treatments is more apparent than real. Howard believes that both treatments work in the same way, enhancing the mapping between semantic and phonological word forms when both are engaged at the same

time (Hillis, 1998). These divergent viewpoints underline the necessity for a comprehensive review of who benefits from each treatment option.

Despite the extensive research on this topic, the evidence on which therapy type to use with a particular patient is still equivocal. Several studies have examined predictors of treatment response and compared the effects of phonological and semantic therapy across or within people. Some studies indicate that semantic therapy may lead to a stronger generalisation to untrained objects (Wisenburn & Mahoney, 2009; Lorenz & Ziegler, 2009; Wambaugh, 2003), but there is also evidence that phonological treatment has a positive impact (Hashimoto, 2012; Holland et al., 2018; Sadeghi et al., 2017). Moreover, numerous studies have demonstrated that employing both techniques improves naming abilities in the same people, and others have similarly failed to identify a consistent association between participant deficiency profiles and treatment type success (Nickels, 2002; van Hees et al., 2013).

A study by Kristinsson et al. (2021) refutes the concept that treatment allocation is a one-size-fits-all approach or that phonological deficits predict good phonological treatment response and semantic deficits predict good semantic treatment response. Instead, a broad interpretation of our findings suggests that semantic treatment most benefits those with moderate aphasia, whereas phonological treatment may best assist people with more severe impairments.

***Constraint-Induced Language Therapy*.** Constraint-induced language therapy (CILT) is an aphasia treatment model based on constraint-induced movement therapy (CIMT), which is utilised in physical therapy for limb weakness post-stroke. The precept of CIMT is to inhibit extremity disuse by forcing the patient

to resort to the affected muscles while avoiding any compensatory techniques (Szaflarski et al., 2006). Taub et al. (2006) postulated that the definite neurobiological principles behind the positive effect of this program research reflects that forced use of the afflicted function can stimulate cortical reorganization by strengthening the unaffected neuronal connections in the impaired areas, exposing silent neuron pathways.

Pulvermüller et al. (2001) applied these principles for language treatment. They created a therapeutic compensatory approach including high intensity and frequency (three to four hours per day for 10 consecutive days), shaping (the difficulty of the required verbal actions is gradually increased according to the patients' needs) and constraint of compensatory (nonverbal) communication strategies (e.g. writing, drawing, gesturing). Studies have noted an improvement in language outcome measures as a result of this approach, both in quality and quantity of language (Szaflarski et al., 2008; Barthel et al., 2008; Maher et al., 2006).

This type of therapy centres around everyday communication, utilising a card game with drawings of objects played between patients and the therapist (Maher et al., 2006). These cards with pictures of a semantic category are given to each participant, and goal is to collect as many pairs of matching cards as possible. The speaker must ask another player (receiver) for a particular card; the receiver must answer with a detailed reply (Meinzer et al., 2005). Shaping is introduced progressively, depending on the patient's progress. Initially, approximations are accepted, but as one improves, utterances and syntactic sentences are expected (Pulvermüller & Roth, 1991). Therapists can cue as necessary to generate a successful turn (Meinzer et al., 2005).

Research has not concluded an absolute advantage of applying CILT to aphasia rehabilitation over other interventions. Balardin and Miotto (2009) suggest that some aspects of this approach grant added benefits. A study by Meinzer et al. (2005) demonstrated that intensity alone does not explain positive differences, as intensity was controlled for. Balardin and Miotto (2009) found that the effect of CILT after therapy is short-lived, which is consistent with other studies investigating aphasia (Meinzer et al., 2005) and motor abilities (Liepert et al., 1998).

***Melodic Intonation Therapy*.** Melodic Intonation Therapy (MIT) (Albert et al., 1973) is an aphasia treatment approach that utilises melody and rhythm to improve expressive language in non-fluent patients. It uses the preserved function of singing whilst using the language-related regions in the undamaged right cortical hemisphere (Norton et al., 2009). MIT benefits patients who have most of the following characteristics: (1) unilateral left-hemisphere stroke, (2) poorly articulated, non-fluent, severely restricted speech output, (3) able to produce some intelligible words while singing familiar songs, (4) poor repetition, even for single words, (5) moderately well-preserved auditory comprehension, (6) poorly articulated attempts at speech and (7) good motivation, emotional stability and attention span (Helm-Estabrooks et al., 1989).

The therapy includes several therapeutic techniques, such as left-hand tapping, inner rehearsal, auditory-motor feedback training and reducing speech rate. The SLP gradually provides less support until the PwA produces a trained utterance independently. MIT aims to improve connected speech by singing two- or three-syllable phrases and gradually increasing them to phrases with five or more syllables (Helm-Estabrooks & Albert, 2004). The clinician gives visual and tactile cues, and

phrases of social and functional importance to the individual are practised. Dependence on intonation is gradually diminished over time.

Preliminary data comparing MIT to an equally intense control therapy that uses no intoning or left-hand tapping reveal that the latter two factors strengthen MIT's efficacy (Schlaug et al., 2008). Sparks et al. (1974) propose that tapping and intoning could engage language regions in the right hemisphere, but this proposal is not developed further.

Some studies have contributed evidence that MIT is effective and facilitates long-term improvement of naming and verbal communication (Wan et al., 2014; Stahl et al., 2013; Hough, 2010; Schlaug et al., 2008; Bonakdarpour et al., 2003). Contrastingly, a randomised controlled trial (RCT) by van der Meulen et al. (2016) found transient improvements with little generalisation to untrained material, word retrieval or verbal communication in daily life. This RCT noted no effects of MIT on auditory verbal comprehension, unlike other previous studies (Bonakdarpour et al., 2003). This RCT (van der Meulen et al., 2016) involved 17 individuals with chronic aphasia who were randomly allocated to the experimental group (six weeks MIT) or to the control group (six weeks no intervention followed by six weeks MIT); 10 were allocated to the experimental condition and seven to the control condition. MIT significantly improved repetition of trained items; however, this improvement was not observed in a follow-up assessment. The study found only minor, temporary effects of MIT without generalisation to untrained material or to conversation. These results further suggest that the effect of MIT in chronic aphasia is more restricted than its effect in earlier stages post-stroke.

Gestural Therapy. Recently, gestures have been studied to promote communication in people with aphasia (Rose, 2006). Some patients start utilising

gestures spontaneously, whilst others do not, hence why aphasia therapy sometimes involves gestures (Rose, 2006). Gestures are not used only by people with language impairment; rather, they are universal in human communication (Kita, 2009). Alibali et al. (2001) noted that humans employ gestures even when they cannot be seen, implying a facilitatory role for the speaker (Krauss et al., 2000). This is substantiated by evidence of neural connections between action and language (Pulvermüller et al., 2005).

Literature shows that symbolic gestures promote language outcomes in PwA (e.g. Raymer et al., 2006; Rose et al., 2002). Often, gestural training combines gestures with some verbal component. PwA could be adept at using gestures to compensate for language difficulties. A plethora of studies have documented cases of PwA who made use of gestures (Wilkinson et al., 2010; Kemmerer et al., 2007; Marshall et al., 2004). Naming therapies that incorporate gestures have improved participants' production of nouns significantly (Rose & Douglas, 2006; Raymer et al., 2006; Rose et al., 2002), as well as the production of verbs (Boo & Rose, 2011; Marangolo et al., 2010; Rose & Sussmilch, 2008; Raymer et al., 2006; Rodriguez et al, 2006). In most studies, gestural therapy included verbal practice, such as repeated naming (Marangolo et al., 2010; Raymer et al., 2006; Rodriguez et al., 2006; Rose & Douglas, 2008) or semantic feature analysis (Boo & Rose, 2011).

A few studies have examined the effects of gesture alone on facilitating language recovery (Boo & Rose, 2011; Rose & Douglas, 2008). However, conclusions on generalisation have been mixed. One should consider also aphasia gesture impairments, which can result from a movement disorder after a stroke (Borod et al., 1989) or an impairment of executive skills (Purdy & Koch, 2006) or may reflect an impairment in symbolic thinking (Goldenberg et al., 2003). These patients,

along with those with severe aphasia, need additional therapeutic input to help them utilise gestures.

McNeill (2005) stated that gestures include beats, deictics, iconics, pantomimes and emblems. In McNeill's (2005) study, gesture production was reinforced by a hierarchy of cues, including moulding, simultaneous copying, delayed copying and verbal cueing.

***Pragmatic Therapy Approach*.** A pragmatic therapy approach focuses on enabling PwA and their communicative partners (family and/or caregivers) to communicate effectively by utilising strategic techniques based on conversational analysis (Fink et al., 2005). One of the best-known pragmatic therapies for aphasia is Promoting Aphasics' Communicative Effectiveness (PACE). Davis and Wilcox (1981) and Davis (2000) state that PACE is based on four principles: (1) The Exchange of New Information, (2) Equal Participation, (3) Free Choice of Communicative Channels and (4) Functional Feedback.

PACE comprises three distinctive features when compared to other therapies: (1) it centres around communication and the natural cues utilised daily, (2) it enables PwA to become aware of communication failure, requiring them to find another method to compensate and (3) the PwA has to be responsive to the clinician's way of receiving the information that is being conveyed (Davis, 1993). PACE has also been noted to produce positive outcomes, as PwA improved their communication effectiveness by using compensatory strategies, such as circumlocution and gestures, when naming deficits occurred (Li et al., 1988).

Conversation Therapy Approach. The Life Participation Approach to Aphasia (LPAA) aims at helping PwA to increase their participation in daily activities (LPAA Project Group, 2008). Armstrong and Mortensen (2006) elucidate that

communication is pivotal for participation, and conversation is the centre of human communication. As such, diverse therapy approaches cohere to the values of LPAA and intervene at the conversational level.

Conversation-based therapy changes behaviours within a natural conversation (Simmons-Mackie et al., 2014). It targets the communication partners rather than the PwAs, as these interventions presume that conversation is reciprocal and that amelioration in the communicative abilities of the partner will enhance the communication of the PwA (Kagan et al., 2001). Kagan et al. (2001) state that such programmes are devised to help the communication partners recognise the competencies of the PwA. These communication partners are without aphasia and may be familiar conversation partners (e.g. family and friends) or unfamiliar conversational partners (e.g. people in the community).

Simmons-Mackie et al. (2005) revealed that training conversation partners strengthens communication, as they start using less non-nonfacilitative behaviours (e.g. interrupting, asking questions that required one-word responses) (Simmons-Mackie et al., 2005). The conversational partners better understand the nature of aphasia following training (Blom Johansson et al., 2013). In a single-subject study, PwAs showed increased verbal responses and enhanced communication skills needed for daily living following partner training (Simmons-Mackie et al., 2005). Other studies have shown that PWAs also reported increased psychosocial wellbeing and confidence (Hickey et al., 2004; McVicker et al., 2009; Worrall & Yiu, 2000). A systematic review established that conversation training improves the communication of a conversation partner, which in turn enhances the participation in conversation of an individual with chronic aphasia.

In a single case study by Wilkinson et al. (2011), no difference was noted in linguistic and cognitive tasks after conversation-focused intervention. Nevertheless, the PwA produced more turns in the conversation after therapy. Subsequently, Wilkinson et al. (2011) trained a PwA to utilise topic alerters to establish more topics. As a result, the PwA initiated more topics, asked more questions and slowed their rate of speech. Despite this promising finding, Wilkinson and Wielaert (2012) note that this is a single case analysis, which reduces the robustness of the evidence base.

Appendix B

Forms and Tools utilised in the study

B1: Demographic Information, Stroke Characteristics and Medical History Form

I-PRAISE
INTERNATIONAL PRACTICE-BASED REHABILITATION APPROACHES FOR APHASIA AFTER STROKE

Phase 1: Initial Contact with a Speech and Language Therapist (SLT)/ Speech and Language Pathologist (SLP), following Stroke

Site Details	
Site ID	
Investigator's Initials	
Date of first contact between SLT/SLP and participant	Dd/mm/yyyy

Participant Details (from Participant)	
Date of Birth or Age	dd/mm/yyyy _____ years
Sex	☐ Male ☐ Female
Pre-Stroke mRS	
Ethnicity (self-Identification)	
Date of Qualifying Stroke	dd/mm/yyyy
Primary Language(s) Spoken	1. _____ 2. _____ 3. _____
Number of Years of Education (0-30)	_____
Handedness	☐ Left ☐ Right ☐ Ambidextrous
Employment	☐ Working now ☐ Only temporarily laid off, sick leave or maternity leave ☐ Looking for work, unemployed ☐ Retired* ☐ Disabled, permanently or temporarily ☐ Keeping house ☐ Student ☐ Other, specify: _____ ☐ Unknown *Reason for retirement ☐ Age ☐ Consequence of stroke ☐ Other chronic disease

Living Arrangements Following Stroke	☐ Alone ☐ With family ☐ Assisted Living/ Sheltered Housing ☐ Residential Facility/ Nursing Home ☐ Other _____
Number of People in Residence (Conversation Stimulation)	_____

Stroke Characteristics and Medical History	
Date of Stroke	
Type of Stroke	☐ Ischaemic ☐ Haemorrhagic ☐ Subarachnoid Haemorrhage
Total NIHSS Score at admission for index stroke (please complete a NIHSS form)	Please enter the total admission NIHSS Score _____ Best Language Score _____
Which hemisphere has been affected by the current stroke?	☐ Left ☐ Right
Was the participant thrombolysed	☐ Yes ☐ No
Did the participant undergo thembectomy?	☐ Ye ☐ No
Did the participant undergo hemicraniectomy?	☐ Yes ☐ No
Did the participant undergo surgical evacuation of a haematoma?	☐ Yes ☐ No

Co-morbidities (please indicate all other relevant medical conditions)	History of Hypertension ☐ Yes ☐ No ☐ Unknown Prior Myocardial Infarction ☐ Yes ☐ No

	☐ Unknown Angina ☐ Yes ☐ No ☐ Unknown Congestive Heart Failure ☐ Yes ☐ No ☐ Unknown History of Atrial Fibrillation ☐ Yes ☐ No ☐ Unknown Type I diabetes ☐ Yes ☐ No ☐ Unknown Type II diabetes ☐ Yes ☐ No ☐ Unknown History of Ischaemic Heart Disease ☐ Yes ☐ No ☐ Unknown Other _____ **Degenerative Disease:** ☐ Post-stroke dementia, please specify type _____ ☐ Parkinson's disease ☐ Motor neurone disease (including, amyotrophic lateral sclerosis, primary lateral sclerosis, progressive muscular atrophy, progressive bulbar palsy, and pseudobulbar palsy) ☐ Other (please specify) _____ **Previous strokes:**

	☐ presence of previous stroke (excluding TIA), Please specify number _____ Did the previous stroke result in aphasia? _____ Which hemisphere was affected by the previous stroke: ☐ Left ☐ Right ☐ Bilateral **Other neurological conditions:** ☐ **Yes** (Please specify) _____ ☐ No

Setting of First Contact with SLT/SLP	
Clinical Setting for first contact with SLT/SLP services	☐ Intensive care unit ☐ Stroke Unit ☐ Primary health care unit ☐ Acute hospital ☐ Community health ☐ Private practice ☐ Outpatient rehabilitation ☐ In-patient rehabilitation ☐ Nursing Home/ Care Facility ☐ Community setting ☐ Other (please specify) _____

Aphasia Descriptions	
Severity of Aphasia **Please complete an Aphasia Severity Rating Scale (0-6)** **(Assessment Sheets to be appended to Document)**	Aphasia Severity Rating Scale: _____
Functional Communication Measure Please complete one Therapy Outcome Measure (TOM) form and one of either: 1. Amsterdam-Nijmegen Everyday Language Test (ANELT) form (verbal participants) OR 2. Scenario Test (non-verbal participants) **(Assessment Sheets to be appended to Document)**	Therapy Outcome Measure (TOM) score: Impairment:_____ Activity:_____ Participation:_____ Wellbeing:_____ Amsterdam-Nijmegen Everyday Language Test (ANELT) Score: A: _____ B: _____ Scenario Test Score: _____

Neuroimaging	
Has a copy of baseline neuroimaging been obtained?	☐ Yes ☐ No
If no, please state reason	
Format	☐ CT ☐ MRI

B2: Demographic and Clinical Data Form[22]

Code number:	**Sex:**		**Age:**	
Date:			**Date of birth:**	
Lives with:				
Other information:				
The following information should describe the patient before current hospital admission/condition *(premorbid description):*				
Language Maltese, English, Other….	**Which language do you usually use?**		**Information about other languages/if relevant**	
	Maltese only			
	Maltese and some English words			
	English only			
	English and some Maltese words			
	Maltese and English (approximately to equal degrees)			
Years of education write the **precise no. of years** in each level	primary		post-secondary tertiary	
	secondary			
	Total number of years of education			
"Are you comfortable with **reading** &	Maltese only	English only	bot	non

[22] Based on Hallowell (2009), Roberts et al. (2003), Brookshire (1983)

writing?”			h		e
“Do you read?”	everyday	Frequently	once a week	rarely	never
Left-handed			Right-handed		
Past occupation			**Current occupation**		

Vision (premorbid description)	"is vision difficult?" YES ☐ NO ☐	"do you wear spectacles" YES ☐ NO ☐
Hearing (premorbid description)	"is hearing difficult?" YES ☐ NO ☐	"do you have a hearing aid?" YES ☐ NO ☐
Other comments about vision and hearing:		
Medical history	Hypertension ☐ Myocardial infact/CHF ☐	Diabetes ☐ Previous stroke ☐
	Medical/neurological conditions; surgeries: _____ Psychiatric conditions (e.g. depression): _____ Other conditions/impairments (e.g. cognitive impairment): _____	

Patient details – in relation to current hospital admission/condition:

Date of CVA:	Time post onset:	Type of CVA:
Stroke severity scale (NIHSS)		
ASRS[23] & type of aphasia		
CT/MRI reports: **lesion size and location**		
Acute intervention[24]		
Comorbidities[25]:		

23 Aphasia Severity Rating Scale

24 e.g. thrombolysis

25 e.g . vision/hearing impairment, hemiparesis …. as a result of current condition

Length of hospital stay:	Discharge destination:
Other comments:	

B3: The Aphasia Severity Rating Scale (ASRS; BDAE-3, Goodglass et al., 2000)

APHASIA SEVERITY RATING SCALE

0. **No usable speech or auditory comprehension**
1. **All communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. The range of information that can be exchanged is limited, and the listener carries the burden of communication.**
2. **Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but the patient shares the burden of communication.**
3. **The patient can discuss almost all everyday problems with little or no assistance. Reduction of speech and/or comprehension, however, makes conversation about certain material difficult or impossible.**
4. **Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.**
5. **Minimal discernible speech handicap; the patient may have subjective difficulties that are not obvious to the listener.**

B4: The Functional Communication Measure (Therapy Outcome Measures (TOMs) for Aphasia; Enderby & John, 2019)

25 Dysphasia

Identify descriptor that is 'best fit'. The patient/client/student does not have to have each feature mentioned. Use 0.5 to indicate if patient/client/student is slightly better or worse than a descriptor and as appropriate to age.

Impairment

0 Profound. Aphasia affecting all modalities: Auditory and reading comprehension inconsistent even at one keyword. No meaningful expression.

1 Severe dysphasia/aphasia. Auditory and/or reading comprehension is consistent at one keyword level. Occasionally understands and expresses limited amount within context.

2 Severe/moderate dysphasia/aphasia. Auditory and/or reading comprehension consistent at a minimum of two or three keyword level. Some limited verbal and/or written expression used appropriately and purposefully.

3 Moderate dysphasia/aphasia. Constant auditory and/or reading comprehension for simple sentences or structures. Inconsistent with complex commands and structures. Consistently reduced verbal and/or written language structure and vocabulary. May have a specific more severe difficulty in one modality.

4 Mild dysphasia/aphasia. Occasional difficulties present in auditory and/or reading comprehension and in verbal and/or written expression particularly in more complex environments.

5 No dysphasia/aphasia.

Activity

0 Unable to communicate in any way. No effective communication. No interaction.

1 Occasionally able to make basic needs known with familiar persons or trained listeners in familiar contexts. Minimal communication with maximal assistance.

2 Limited functional communication. Consistently able to make basic needs/conversation understood but is heavily dependent on cues and context. Communicates better with trained listener or family members or in familiar settings. Frequent repetition required. Maintains meaningful interaction related to here and now.

3 Consistently able to make needs known but can sometimes convey more information than this. Some inconsistency in unfamiliar settings. Is less dependent for intelligibility on cues and context. Occasional repetition required. Communicates beyond here/now with familiar persons; needs cues and prompting.

4 Can be understood most of the time by any listener despite communication irregularities. Holds conversation; requires occasional prompts, particularly with a wider range of people.

5 Communicates effectively in all situations.

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Participation

0 Unable to fulfil any social/educational/family role. Not involved in decision-making, no autonomy, no control over environment, no social integration.

1 Low self-confidence/poor self-esteem, limited social integration, socially isolated/ contributes to some basic and limited decisions. Cannot achieve potential in any situation.

2 Some self-confidence/some social integration, makes some decisions and influences control in familiar situations.

3 Some self-confidence, autonomy emerging. Makes decisions and has control of some aspects of life. Able to achieve some limited social integration/educational activities. Diffident over control over life. Needs encouragement to achieve potential.

4 Mostly confident, Occasional difficulties integrating or in fulfilling social/role activity. Participating in all appropriate decisions. May have difficulty in achieving potential in some situations occasionally.

5 Achieving potential. Autonomous and unrestricted. Able to fulfil social, educational and family role.

Wellbeing/Distress

0 Severe constant: High and constant levels of distress/upset/concern/frustration/anger/ distress/embarrassment/withdrawal/severe depression or apathy. Unable to express or control emotions appropriately.

1 Frequently severe: Moderate distress/upset/concern/frustration/anger/distress/ embarrassment/withdrawal/severe depression or apathy. Becomes concerned easily, requires constant reassurance/support, needs clear/tight limits and structure, loses emotional control easily.

2 Moderate consistent: Distress/upset/concern/frustration/anger/distress/embarrassment/ withdrawal/severe depression/apathy in unfamiliar situations. Frequent emotional encouragement and support required.

3 Moderate frequent: Distress/upset/concern/frustration/anger/distress/embarrassment/ withdrawal/severe depression/apathy. Controls emotions with assistance, emotionally dependent on some occasions, vulnerable to change in routine, etc., spontaneously uses methods to assist emotional control.

4 Mild occasional: Distress/upset/concern/frustration/anger/distress/embarrassment/ withdrawal/ severe depression/apathy. Able to control feelings in most situations, generally well adjusted/stable (most of the time/most situations), occasional emotional support/encouragement needed.

5 Not inappropriate: Distress/upset/concern/frustration/anger/distress/embarrassment/ withdrawal/severe depression/apathy. Well adjusted, stable and able to cope emotionally with most situations, good insight, accepts and understands own limitations.

Therapy Outcome Measures for Rehabilitation Professionals © J&R Press 2015

B5: The Modified Rankin Scale (mRS)

MODIFIED RANKIN SCALE (MRS)

Patient Name: _____

Rater Name: _____

Date: _____

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead

TOTAL (0–6): _____

B6: The European Quality of Life Scale (EQ-5D-5L, 2009)

Kwestjonarju dwar is-Saħħa

Verżjoni Maltija għal Malta

(Maltese version for Malta)

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Taħt kull kategorija, jekk jogħġbok immarka kaxxa WAĦDA li tiddeskrivi bl-aħjar mod saħħtek ILLUM.

MOBILITÀ

M'għandix problemi biex nimxi ❑
Għandi problemi żgħar biex nimxi ❑
Għandi problemi moderati biex nimxi ❑
Għandi problemi serji biex nimxi ❑
M'iniex kapaċi nimxi ❑

KAPAĊITÀ LI NIEĦU ĦSIEB TIEGĦI NNIFSI

M'għandix problemi biex ninħasel jew nilbes waħdi ❑
Għandi problemi żgħar biex ninħasel jew nilbes waħdi ❑
Għandi problemi moderati biex ninħasel jew nilbes waħdi ❑
Għandi problemi serji biex ninħasel jew nilbes waħdi ❑
M'iniex kapaċi ninħasel jew nilbes waħdi ❑

ATTIVITAJIET TAS-SOLTU *(eż. xogħol, studju, xogħol tad-dar, attivitajiet mal-familja, attivitajiet rikreattivi)*

M'għandix problemi biex nagħmel l-attivitajiet tiegħi tas-soltu ❑
Għandi problemi żgħar biex nagħmel l-attivitajiet tiegħi tas-soltu ❑
Għandi problemi moderati biex nagħmel l-attivitajiet tiegħi tas-soltu ❑
Għandi problemi serji biex nagħmel l-attivitajiet tiegħi tas-soltu ❑
M'iniex kapaċi nagħmel l-attivitajiet tiegħi tas-soltu ❑

UĠIGĦ / SKUMDITÀ

M'għandix uġigħ jew skumdità ❑
Għandi wġigħ żgħir jew skumdità żgħira ❑
Għandi wġigħ moderat jew skumdità moderata ❑
Għandi wġigħ serju jew skumdità serja ❑
Għandi wġigħ estrem jew skumdità estrema ❑

ANZJETÀ / DEPRESSJONI

M'għandix anzjetà jew depressjoni ❑
Għandi anzjetà jew depressjoni żgħira ❑
Għandi anzjetà jew depressjoni moderata ❑
Għandi anzjetà jew depressjoni serja ❑
Għandi anzjetà jew depressjoni estrema ❑

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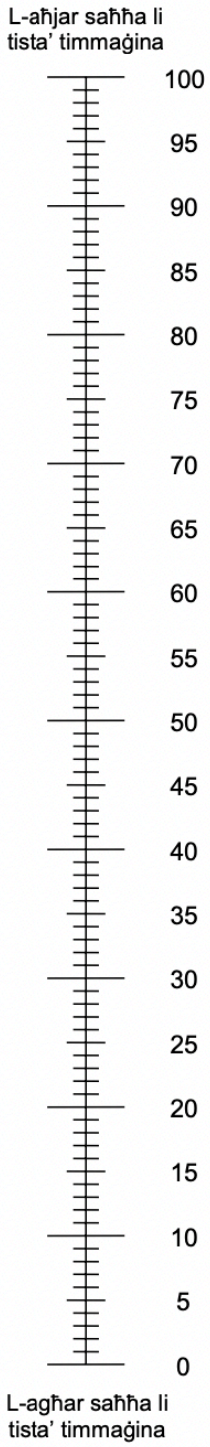
- Nixtiequ nkunu nafu kemm hi tajba jew ħażina saħħtek ILLUM.
- Din l-iskala tibda minn 0 sa 100.
- 100 jfisser l-aħjar saħħa li tista' timmaġina.
  0 jfisser l-agħar saħħa li tista' timmaġina.
- Agħmel X fuq l-iskala biex tindika kif inhi saħħtek ILLUM.
- Issa, jekk jogħġbok ikteb in-numru li mmarkajt fuq l-iskala fil-kaxxa ta' hawn taħt.

SAĦĦTEK ILLUM = ☐



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B7: Therapy Description Form

Therapy Log	
Date (dd/mm/yyyy)	**Description of Therapy Content**
Session Number	
Therapy Regime	Total duration of session (hh:mm) _____
Delivery Approach (multiple selections are permitted)	☐ Qualified SLT/ SLP with experience <2 years ☐ Qualified SLT/ SLP with experience between 3-5 years ☐ Qualified SLT/ SLP with experience >6 years ☐ Therapy assistant led ☐ Volunteer led ☐ Carer Led ☐ Participant led ☐ Support Group led ☐ Computer based ☐ App/ mobile device led ☐ Other (please specify)_____
Setting	☐ One to one ☐ Group
Dose	Number per sessions per day _____ Activities and duration of activities prescribed out of session _____ _____ _____ _____ _____ _____ _____
Therapeutic approach	☐ Semantic processing ☐ Lexical processing ☐ Phonological processing ☐ Orthographic processing ☐ Communication strategies for patient ☐ Communication strategies for communication partner ☐ Melodic intonation ☐ Constraint Induced Movement Therapy

	☐ Functional communication therapy ☐ Gestural therapy ☐ Narrative therapy ☐ Other (please detail) _____ __
Was therapy delivered in the participant's primary native language?	☐ Yes ☐ No
Target of therapy (multiple selections are permitted)	Language comprehension ☐ Auditory ☐ Reading Language production ☐ Verbal ☐ Writing

B8: Support Services & Resource Utilisation Form

Participant Status	☐ alive and participating ☐ alive but unable to participate /withdrawn from study ☐ lost to follow up ☐ dead (Please specify date of death mm/dd/yyyy)
Functional Communication Measure Please complete one Therapy Outcome Measure (TOM) form	Therapy Outcome Measure (TOM) score: Impairment:_____ Activity:_____ Participation:_____ Wellbeing:_____
Quality of Life Assessment Please complete a European Quality of Life Scale form **(Assessment Sheets to be appended to Document)**	European Quality of Life Scale Scores: Mobility: _____ Self-Care: _____ Usual Activities: _____ Anxiety/ Depression: _____ Pain/ Discomfort: _____ VAS: _____
Level of Dependency Please complete a modified Rankin Scale form **(Assessment Sheets to be appended to Document)**	modified Rankin Scale _____
Support services & Resource utilisation	Have any community support services and /or third sector organisations been accessed by the participant since discharge from therapy? ☐ Yes ☐ No If yes, please describe the community support services and /or third sector organisations that have been accessed ☐ Day centres ☐ Stroke Support Groups run by charities

	☐ Stroke Support Groups run by other groups ☐ Other (please specify) _____ Has the participant been re-hospitalised since discharge after index stroke? ☐ Yes ☐ No How many times was the participant re-hospitalised? _____ What was the reason for rehospitalisation? _____ Which of the following is applicable to the participant? ☐ No Rehabilitation has been accessed ☐ Community Rehabilitation has been accessed ☐ Inpatient Rehab has been accessed ☐ Meals on wheels is used ☐ Home care is used ☐ Aids and equipment have been accessed ☐ Legal and financial aid have been accessed ☐ Mobility and Transport aids have been accessed ☐ Carer Support Resources have been accessed ☐ Further and treatment and therapy resources beyond standard care have been accessed ☐ How many GP visits has the participant had since discharge after index stroke? _____ ☐ Other services accessed (please specify) _____ Has the participant returned to work since this stroke? ☐ Yes ☐ No

B9: Therapy Satisfaction Form for Participants

Perception of Speech Language Therapy Services in the Community

Participant's Questionnaire

Name/Code :	Date:

4) How satsified are you with the **speech language therapy services** provided?

5) How satisfied are you with the **frequency** of the speech therapy provided?

6) How satisfied are you with the **type** of speech therapy provided?

Other comments:

_____

_____

_____

_____

B10: Therapy Satisfaction Form for Relatives

Perception of Speech Language Therapy Services in the Community

Relative's Questionnaire

Code : Date:	Relation to participant:

1) How satsified are you with the **speech language therapy services** provided?

2) How satisfied are you with the **frequency** of the speech therapy provided?

3) How satisfied are you with the **type** of speech therapy provided?

Other comments:

_____

_____

_____

_____

Appendix C

Permissions and information Letters

C1: Permission to utilise the EQ-5D-5L

L-Università ta' Malta

Ritienne Grima <ritienne.grima@um.edu.mt>

EQ-5D-5L Paper-ID24092

Ritienne Grima <ritienne.grima@um.edu.mt> 11 March 2018 at 17:23
To: Rita Anna Grima <ritienne.grima@um.edu.mt>

From: **Ritienne Grima** <ritienne.grima@um.edu.mt>
Date: 11 March 2018 at 17:21
Subject: Re: EQ-5D-5L Paper-ID24092
To: Anita Dwarkasing <dwarkasing@euroqol.org>
Cc: Gerben Bakker <bakker@euroqol.org>

Thank you for your kind reply and for attaching the Maltese version.
Best regards
Ritienne Grima

On 9 March 2018 at 15:09, Anita Dwarkasing <dwarkasing@euroqol.org> wrote:

> Dear Ms. / Mr. Ritienne Grima,
>
> Thank you for registering your research at the EuroQol Research Foundation's website.
>
> As the study / project "International population registry for aphasia after stroke" you registered involves low patient numbers you may use the EQ-5D-5L - Paper version free of charge.
>
> Please note that separate permission is required if any of the following is applicable:
>
> - The registered study / project is funded by a pharmaceutical company, medical device manufacturer or other profit-making stakeholder;
> - Using EQ-5D in a Routine Outcome Measurement or Registry setting;
> - Using EQ-5D in languages other than the ones indicated in this email;
> - Using digital representations (e.g. PDA, Tablet or Web) of the EQ-5D
>
> I'm attaching the Maltese (Malta) EQ-5D-5L - Paper version (in MS Word format). Requests to use digital representations of EQ-5D (e.g. web, tablet, PDA) should be made separately to userinformationservice@euroqol.org attaching your initial registration. The corresponding user guide can be downloaded from our website: https://euroqol.org/publications/user-guides/.
>
> Best regards,
>
> **Anita Dwarkasing**
> Legal assistant
> **EuroQol Research Foundation**
>
> **A reply to e-mails can be expected within approximately 5 business days.**
>
> **I do not work on Wednesdays**

C2: Information Letters sent to several personnel to obtain permission to conduct study in different settings

Francesca Vella
M.Sc Communication Therapy Student
Faculty of Health Sciences, University of Malta
francesca.vella.14@um.edu.mt

9th April 2019

Dear

I am a part-time student reading for Master of Science (by research) in Communication Therapy within the Faculty of Health Sciences. I would like to brief you about a new international project entitled *The International Population Registry for Aphasia after Stroke (I-PRAISE),* on which I will be conducting my thesis.

The International Population Registry for Aphasia after Stroke (I-PRAISE) aims to describe the clinical aphasia population across Europe, to describe the clinical treatments for aphasia after stroke in the general population and to examine the outcomes after clinical intervention for aphasia. Data will be collected from different sites in different countries including the UK, Ireland, Germany, Australia, Cyprus, Israel, Sweden, Italy, Finland, Portugal, Turkey, Chile, the Netherlands, Norway, Spain and Malta.

Locally, participants with stroke-induced aphasia will be recruited from Mater Dei Hospital and will be followed up at the point of therapy completion, at six months and at twelve months post stroke. New participants will be recruited from the following wards at Mater Dei Hospital (MDH): NMW, MAU1, MAU3, MW1, MW2, MW3, MW4, MW5, MW6 and Observation ward 2. All the necessary permissions have been granted by the medical consultants, the nursing managers and the charge nurses of the wards. Ms Sharon Young (Data Protection Officer, MDH) and Mr Ivan Falzon (Chief Executive Officer, MDH) have given permission to carry out this research project. Dr Rita Micallef, as the Professional Lead of the Speech Language Centre and the Data Protection Officer of Primary Health Care Dr Mario Vella have also granted permission to follow up consenting participants in the community.

Confidentiality will be stressed and all participant details will remain confidential and be securely stored abiding with general data protection regulation (GDPR) and legal legislation. This project has been approved by the Faculty and University Research Ethics Committees (FRECFHS_1718_083).

On site Speech Language Pathologists will identify persons with aphasia post-stroke and will serve as intermediaries between the participants and the researcher. Every new patient (≥18 years of age) with aphasia as a result of stroke will be regarded as a potential participant and will be included in the study if:

(i) informed consent is provided by the participant and
(ii) the person is medically stable and can sit up and attend for at least ten minutes.

The following are the exclusion criteria:

(i) presence of language/communication difficulties which may be attributed to neurological aetiologies other than stroke;
(ii) presence of dysarthria or apraxia of speech alone;
(iii) pre-stroke clinical diagnosis of dementia and
(iv) known life-threatening illness that is likely to lead to death within six months.

I will be very grateful and appreciative of your kind help in serving as an intermediary and identifying potential participants with stroke-induced aphasia.

Francesca Vella
M.Sc Communication Therapy Student
Faculty of Health Sciences, University of Malta
francesca.vella.14@um.edu.mt

The following information will be collected by myself following consent from research participants:

1. Baseline measurements (as soon as possible after the diagnosis of stroke-induced aphasia is made):
   a) Demographic and clinical data (e.g. age, sex, time since stroke, comorbidities, neuroimaging reports and medical history). This data will be collected from the participant's medical file.
   b) Aphasia Severity Rating Scale (BDAE-3, Goodglass, Kaplan & Barresi, 2000).

2. Therapy completion (at the point of discharge from Speech Language Therapy services), the following forms will be completed:
   a) A therapy description form: Data from this form will help to determine the different types of interventions used.
   b) Aphasia Severity Rating Scale (BDAE-3, Goodglass, Kaplan & Barresi, 2000).
   c) Functional Communication Measure (Therapy Outcome Measure for Aphasia (Enderby & John, 2015))

3. Follow up assessments at 6 months and 12 months post stroke will be carried out by the principal researcher to establish primary and secondary outcomes:
   a) Aphasia Severity Rating Scale (BDAE-3, Goodglass, Kaplan & Barresi, 2000).
   b) Modified Rankin Scale (mRS)
   c) European Quality of Life Scale (EQ-5D) – Maltese version
   d) Functional Communication Measure (Therapy Outcome Measure for Aphasia (Enderby & John, 2015))

Participation in I-PRAISE will help to generate robust data on treatments for aphasia, recovery from aphasia and third sector services available for aphasia after stroke internationally. Differences in care and outcomes will shed light on optimal interventions for different individuals with aphasia.

Should you require further information and/or clarification please do not hesitate to contact me.

Your kind collaboration is extremely appreciated. I thank you in advance.

F Vella

Francesca Vella
B.Sc. (Hons) Communication Therapy
Speech-Language Pathologist
francesca.vella.14@um.edu.mt

Ritienne Grima, Ph.D
Research Supervisor
University of Malta
ritienne.grima@um.edu.mt

C3: Participants' Information Letter in Maltese

Ittra informattiva - Malti

Dr Ritienne Grima
Id-Dipartiment tal-'Communication Therapy'
Il-Fakultà tas-Saħħa u x-Xjenza
L-Università ta' Malta
L-Imsida, MSD 2080

Id-data .....

Għażiż/a Sinjur/Sinjorina/Sinjura,

Jisimni Ritienne Grima u nagħmel parti mill-istaff akkademiku tad-Dipartiment tal-'Communication Therapy', fil-Fakultà tas-Saħħa u x-Xjenza fl-Università ta' Malta. Bħalissa qed naħdem fuq proġett dwar l-afasja. L-afasja hija diffikultà fil-lingwa li tista' tiġi minħabba puplesija. Din tista' taffettwa kemm il-ħila li tifhem il-lingwa mitkellma u/jew miktuba, kif ukoll il-ħila li tesprimi ruħek bil-lingwa mitkellma u/jew miktuba. Din ir-riċerka tagħmel parti minn proġett internazzjonali msejjaħ 'The International Population Registry for Aphasia after Stroke' (I-PRAISE). L-għan hu li nistħarrġu s-servizzi eżistenti tas-saħħa għal persuni bl-afasja wara li jkollhom puplesija, kif ukoll il-mod kif jirnexxilhom jirkupraw u jerġgħu jintegraw fis-soċjetà.

Il-proġett ġie approvat mill-Kumitat tal-Etika tal-Fakultà tas-Saħħa u x-Xjenza.

Inti tista' tieħu sehem f'dan l-istudju minħabba li skont id-dijanjosi għandek afasja. Is-sehem tiegħek għandu valur kbir u napprezzawh bil-bosta minħabba li se jgħinna nitgħallmu aktar dwar l-afasja, il-modi kif wieħed jirkupra u s-servizzi tas-saħħa disponibbli għal din il-kundizzjoni.

Parteċipazzjoni fir-riċerka

Jekk inti taċċetta li tieħu sehem ikun hemm bżonn li tiltaqa' miegħi jew mal-assistent/a tiegħi:

1. waqt li inti tkun għadek l-isptar
2. meta ma tibqax meħtieġa terapija fit-taħdit u l-lingwa
3. sitt xhur wara li kellek il-puplesija
4. tnax-il xhar wara li kellek il-puplesija

Kull laqgħa ddum madwar siegħa.

Waqt dawn il-laqgħat jiena (ir-riċerkatriċi) u/jew l-assistent/a tiegħi nkunu nistgħu:

1. niġbru ftit informazzjoni dwarek mill-file mediku tal-isptar
2. nikkwantifikaw kemm hi gravi l-afasja li għandek
3. nagħmlulek ftit testijiet żgħar dwar l-abbiltajiet komunikattivi tiegħek
4. niġbru tagħrif dwar it-terapija fit-taħdit u l-lingwa li ngħatajt

Parteċipazzjoni

Il-parteċipazzjoni tiegħek fl-istudju hija totalment fuq bażi volontarja u fl-ebda ħin m'inti se tkun imġiegħel jew imġiegħla tieħu sehem. Il-parteċipazzjoni tiegħek fl-istudju tintlaqa' biss jekk tkun qed tagħmilha minn jeddek, wara li tkun ingħatajt it-tagħrif meħtieġ u tajt il-kunsens tiegħek.
Jekk tiddeċiedi li ma tiħux sehem f'dan il-proġett, il-kwalità ta' kura li tkun qed tirċievi jew li jkollok bżonn tirċievi mill-isptar, ma jiġux affettwati.

Dritt li tirtira mill-istudju
Inti għandek kull dritt li tirtira l-kunsens tiegħek li tipparteċipa f'dan l-istudju f'kull ħin bla ebda forma ta' penali u mingħajr il-bżonn li tipprovdi raġuni jew spjegazzjoni. Tista' tirtira wkoll mill-istudju wara li tkun ipparteċipajt u pprovdejt l-informazzjoni dwarek. Jekk tagħmel dan, kull informazzjoni dwarek tiġi meqruda immedjatament. Tista' tirtira l-kunsens tiegħek billi tikkuntattja lir-riċerkatriċi permezz ta' email jew telefonata.

Riskji
M'hemm l-ebda riskju assoċċjat mal-parteċipazzjoni tiegħek fl-istudju.

Benefiċċji
Inti m'intix se tibbenefika direttament minn din ir-riċerka. Madanakollu, jista jgħinek il-fatt li se nibqgħu nsegwu l-progress tiegħek matul il-perjodu tal-istudju. L-informazzjoni kollha miġbura se twassal ukoll biex jinħolqu iktar servizzi xierqa għal nies bl-afasja.

Kunfidenzjalità
L-informazzjoni miġbura mingħandek se tibqa' għal kollox kunfidenzjali. Kull tagħrif miġbur se jinżamm b'mod psewdoanonimu billi jingħata kodiċi. Barra minn hekk, se jinħażen separatament mill-informazzjoni personali tiegħek. Kemm ismek u anke l-informazzjoni l-oħra dwarek, bħal, pereżempju, in-numru tal-karta tal-identità tiegħek, fl-ebda ħin m'huma se jkunu abbinati ma' xi tagħrif ieħor li tkun għaddejtilna. Kull informazzjoni se tkun imħarsa b'password u ħadd ħlief ir-riċerkatriċi u l-assistent/a tagħha mhu se jkollu aċċess għaliha. Skont l-Att dwar il-Protezzjoni tad-Data, inti għandek id-dritt li taċċessa, temenda u tħassar kull informazzjoni li tikkonċernak. L-informazzjoni personali kollha se titħassar hekk kif jintemm dan l-istudju ta' riċerka.

Ħlas
Inti m'intix se tingħata ħlas għall-parteċipazzjoni tiegħek f'din ir-riċerka. Lanqas m'inti se tħallas xi flus biex tieħu sehem f'din ir-riċerka.

Tista' żżomm kopja ta' din l-ittra biex tirreferi għaliha fil-futur.

Jekk ikollok xi mistoqsijiet dwar dan l-istudju tista' tikkuntattjani. Ikun ta' pjaċir għalija li nwieġeb u niċċara xi punti li għandek bżonn tistaqsi dwarhom. Is-sehem tiegħek f'dan l-istħarriġ hu apprezzat ħafna.

Nirringrazzjak bil-quddiem.

Dejjem tiegħek,

Dr Ritienne Grima
Senior Lecturer / Riċerkatriċi
ritienne.grima@um.edu.mt
Tel. : 2340 1142

C4: Participants' Consent Letter in Maltese

Formula ta' kunsens – Malti

Jiena,_____, hawn taħt iffirmat/a, nikkonferma li ngħatajt id-dettalji kollha meħtieġa dwar din ir-riċerka minn Dr Ritienne Grima. Għalhekk, jiena qed nagħti l-kunsens tiegħi u naċċetta li nipparteċipa f'dan l-istudju li qed isir minn Dr Ritienne Grima.

Jiena naċċetta li nieħu sehem minn jeddi u nifhem li nista' nirtira l-kunsens tiegħi fi kwalunkwe ħin u żmien tar-riċerka.

Nifhem li kull tagħrif miġbur se jinżamm b'mod psewdoanonimu billi jingħata kodiċi. Barra minn hekk, se jinħażen separatament mill-informazzjoni personali tiegħi. Kull tagħrif miġbur se jkun imħares b'password u ħadd ħlief ir-riċerkatriċi u l-assistent/a tagħha mhu se jkollu aċċess għaliha. Skont l-Att dwar il-Protezzjoni tad-Data, jien għandi d-dritt li naċċessa, nemenda u nħassar kull informazzjoni li tikkonċernani. Nifhem ukoll li l-informazzjoni personali kollha se titħassar hekk kif jintemm dan l-istudju ta' riċerka.

Nista' nżomm kopja ta' din il-formula biex nirreferi għaliha fil-futur.

Jekk ikolli xi mistoqsijiet dwar din ir-riċerka nista' nikkuntattja lir-riċerkatriċi permezz tat-telefon jew inkella bl-email.

_____

Dr Ritienne Grima
Senior Lecturer / Riċerkatriċi
ritienne.grima@um.edu.mt
Tel. : 2340 1142

Ftehim

Jiena naqbel u naċċetta li nipparteċipa f'dan l-istudju.

Firma _____

Isem _____ Parteċipant / Qarib (immarka skont il-bżonn)

Data _____

C5: Participants' Information Letter in English

Information Letter – English

Dr Ritienne Grima
Department of Communication Therapy
Faculty of Health Sciences
University of Malta
Msida
MSD 2080

Date ……

Dear Sir / Madam

I am a full time academic member of staff within the Department of Communication Therapy, Faculty of Health Sciences, at the University of Malta. I am currently working on a research project on stroke-induced aphasia. Aphasia is an acquired language disorder which may result from a stroke. It may affect comprehension and/or expression of spoken and/or written language. This research is part of an international project which is called 'The International Population Registry for Aphasia after Stroke' (I-PRAISE). It aims to explore current health services for people with aphasia after stroke, as well as their recovery and reintegration.

The project has been approved by the Faculty Research Ethics Committee.

Since you have been diagnosed with aphasia you may participate in this study. Your participation would be extremely valuable and greatly appreciated as it will enable the researchers to learn more about aphasia, its recovery patterns and the health services available for aphasia.

What will happen?

If you agree to participate I (the researcher) or a research assistant will meet you:

1. while you are still in hospital
2. when you are discharged from speech language therapy services
3. six months after your stroke
4. twelve months after your stroke

Each meeting will last approximately one hour.

During these visits I (or a research assistant) will:

1. obtain information about you from your medical file
2. rate the severity of your aphasia
3. assess your ability to communicate
4. gather information about the Speech Language Therapy that you have received.

Participation

Your participation in the study will be entirely voluntary and at no point will you be coerced in any way. Your participation will be accepted solely if given freely and following informed consent. Should you decline to participate you will continue to receive the same quality of care that you are receiving from the hospital staff.

Withdrawal
You have the right to withdraw your consent from participation in the study at any time without any form of penalty and without the need to give a reason. Once the data has been collected and your participation is over, you also have the right to withdraw from the study. Should you decide to withdraw from the study, all the information collected will be destroyed. Your withdrawal will not affect the quality of care you are receiving from the hospital or from any other institution. You can withdraw from the study or request removal of data by contacting the researcher by email or telephone.

Risks
There are absolutely no risks associated with participation in the study.

Benefits
There are no direct benefits for you if you participate in this research. However, your progress will be monitored during the study and this may be beneficial to you. The data collected from the study will lead towards the development of further services for people with aphasia.

Confidentiality
Your data will be kept strictly confidential. All data collected will be pseudonymised using code numbers and it will be stored separately from your personal data. Your name and other identifying information such as your identity card number will not be linked to the data at any time. All information collected will be password protected and no other person except for the researcher and a research assistant will have access to it. Under the Data Protection Act, you have the right to access, rectify and erase data concerning you. All personal data will be deleted upon completion of the research study.

Payment
You will not receive payment for participating in the study, and you will not be expected to pay for participation.

You may keep a copy of this information letter for future reference.

Should you require further clarification please do not hesitate to contact me. I will be very happy to answer any questions and to make all the necessary clarifications. Your kind participation is extremely appreciated.

I thank you in advance.

Yours sincerely

Ritienne Grima, Ph.D
Senior Lecturer/researcher
ritienne.grima@um.edu.mt
Tel. no.: 2340 1142

C6: Participants' Consent Letter in English

Consent Form - English

I_____, the undersigned participant / caregiver of the participant confirm that the details about this research project have been explained to me by Dr Ritienne Grima. I hereby give consent and agree to participate in the study being carried out by the same Dr Ritienne Grima.

I accept to contribute to the study of my own free will and I understand that I can withdraw my consent from this study at any time during the research.

I understand that all data collected will be pseudonymised using code numbers and it will be stored separately from my personal data. All information collected will be password protected and no other person except for the researcher and a research assistant will have access to it. Under the Data Protection Act, I have the right to access, rectify and erase data concerning myself. I also understand that all personal data will be deleted upon completion of the research study.

I may keep a copy of this consent form for future reference.

Should I have any questions or require any sort of clarification, I can contact the researcher by phone or through email.

_____

Dr Ritienne Grima
Senior Lecturer/researcher
ritienne.grima@um.edu.mt
Tel. no.: 2340 1142

Agreement
I agree to participate in the research study as described above.

_____

Name _____ Participant / Significant caregiver (delete accordingly)

Date _____

C7: Aphasia-friendly information letter in Maltese

ITTRA TA' INFORMAZZJONI GĦALL-PARTEĊIPANTI

X'inhi r-riċerka?

	Qegħdin nagħmlu ftit **riċerka** Din hi dwar il-**puplesija u l-afasja** Ir-riċerka tgħinna **nitgħallmu** Għandna bżonn **insiru nafu** aktar dwar **kif nistgħu ngħinu**
	

Għala jien?

	Inti **kellek puplesija**
	Il-puplesija qed taffettwalek **il-komunikazzjoni**
	Inti għandek l-**afasja**

Inti qed tingħata trattament fl-**Isptar Mater Dei**

Min qed jagħmel ir-riċerka?

Din ir-riċerka hija parti minn studju **internazzjonali**

L-istudju jismu International Population Registry for

Aphasia after Stroke (**I-PRAISE**)

Jiena Dr Ritienne Grima

Jiena r-**riċerkatriċi ewlenija f'Malta**

Naħdem fid-Dipartiment tal-Communication Therapy

Fil-Fakultà tas-Saħħa u x-Xjenza

Tal-Università ta' Malta

Għala qed nagħmlu din ir-riċerka?

 	Teżisti **terapija** sabiex tkun tista' tkampa wara puplesija Terapisti tal-lingwa u t-taħdit jipprovdu din it-**terapija** **Ma nafux** biżżejjed dwarha Ir-**riċerka** se tgħinna **nitgħallmu aktar**
	Irridu niskopru x'jaħdem **l-aħjar**
	 **X'kien hemm tajjeb?**  **X'jista' jkun aħjar?**

X’jiġri waqt ir-riċerka?

Irridu li **persuni bl-afasja** jipparteċipaw

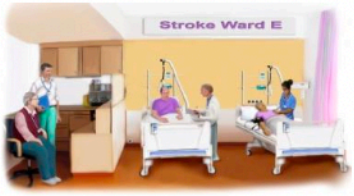
Ir-riċerkaturi **jiflu r-riżultati**

Se **jitgħallmu** dwar it-terapija għall-afasja

X'se nagħmlu?

	Se naqraw il–**file mediku**
	**Nikkwantifikaw kemm hi gravi** l-afasja tiegħek
	Inti **twieġeb** ftit **mistoqsijiet**
	Nagħmlu ftit **testijiet** tal-komunikazzjoni
	Nieħdu **informazzjoni** dwar **it-terapija** tiegħek
	Dan jgħinna **nkejlu** kwalunkwe bidla
	Ir-riċerkaturi biss se jaraw **l-informazzjoni dwarek**
	Se nżommu **l-informazzjoni** dwarek **f'post sigur**

Fejn se ssir ir-riċerka?

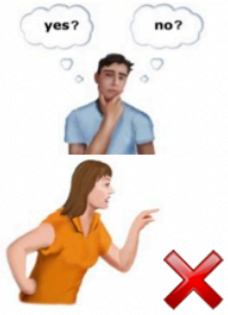
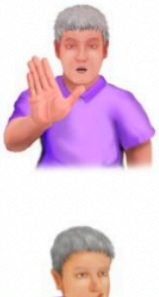


Se niltaqgħu miegħek:

1. Meta tkun **għadek l-isptar**
2. Meta **ma tibqax meħtieġa terapija** fit-taħdit u l-lingwa
3. **Sitt xhur wara** li kellek il-puplesija
4. **Tnax-il xahar wara** li kellek puplesija

Kull laqgħa ddum madwar **siegħa**

Bilfors irrid nieħu sehem?

	**Tista' tiddeċiedi** **Mhux bilfors** Jekk ma tiħux sehem **xorta** se **tingħata l-għajnuna tas-soltu**
	Jekk tbiddel fehemtek, **tista' tieqaf x'ħin trid** **M'għandekx għalfejn tagħti raġuni**

X'jiġri jekk ma niħux sehem fir-riċerka?

	**Xorta** se tingħata **l-għajnuna tas-soltu**

Min se jara l-informazzjoni dwari?

	Se nżommu **l-informazzjoni** dwarek **f'post sigur** **Ir-riċerkaturi biss** se jaraw **l-informazzjoni dwarek**
 	Aħna **nistgħu naqsmu** l-informazzjoni dwarek ma' **riċerkaturi oħrajn f'dan il-pajjiż** Aħna **nistgħu naqsmu** l-informazzjoni dwarek ma' **riċerkaturi f'pajjiżi oħrajn** Dan **jgħin** fejn tidħol **riċerka oħra** dwar **il-puplesija** Se **nneħħulek ismek** u **dettalji oħra personali**

Hemm xi perikli f'din ir-riċerka?

	Hemm **kumitati** li **jiddeċiedu jekk għandhiex issir ir-riċerka** Dan huma l-**kumitati etiċi**
	Dawn jgħidu li **din ir-riċerka tista' ssir** Dawn jgħidu li **m'hemmx perikli**
	Dawn jgħidu li din ir-riċerka **tfasslet kif jixraq**

X'se jiġri wara r-riċerka?

	Ir-riċerkaturi **se jiflu r-riżultati**
	Se **jitgħallmu aktar dwar l-afasja**

X'se jiġri mir-riżultati?

  	Se **naqsmu r-riżultati** ma' **riċerkaturi oħrajn** waqt **konferenzi u laqgħat** permezz ta' **newsletters u rivisti** **f'ġurnali akkademiċi** ma' **nies oħrajn** li jkollhom **puplesija**
	Ir-riżultati **mhux se jużaw ismek**
	Ir-riżultati jistgħu jinkludu **dak li għidt** imma **mhux min qalu**

U issa?

	**Trid tieħu sehem?** Trid **tiddeċiedi**
  	Jekk tkun **trid aktar tagħrif** **Ikkuntattja lil** Dr Ritienne Grima Se twieġeb **il-mistoqsijiet** tiegħek Tista tikkuntattjaha fuq telfon 2340 1142 jew email ritienne.grima@um.edu.mt
 	Jekk tiddeċiedi li tieħu sehem ikollok bżonn **tiffirma formula ta' kunsens** Din tgħid li int **qed tifhem** x'inhi din ir-riċerka u **taqbel** li tieħu sehem
  	Se nistaqsuk x'inhi **d-deċiżjoni tiegħek** **Iva rrid** **Le ma rridx**

C8: Aphasia-friendly Consent Letter in Maltese

FORMULA TA' KUNSENS GĦALL-PARTEĊIPANTI

Biex tieħu sehem fir-riċerka dwar il-puplesija u l-afasja

Jekk jogħġbok **immarka**

iva le

Jiena **qrajt** it-**tagħrif** dwar ir-**riċerka**

iva le

Jiena kelli l-**opportunità** li **nistaqsi mistoqsijiet** dwar ir-riċerka

iva le

Jiena **kuntent**/a bit-**tweġibiet** li ngħatajt għall-mistoqsijiet tiegħi

👍☐ iva 👎☐ le

Jiena nifhem li t-**tagħrif** li tajt dwari se jinżamm **f'post sigur**

👍☐ iva 👎☐ le

Dan it-**tagħrif mhux se jgħaddi għand ħaddieħor li m'għandux x'jaqsam mar-riċerka**

👍☐ iva 👎☐ le

Jiena naf li meta r-**riżultati** se jinqasmu ma' ħaddieħor, ir-riċerkaturi **mhux se jużaw ismi**

👍▢ iva 👎▢ le

Jiena nifhem li **nista' nieqaf milli nieħu sehem fir-riċerka** meta rrid

👍▢ iva 👎▢ le

Jekk nieqaf m'għandix għalfejn nagħti raġuni ... u **xorta se ningħata l-kura tas-soltu**

👍▢ iva 👎▢ le

Jiena naqbel li nieħu sehem fir-riċerka

iva le

Isem _____

Data _____

Firma _____

Jiena nagħti l-kunsens tiegħi lil

Isem _____

Data _____

Firma _____

Ir-riċerkatriċi ewlenija hi

Dr Ritienne Grima

Għal kwalunkwe **mistoqsija** ... jekk jogħġbok ċempel fuq

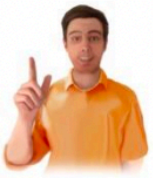
Tel: 2340 1142

ritienne.grima@um.edu.mt

C9: Aphasia-friendly information letter in English

INFORMATION LETTER FOR PARTICIPANTS

What is the research?



We are doing some **research**

It is about **stroke and aphasia**

Research helps us **learn**

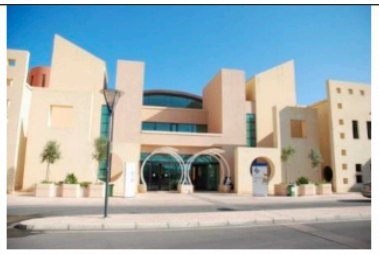
We need to **know** more about **how to help**

Why me?

You **have had a stroke**

Your stroke affected your **communication**

You have **aphasia**



You are receiving **treatment** for your stroke at **Mater Dei Hospital**

Who is doing the research?

This research is part of an international research project

This is called the International Population Registry for Aphasia after Stroke (**I-PRAISE**)

I am Dr Ritienne Grima

I am the **main researcher in Malta**

I am a member of staff of the Department of Communication Therapy

Faculty of Health Sciences

University of Malta

Why are we doing the research?

<table>
<tr>
<td> 
  </td>
<td>There is therapy for aphasia after stroke
Speech Language Pathologists provide this therapy

We don't know enough about it
This research will help us to learn more</td>
</tr>
<tr>
<td>  </td>
<td>We can find out what works best</td>
</tr>
<tr>
<td> 
</td>
<td> 
What was good?
 
What could be improved?</td>
</tr>
</table>

What happens in the research?

We want **people** with aphasia to take part

The researchers will **look at the results**

They will **learn** about therapy for aphasia

What will we do?

We will read your **medical file**

We will rate the **severity** of your aphasia

You will **answer** some **questions**

You will have some **assessments**

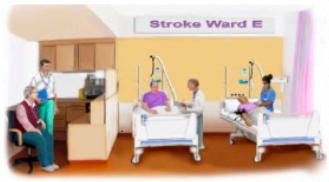
We will get **information** about your **therapy**

This helps us to **measure** any **change**

Only the researchers will **see** your details and test results

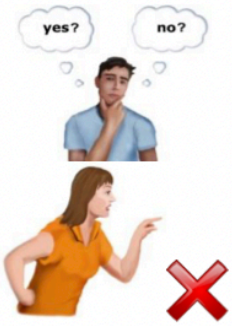
They will be kept **safe**

Where will the research happen?

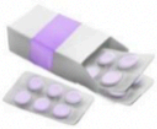
<table>
<tr>
<td> 


 </td>
<td>We will meet you :
1. while you are still in hospital
2. when you are discharged from speech language therapy services
3. six months after your stroke
4. twelve months after your stroke</td>
</tr>
<tr>
<td>  </td>
<td>Each meeting will last 1 hour</td>
</tr>
</table>

Do I have to take part?

	**You can decide** You **don't have to** take part
 	If you change your mind, **you can stop** at any time You **don't** have to **give a reason**

What if I don't take part in the research?

 	You will still get your **normal help**

Who will see the information about me?

	We will keep the **information** about you **safe** **Only** the **researchers** will see the **information about you**
 	We may **share** your information with **other researchers** in this **country** We may **share** your information with **researchers** in **other countries** This **helps** with **other research** about **stroke** We will **take out your name** and **personal details**

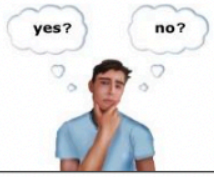
Is the research safe?

	Research committees **decide if research can happen** These are the **ethics committees**
	They say that **this research can happen** They say that it is **safe**
	They say that it has been **planned properly**

What will happen after the research?

	The **researchers** will **look at the results**
	They will **learn more** about aphasia

What next?

	Do you **want** to **take part?** **You need to decide**
  	You may want **more information** Contact Dr Ritienne Grima She will **answer your questions** You can **contact her** on telephone 2340 1142 or email ritienne.grima@um.edu.mt
 	If you decide to take part you will need to **sign a consent form** This says that **you understand** the research and **you agree** to take part
  	We will ask for **your decision** **Yes** I want to **No** I don't want to

C10: Aphasia-friendly consent letter in English

CONSENT FORM FOR PARTICIPANTS

Taking part in research about stroke and aphasia

Please **mark**

yes ☐ no ☐

I have **read** the **information** about the **research**

yes ☐ no ☐

I have had the **chance** to **ask questions** about the research

yes ☐ no ☐

I am **happy** with the **answers** to my questions

yes ☐ no ☐

I understand that **information** about me will be **kept safe**

yes ☐ no ☐

It will **not** be **shared** with **anyone outside the research**

yes ☐ no ☐

I know that when **results** are shared the researcher will **not use my name**

yes ☐ no ☐

I understand that **I can stop being in the research** at any time

yes ☐ no ☐

If I stop I do not have to **give a reason**

...and I will still **get my normal care**

yes ☐ no ☐

I agree to take part in the research

yes ☐ no ☐

Name_____

Signature _____ **Date**_____

I give my consent to

Name _____

Signature_____ **Date**_____

The **main researcher** is

Dr Ritienne Grima

Any **questions...** please **contact**

Tel: 2340 1142

ritienne.grima@um.edu.mt

Appendix D

Raw Data

Table D1

Scores of outcomes obtained by each participant.

		Phase 1	Phase 2	Phase 3
Participant 201	ASRS	4	5	6
	TOM Impairment	4	4	5
	TOM Activity	5	4	5
	TOM Participation	3	4	5
	TOM Wellbeing	4	5	5
	mRS	3	2	2
	EQ-5D-5L	n/a	77	90
	MAST Total Score	62	n/a	95
	MAST Comprehension Score	27	n/a	39
	MAST Expression Score	35	n/a	56
Participant 202	ASRS	2	5	6
	TOM Impairment	35	4	5
	TOM Activity	2	4	5
	TOM Participation	2	5	5
	TOM Wellbeing	2	5	5
	mRS	4	3	3
	EQ-5D-5L	n/a	95	87
	MAST Total Score	60	n/a	73
	MAST Comprehension Score	29	n/a	29
	MAST Expression Score	31	n/a	44
Participant 203	ASRS	2	5	6
	TOM Impairment	4	5	5
	TOM Activity	5	5	5
	TOM Participation	4	5	5
	TOM Wellbeing	5	5	5
	mRS	3	2	1
	EQ-5D-5L	n/a	98	96
	MAST Total Score	84	n/a	90
	MAST Comprehension Score	31	n/a	34
	MAST Expression Score	53	n/a	56
Participant 204	ASRS	0	0	2
	TOM Impairment	0	0	2
	TOM Activity	0	2	4
	TOM Participation	0	0	2
	TOM Wellbeing	0	3	4
	mRS	5	4	4
	EQ-5D-5L	n/a	34	50
	MAST Total Score	0	n/a	28
	MAST Comprehension Score	0	n/a	8
	MAST Expression Score	0	n/a	20

Participant 205	ASRS	5	5	6
	TOM Impairment	5	4	5
	TOM Activity	2	5	5
	TOM Participation	5	5	5
	TOM Wellbeing	5	5	5
	mRS	2	2	1
	EQ-5D-5L	n/a	80	86
	MAST Total Score	94	n/a	99
	MAST Comprehension Score	35	n/a	39
	MAST Expression Score	59	n/a	60
Participant 206	ASRS	2	-	-
	TOM Impairment	3	-	-
	TOM Activity	2	-	-
	TOM Participation	3	-	-
	TOM Wellbeing	4	-	-
	mRS	3	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	62	n/a	-
	MAST Comprehension Score	32	n/a	-
	MAST Expression Score	30	n/a	-
Participant 207	ASRS	1	-	-
	TOM Impairment	1	-	-
	TOM Activity	1	-	-
	TOM Participation	0	-	-
	TOM Wellbeing	2	-	-
	mRS	5	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	0	n/a	-
	MAST Comprehension Score	0	n/a	-
	MAST Expression Score	0	n/a	-
Participant 208	ASRS	5	5	5
	TOM Impairment	4	4	5
	TOM Activity	4	4	5
	TOM Participation	3	4	5
	TOM Wellbeing	5	5	5
	mRS	3	2	1
	EQ-5D-5L	n/a	75	80
	MAST Total Score	79	n/a	88
	MAST Comprehension Score	39	n/a	38
	MAST Expression Score	40	n/a	50
Participant 209	ASRS	4	4	6
	TOM Impairment	4	4	5
	TOM Activity	4	5	5
	TOM Participation	4	4	5
	TOM Wellbeing	5	5	5
	mRS	2	2	1

	EQ-5D-5L	n/a	83	94
	MAST Total Score		n/a	
	MAST Comprehension Score		n/a	
	MAST Expression Score		n/a	
Participant 210	ASRS	5	5	6
	TOM Impairment	0	3	4
	TOM Activity	1	3	4
	TOM Participation	0	2	4
	TOM Wellbeing	0	3	4
	mRS	5	3	2
	EQ-5D-5L	n/a	63	78
	MAST Total Score	84	n/a	89
	MAST Comprehension Score	36	n/a	38
	MAST Expression Score	48	n/a	51
Participant 212	ASRS	4	5	6
	TOM Impairment	4	4	5
	TOM Activity	5	5	5
	TOM Participation	4	5	5
	TOM Wellbeing	5	5	5
	mRS	2	2	2
	EQ-5D-5L	n/a	95	96
	MAST Total Score	67	n/a	77
	MAST Comprehension Score	27	n/a	30
	MAST Expression Score	40	n/a	47
Participant 213	ASRS	3	4	6
	TOM Impairment	3	4	5
	TOM Activity	4	5	5
	TOM Participation	3	5	5
	TOM Wellbeing	4	5	5
	mRS	4	3	2
	EQ-5D-5L	n/a	90	94
	MAST Total Score	76	n/a	96
	MAST Comprehension Score	30	n/a	38
	MAST Expression Score	46	n/a	58
Participant 214	ASRS	3	4	5
	TOM Impairment	3	3	4
	TOM Activity	3	3	4
	TOM Participation	3	3	4
	TOM Wellbeing	4	4	4
	mRS	4	4	3
	EQ-5D-5L	n/a	65	86
	MAST Total Score	71	n/a	85
	MAST Comprehension Score	35	n/a	36
	MAST Expression Score	36	n/a	49
Participant 215	ASRS	4	5	6

	TOM Impairment	4	4	5
	TOM Activity	5	5	5
	TOM Participation	4	5	5
	TOM Wellbeing	5	5	5
	mRS	2	2	1
	EQ-5D-5L	n/a	88	95
	MAST Total Score	74	n/a	95
	MAST Comprehension Score	29	n/a	38
	MAST Expression Score	45	n/a	57
Participant 216	ASRS	3	4	5
	TOM Impairment	4	4	5
	TOM Activity	3	4	4
	TOM Participation	2	3	5
	TOM Wellbeing	4	2	3
	mRS	3	2	1
	EQ-5D-5L	n/a	60	83
	MAST Total Score	65	n/a	85
	MAST Comprehension Score	30	n/a	36
	MAST Expression Score	35	n/a	49
Participant 217	ASRS	3	4	-
	TOM Impairment	3	4	-
	TOM Activity	2	3	-
	TOM Participation	3	2	-
	TOM Wellbeing	3	3	-
	mRS	4	3	-
	EQ-5D-5L	n/a	55	-
	MAST Total Score	63	n/a	-
	MAST Comprehension Score	30	n/a	-
	MAST Expression Score	35	n/a	-
Participant 219	ASRS	4	4	4
	TOM Impairment	4	4	4
	TOM Activity	4	4	5
	TOM Participation	4	4	5
	TOM Wellbeing	3	5	5
	mRS	3	2	2
	EQ-5D-5L	n/a	85	90
	MAST Total Score	65	n/a	75
	MAST Comprehension Score	27	n/a	37
	MAST Expression Score	38	n/a	38
Participant 220	ASRS	3	4	6
	TOM Impairment	4	5	5
	TOM Activity	5	5	5
	TOM Participation	5	5	5
	TOM Wellbeing	5	5	5
	mRS	2	1	1
	EQ-5D-5L	n/a	77	87

	MAST Total Score	77	n/a	92
	MAST Comprehension Score	29	n/a	38
	MAST Expression Score	48	n/a	54
Participant 221	ASRS	4	4	4
	TOM Impairment	3	4	4
	TOM Activity	3	3	4
	TOM Participation	4	3	4
	TOM Wellbeing	5	4	4
	mRS	4	3	3
	EQ-5D-5L	n/a	55	78
	MAST Total Score	60	n/a	70
	MAST Comprehension Score	33	n/a	38
	MAST Expression Score	27	n/a	54
Participant 222	ASRS	2	4	-
	TOM Impairment	2	3	-
	TOM Activity	2	3	-
	TOM Participation	3	4	-
	TOM Wellbeing	4	5	-
	mRS	5	3	-
	EQ-5D-5L	n/a	85	
	MAST Total Score	46	n/a	-
	MAST Comprehension Score	18	n/a	-
	MAST Expression Score	28	n/a	-
Participant 224	ASRS	0	1	2
	TOM Impairment	1	3	3
	TOM Activity	0	1	3
	TOM Participation	0	1	3
	TOM Wellbeing	4	3	4
	mRS	4	3	3
	EQ-5D-5L	n/a	45	52
	MAST Total Score	22	n/a	57
	MAST Comprehension Score	22	n/a	29
	MAST Expression Score	0	n/a	28
Participant 225	ASRS	0	1	2
	TOM Impairment	0	1	2
	TOM Activity	0	0	2
	TOM Participation	0	0	2
	TOM Wellbeing	0	0	3
	mRS	5	5	4
	EQ-5D-5L	n/a	30	55
	MAST Total Score	0	n/a	49
	MAST Comprehension Score	0	n/a	29
	MAST Expression Score	0	n/a	20
Participant 226	ASRS	2	3	3
	TOM Impairment	2	3	4

	TOM Activity	2	3	4
	TOM Participation	2	3	5
	TOM Wellbeing	3	3	4
	mRS	4	4	4
	EQ-5D-5L	n/a	55	72
	MAST Total Score		n/a	
	MAST Comprehension Score		n/a	
	MAST Expression Score		n/a	
Participant 227	ASRS	2	3	-
	TOM Impairment	3	4	-
	TOM Activity	3	4	-
	TOM Participation	4	4	-
	TOM Wellbeing	4	4	-
	mRS	5	4	-
	EQ-5D-5L	n/a	34	-
	MAST Total Score	53	n/a	-
	MAST Comprehension Score	19	n/a	-
	MAST Expression Score	34	n/a	-
Participant 228	ASRS	4	-	-
	TOM Impairment	3	-	-
	TOM Activity	4	-	-
	TOM Participation	2	-	-
	TOM Wellbeing	0	-	-
	mRS	4	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	63	n/a	-
	MAST Comprehension Score	26	n/a	-
	MAST Expression Score	37	n/a	-
Participant 229	ASRS	1	1	2
	TOM Impairment	1	2	3
	TOM Activity	2	3	4
	TOM Participation	3	3	3
	TOM Wellbeing	4	2	4
	mRS	5	4	3
	EQ-5D-5L	n/a	42	50
	MAST Total Score	16	n/a	59
	MAST Comprehension Score	6	n/a	30
	MAST Expression Score	10	n/a	29
Participant 230	ASRS	5	5	6
	TOM Impairment	4	5	5
	TOM Activity	5	5	5
	TOM Participation	5	5	5
	TOM Wellbeing	5	5	5
	mRS	2	1	1
	EQ-5D-5L	n/a	95	100

	MAST Total Score	89	n/a	98
	MAST Comprehension Score	40	n/a	40
	MAST Expression Score	49	n/a	58
Participant 232	ASRS	5	5	-
	TOM Impairment	4	5	-
	TOM Activity	4	5	-
	TOM Participation	4	5	-
	TOM Wellbeing	4	5	-
	mRS	2	1	-
	EQ-5D-5L	n/a	93	-
	MAST Total Score	69	n/a	-
	MAST Comprehension Score	26	n/a	-
	MAST Expression Score	43	n/a	-
Participant 234	ASRS	5	5	6
	TOM Impairment	4	5	5
	TOM Activity	5	5	5
	TOM Participation	4	5	5
	TOM Wellbeing	4	5	5
	mRS	2	1	0
	EQ-5D-5L	n/a	85	94
	MAST Total Score	84	n/a	93
	MAST Comprehension Score	37	n/a	39
	MAST Expression Score	47	n/a	54
Participant 235	ASRS	4	-	-
	TOM Impairment	4	-	-
	TOM Activity	3	-	-
	TOM Participation	2	-	-
	TOM Wellbeing	5	-	-
	mRS	3	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	76	n/a	-
	MAST Comprehension Score	29	n/a	-
	MAST Expression Score	47	n/a	-
Participant 236	ASRS	5	6	-
	TOM Impairment	4	5	-
	TOM Activity	5	5	-
	TOM Participation	5	4	-
	TOM Wellbeing	4	4	-
	mRS	2	1	-
	EQ-5D-5L	n/a	89	-
	MAST Total Score	71	n/a	-
	MAST Comprehension Score	33	n/a	-
	MAST Expression Score	38	n/a	-
Participant 237	ASRS	3	4	4
	TOM Impairment	3	4	5

	TOM Activity	4	4	4
	TOM Participation	4	5	5
	TOM Wellbeing	5	4	5
	mRS	2	2	1
	EQ-5D-5L	n/a	87	94
	MAST Total Score	64	n/a	74
	MAST Comprehension Score	35	n/a	29
	MAST Expression Score	29	n/a	45
Participant 238	ASRS	5	5	6
	TOM Impairment	4	5	5
	TOM Activity	5	5	5
	TOM Participation	4	5	5
	TOM Wellbeing	5	5	5
	mRS	2	1	1
	EQ-5D-5L	n/a	90	93
	MAST Total Score	87	n/a	98
	MAST Comprehension Score	39	n/a	40
	MAST Expression Score	48	n/a	58
Participant 239	ASRS	1	1	3
	TOM Impairment	2	2	3
	TOM Activity	0	1	2
	TOM Participation	0	1	3
	TOM Wellbeing	4	4	4
	mRS	4	4	3
	EQ-5D-5L	n/a	15	32
	MAST Total Score	7	n/a	40
	MAST Comprehension Score	6	n/a	17
	MAST Expression Score	1	n/a	23
Participant 241	ASRS	3	5	-
	TOM Impairment	3	5	-
	TOM Activity	4	5	-
	TOM Participation	4	5	-
	TOM Wellbeing	4	5	-
	mRS	3	2	-
	EQ-5D-5L	n/a	95	-
	MAST Total Score	51	n/a	-
	MAST Comprehension Score	22	n/a	-
	MAST Expression Score	29	n/a	-
Participant 242	ASRS	1	1	-
	TOM Impairment	0	1	-
	TOM Activity	1	0	-
	TOM Participation	1	0	-
	TOM Wellbeing	4	3	-
	mRS	5	5	-
	EQ-5D-5L	n/a	0	-

	MAST Total Score	7	n/a	-
	MAST Comprehension Score	6	n/a	-
	MAST Expression Score	1	n/a	-
Participant 244	ASRS	5	5	6
	TOM Impairment	4	4	4
	TOM Activity	3	4	4
	TOM Participation	4	4	4
	TOM Wellbeing	5	4	4
	mRS	2	2	1
	EQ-5D-5L	n/a	83	83
	MAST Total Score	80	n/a	90
	MAST Comprehension Score	37	n/a	38
	MAST Expression Score	43	n/a	52
Participant 245	ASRS	3	4	5
	TOM Impairment	3	4	4
	TOM Activity	3	4	4
	TOM Participation	2	4	4
	TOM Wellbeing	3	3	3
	mRS	2	1	1
	EQ-5D-5L	n/a	80	80
	MAST Total Score	52	n/a	85
	MAST Comprehension Score	29	n/a	34
	MAST Expression Score	33	n/a	51
Participant 246	ASRS	2	-	-
	TOM Impairment	2	-	-
	TOM Activity	1	-	-
	TOM Participation	1	-	-
	TOM Wellbeing	3	-	-
	mRS	4	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	21	n/a	-
	MAST Comprehension Score	9	n/a	-
	MAST Expression Score	12	n/a	-
Participant 247	ASRS	3	-	-
	TOM Impairment	3	-	-
	TOM Activity	4	-	-
	TOM Participation	4	-	-
	TOM Wellbeing	4	-	-
	mRS	3	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	66	n/a	-
	MAST Comprehension Score	34	n/a	-
	MAST Expression Score	32	n/a	-
Participant 248	ASRS	0	2	3
	TOM Impairment	0	2	2

	TOM Activity	0	2	3
	TOM Participation	0	2	4
	TOM Wellbeing	0	2	3
	mRS	5	4	4
	EQ-5D-5L	n/a	62	69
	MAST Total Score	0	n/a	67
	MAST Comprehension Score	0	n/a	25
	MAST Expression Score	0	n/a	42
Participant 249	ASRS	5	5	5
	TOM Impairment	4	5	5
	TOM Activity	4	5	5
	TOM Participation	5	5	5
	TOM Wellbeing	5	5	5
	mRS	2	1	0
	EQ-5D-5L	n/a	95	97
	MAST Total Score	71	n/a	84
	MAST Comprehension Score	29	n/a	46
	MAST Expression Score	42	n/a	38
Participant 250	ASRS	0	-	-
	TOM Impairment	0	-	-
	TOM Activity	0	-	-
	TOM Participation	0	-	-
	TOM Wellbeing	0	-	-
	mRS	5	-	-
	EQ-5D-5L	n/a	-	-
	MAST Total Score	0	n/a	-
	MAST Comprehension Score	0	n/a	-
	MAST Expression Score	0	n/a	-
Participant 251	ASRS	0	2	5
	TOM Impairment	0	2	4
	TOM Activity	0	2	4
	TOM Participation	0	2	5
	TOM Wellbeing	0	2	3
	mRS	5	4	3
	EQ-5D-5L	n/a	60	85
	MAST Total Score	0	n/a	93
	MAST Comprehension Score	0	n/a	38
	MAST Expression Score	0	n/a	55

Table D2

Therapy Description Raw Data

	In the first six-month post-stroke				In the first twelfth month post-stroke			
	Therapeutic Approach	Time of therapy received	Setting	Delivery Approach	Therapeutic Approach	Time of therapy received	Setting	Delivery Approach
P201	Communication strategies for the patient	550min	One-to-one	Qualified SLP with <2 years of experience	Communication strategies for the patient	750min	One-to-one	Qualified SLP with <2 years of experience
P202	Semantic Processing	200min	One-to-one	Qualified SLP with 3-5 years of experience	Semantic Processing	405min	One-to-one	Qualified SLP with 3-5 years of experience
P203	Did not receive therapy for aphasia							
P204	Communication strategies for the patient	1800min	One-to-one	Qualified SLP with 3-5 years of experience	Communication strategies for the patient	3900min	One-to-one	Qualified SLP with 3-5 years of experience

P205	Functional Communication	300min	One-to-one	Qualified SLP 5< years of experience	Functional Communication	657min	One-to-one	Qualified SLP 5< years of experience
P208	Did not receive therapy for aphasia							
P209	Semantic Processing	400min	One-to-one	Qualified SLP with <2 years of experience	Semantic Processing	600min	One-to-one	Qualified SLP with <2 years of experience
P210	CILT	4000min	One-to-one	Qualified SLP with 3-5 years of experience	CILT	8040min	One-to-one	Qualified SLP with 3-5 years of experience
P212	CILT	200min	One-to-one	Qualified SLP with <2 years of experience	CILT	300min	One-to-one	Qualified SLP with <2 years of experience
P213	Semantic Processing	250min	One-to-one	Qualified SLP with 3-5 years of experience	Semantic Processing	585min	One-to-one	Qualified SLP with 3-5 years of experience

P214	Functional Communication	500min	One-to-one	Qualified SLP with 3-5 years of experience	Lexical Processing	855min	One-to-one	Qualified SLP with 3-5 years of experience
P215	Semantic Processing	150min	One-to-one	Qualified SLP 5< years of experience	Semantic Processing	225min	One-to-one	Qualified SLP 5< years of experience
P216	Did not receive therapy for aphasia							
P217	MIT	300min	One-to-one	Qualified SLP with 3-5 years of experience	Participant attrition			
P219	MIT	250min	One-to-one	Qualified SLP 5< years of experience	Functional Communication	300min	One-to-one	Qualified SLP 5< years of experience
P220	Did not receive therapy for aphasia							
P221	Semantic Processing	400min	One-to-one	Qualified SLP with 3-	Semantic Processing	630min	One-to-one	Qualified SLP with 3-

				5 years of experience				5 years of experience
P222	MIT	430min	One-to-one	Qualified SLP with 3-5 years of experience	Participant attrition			
P224	Semantic Processing	90min	One-to-one	Qualified SLP 5< years of experience	Semantic Processing	150min	One-to-one	Qualified SLP 5< years of experience
P225	Lexical Processing	120min	One-to-one	Qualified SLP 5< years of experience	Lexical Processing	150min	One-to-one	Qualified SLP 5< years of experience
P226	Communication Strategies	60min	One-to-one	Qualified SLP 5< years of experience	Communication Strategies for the patient	200min	One-to-one	Qualified SLP 5< years of experience
P229	Lexical Processing	190min	One-to-one	Qualified SLP 5<	Lexical Processing	360min	One-to-one	Qualified SLP 5<

				years of experience				years of experience
P230	Semantic Processing	300min	One-to-one	Qualified SLP with 3-5 years of experience	Lexical Processing	620min	One-to-one	Qualified SLP with 3-5 years of experience
P232	MIT	700min	One-to-one	Qualified SLP with <2 years of experience		Participant attrition		
P234	Did not receive therapy for aphasia							
P236	CILT	630min	One-to-one	Qualified SLP with <2 years of experience		Participant attrition		
P237	Did not receive therapy for aphasia							
P238	CILT	90min	One-to-one	Qualified SLP 5< years of experience	Lexical Processing	190min	One-to-one	Qualified SLP 5< years of experience

P239	Semantic Processing	330min	One-to-one	Qualified SLP with 3-5 years of experience	Semantic Processing	600min	One-to-one	Qualified SLP with 3-5 years of experience
P241	CILT	420min	One-to-one	Qualified SLP 5< years of experience		Participant attrition		
P242	CILT	600min	One-to-one	Qualified SLP with 3-5 years of experience		Participant attrition		
P244	Did not receive therapy for aphasia							
P245	Did not receive therapy for aphasia							
P248	MIT	240min	One-to-one	Qualified SLP with <2 years of experience	Functional Communication	300min	One-to-one	Qualified SLP with <2 years of experience
P249	Did not receive therapy for aphasia							
P251	MIT	3350min	One-to-one	Qualified SLP with <2	CILT	7080min	One-to-one	Qualified SLP with <2

	years of experience	years of experience

Appendix E

Normality Testing

Table E1:

Normality testing between gender and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Sex	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Male	.27	27	<.00	.79	27	<.00
	Female	.21	17	0.04	.83	17	.00
TOM Activity Phase 1	Male	.27	27	<.00	.85	27	.00
	Female	.18	17	.11	.86	17	.01
TOM Participation Phase 1	Male	.20	27	.00	.87	27	.00
	Female	.20	17	.05	.85	17	.01
TOM Wellbeing Phase 1	Male	.35	27	<.00	.72	27	<.00
	Female	.29	17	<.00	.75	17	<.00
MAST Total Score Phase 1	Male	.25	27	<.00	.83	27	<.00
	Female	.13	17	.20	.90	17	.09
MAST Comprehension Score Phase 1	Male	.26	27	<.00	.82	27	<.00
	Female	.19	17	.09	.93	17	.22
MAST Expression Score Phase 1	Male	.17	27	.03	.90	27	.02
	Female	.20	17	.05	.81	17	.00
ASRS Phase 1	Male	.19	27	.011	.88	27	.00
	Female	.21	17	.042	.85	17	.013

Table E2

Normality testing between handedness and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Handedness	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Right	.26	36	<.00	.82	36	<.00
	Left	.31	8	.02	.78	8	.01
TOM Activity Phase 1	Right	.18	36	.00	.88	36	.00
	Left	.23	8	.20	.88	8	.20
TOM Participation Phase 1	Right	.19	36	.00	.86	36	<.00
	Left	.25	8	.14	.88	8	.20
TOM Wellbeing Phase 1	Right	.31	36	<.00	.74	36	<.00
	Left	.40	8	<.00	.65	8	<.00
MAST Total Score Phase 1	Right	.21	36	<.00	.85	36	<.00
	Left	.21	8	.20	.91	8	.36
MAST Comprehension Score Phase 1	Right	.21	36	<.00	.84	36	<.00
	Left	.22	8	.20	.92	8	.46
MAST Expression Score Phase 1	Right	.17	36	.00	.88	36	.00
	Left	.21	8	.20	.89	8	.23
ASRS Phase 1	Right	.20	36	<.00	.88	36	.00
	Left	.31	8	.01	.78	8	.01

Table E3

Normality testing between age group and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Age	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	40-49 years	.30	6	.09	.77	6	.03
	50-59 years	.26	2	.			
	60-69 years	.31	14	<.00	.77	14	.00
	70-79 years	.26	14	.00	.80	14	.00
	80-89 years	.21	7	.20	.89	7	.31
TOM Activity Phase 1	40-49 years	.20	6	.20	.89	6	.33
	50-59 years	.26	2	.		2	
	60-69 years	.32	14	<.00	.79	14	.00
	70-79 years	.16	14	.20	.90	14	.14
	80-89 years	.14	7	.20	.92	7	.52
TOM Participation Phase 1	40-49 years	.26	6	.20	.87	6	.24
	50-59 years	.	2	.			
	60-69 years	.30	14	<.00	.84	14	.01
	70-79 years	.18	14	.18	.87	14	.04
	80-89 years	.26	7	.13	.81	7	.06
TOM Wellbeing Phase 1	40-49 years	.40	6	.00	.70	6	.00

	50-59 years	.	2	.			
	60-69 years	.35	14	<.00	.69	14	<.00
	70-79 years	.22	14	.04	.80	14	.00
	80-89 years	.31	7	.03	.78	7	.02
MAST Total Score Phase 1	40-49 years	.19	6	.20	.89	6	.31
	50-59 years	.26	2	.			
	60-69 years	.14	14	.20	.91	14	.20
	70-79 years	.25	14	.01	.82	14	.01
	80-89 years	.24	7	.20	.91	7	.42
MAST Comprehension Score Phase 1	40-49 years	.24	6	.20	.86	6	.21
	50-59 years	.26	2	.			
	60-69 years	.15	14	.20	.94	14	.50
	70-79 years	.24	14	.02	.83	14	.01
	80-89 years	.23	7	.20	.89	7	.29
MAST Expression Score Phase 1	40-49 years	.22	6	.20	.85	6	.16
	50-59 years	.26	2	.			
	60-69 years	.18	14	.20	.91	14	.16
	70-79 years	.22	14	.06	.81	14	.00
	80-89 years	.26	7	.14	.86	7	.16
ASRS Phase 1	40-49 years	.26	6	.20	.79	6	.05
	50-59 years	.26	2	.			

60-69 years	.20	14	.12	.87	14	.05
70-79 years	.23	14	.03	.86	14	.03
80-89 years	.24	7	.20	.92	7	.47

* All outcomes are constant when Age = 90-99 years therefore they have been omitted.

Table E4

Normality testing between education and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Education	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Primary	.22	20	.01	.86	20	.01
	Secondary	.32	16	.00	.67	16	<.00
	Post-Secondary	.22	6	.20	.87	6	.25
	University	.26	2	.			
TOM Activity Phase 1	Primary	.24	20	.00	.87	20	.01
	Secondary	.21	16	.04	.87	16	.02
	Post-Secondary	.20	6	.20	.90	6	.42
	University	.26	2	.			
TOM Participation Phase 1	Primary	.29	20	<.00	.81	20	.00
	Secondary	.17	16	.19	.91	16	.13
	Post-Secondary	.22	6	.20	.87	6	.25
	University	.26	2	.			
TOM Wellbeing Phase 1	Primary	.31	20	<.00	.73	20	<.00
	Secondary	.28	16	.00	.78	16	.00
	Post-Secondary	.44	6	<.00	.66	6	.00
	University	.26	2				
MAST Total Score Phase 1	Primary	.23	20	.00	.86	20	.00
	Secondary	.21	16	.05	.81	16	.00
	Post-Secondary	.20	6	.20	.96	6	.81
	University	.26	2	.			
MAST Comprehension Score Phase 1	Primary	.24	20	.00	.87	20	.01
	Secondary	.28	16	.00	.83	16	.00
	Post-Secondary	.15	6	.20	.96	6	.84
	University	.26	2	.			
MAST Expression Score Phase 1	Primary	.21	20	.01	.88	20	.02
	Secondary	.19	16	.08	.86	16	.02
	Post-Secondary	.19	6	.20	.90	6	.41
	University	.26	2	.			
ASRS Phase 1	Primary	.23	20	.00	.86	20	.01
	Secondary	.24	16	.00	.84	16	.01
	Post-Secondary	.21	6	.20	.95	6	.80
	University	.26	2	.			

Table E5

Normality testing between language knowledge and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Lang.	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Monolingual	.22	17	.02	.83	17	.00
	Bilingual	.26	25	<.00	.80	25	<.00
	Multilingual	.26	2	.			
TOM Activity Phase 1	Monolingual	.17	17	.17	.87	17	.02
	Bilingual	.19	25	.01	.90	25	.02
	Multilingual	.26	2	.			
TOM Participation Phase 1	Monolingual	.30	17	<.00	.79	17	.00
	Bilingual	.17	25	.06	.89	25	.03
	Multilingual	.26	2				
TOM Wellbeing Phase 1	Monolingual	.36	17	<.00	.69	17	<.00
	Bilingual	.30	25	<.00	.74	25	<.00
	Multilingual	.26	2	.			
MAST Total Score Phase 1	Monolingual	.17	17	.18	.89	17	.06
	Bilingual	.23	25	.00	.82	25	<.00
	Multilingual	.26	2	.			
MAST Comprehension Score Phase 1	Monolingual	.15	17	.20	.90	17	.09
	Bilingual	.24	25	<.00	.82	25	<.00
	Multilingual	.26	2	.			
MAST Expression Score Phase 1	Monolingual	.17	17	.15	.86	17	.02
	Bilingual	.18	25	.02	.87	25	.00
	Multilingual	.26	2	.			
ASRS Phase 1	Monolingual	.18	17	.14	.86	17	.01
	Bilingual	.20	25	.00	.86	25	.00
	Multilingual	.26	2				

Table E6

Normality testing between stroke type and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Stroke type	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Ischaemic	.27	37	<.00	.80	37	<.00
	Haemorrhagic	.44	7	<.00	.65	7	.00
TOM Activity Phase 1	Ischaemic	.20	37	<.00	.87	37	<.00
	Haemorrhagic	.17	7	.20	.96	7	.87
TOM Participation Phase 1	Ischaemic	.19	37	.00	.87	37	<.00
	Haemorrhagic	.31	7	.03	.72	7	.00
TOM Wellbeing Phase 1	Ischaemic	.30	37	<.00	.75	37	<.00
	Haemorrhagic	.43	7	<.00	.60	7	<.00
MAST Total Score Phase 1	Ischaemic	.20	37	<.00	.86	37	<.00
	Haemorrhagic	.31	7	.03	.75	7	.01
MAST Comprehension Score Phase 1	Ischaemic	.20	37	<.00	.87	37	<.00
	Haemorrhagic	.28	7	.09	.78	7	.02
MAST Expression Score Phase 1	Ischaemic	.17	37	.00	.85	37	<.00
	Haemorrhagic	.25	7	.17	.86	7	.16
ASRS Phase 1	Ischaemic	.24	37	<.00	.83	37	<.00
	Haemorrhagic	.26	7	.14	.91	7	.42

Table E7

Normality testing between lesion location affected and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Posterior Occlusion	.26	2	.			
	Left MCA	.22	5	.200	.90	5	.42
	Right MCA	.44	4	.	.63	4	.00
	Multiple Infarcts	.20	9	.200	.86	9	.09
	Haemorrhagic	.26	2	.			
TOM Activity Phase 1	Posterior Occlusion	.26	2	.			
	Left MCA	.22	5	.20	.90	5	.42
	Right MCA	.32	4	.	.89	4	.40
	Multiple Infarcts	.26	9	.06	.85	9	.08
	Haemorrhagic	.26	2	.			
TOM Participation Phase 1	Posterior Occlusion	.26	2	.			
	Left MCA	.36	5	.02	.75	5	.03
	Right MCA	.32	4	.	.89	4	.40
	Multiple Infarcts	.28	9	.03	.80	9	.02
	Haemorrhagic	.	2	.			
TOM Wellbeing Phase 1	Posterior Occlusion	.26	2	.			
	Left MCA	.42	5	.00	.72	5	.01
	Right MCA	.30	4	.		4	.02
	Multiple Infarcts	.28	9	.03		9	.02
	Haemorrhagic	.	2	.			
MAST Total Score Phase 1	Posterior Occlusion	.26	2	.			
	Left MCA	.35	5	.04	.79	5	.07
	Right MCA	.37	4	.	.78	4	.07
	Multiple Infarcts	.20	9	20	.86	9	.10
	Haemorrhagic	.26	2	.			
MAST Comprehension Score Phase 1	Posterior Occlusion	.26	2	.			
	Left MCA	.26	5	.20	.84	5	.19
	Right MCA	.41	4	.	.72	4	.01
	Multiple Infarcts	.22	9	.20	.86	9	.10
	Haemorrhagic	.26	2	.			
	Posterior Occlusion	.26	2	.			

MAST Expression Score Phase 1	Left MCA	.31	5	.11	.76	5	.04
	Right MCA	.31	4	.	.85	4	.24
	Multiple Infarcts	.28	9	.03	.79	9	.01
	Haemorrhagic	.26	2	.			
	Posterior Occlusion	.26	2	.			
ASRS Phase 1	Left MCA	.31	5	.13	.87	5	.27
	Right MCA	.26	4		.82	4	.16
	Multiple Infarcts	.18	9	.20	.87	9	.14
	Haemorrhagic	.26	2				

Table E8

Normality testing between hemisphere affected and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Left	.25	26	<.00	.82	26	<.00
	Right	.32	16	<.00	.78	16	.00
	Both	.	2	.			
TOM Activity Phase 1	Left	.20	26	.00	.89	26	.01
	Right	.20	16	.08	.86	16	.02
	Both	.	2	.			
TOM Participation Phase 1	Left	.19	26	.01	.88	26	.00
	Right	.27	16	.00	.85	16	.01
	Both	.	2	.			
TOM Wellbeing Phase 1	Left	.40	26	<.00	.66	26	<.00
	Right	.22	16	.02	.77	16	.00
	Both	.	2	.			
MAST Total Score Phase 1	Left	.20	26	.00	.87	26	.00
	Right	.22	16	.03	.85	16	.01
	Both	.	2	.			
MAST Comprehension Score Phase 1	Left	.21	26	.00	.88	26	.00
	Right	.25	16	.00	.83	16	.00
	Both	.	2	.			
MAST Expression Score Phase 1	Left	.15	26	.13	.89	26	.01
	Right	.23	16	.02	.84	16	.01
	Both	.	2	.			
ASRS Phase 1	Left	.17	26	.03	.89	26	.01
	Right	.25	16	.01	.84	16	.01
	Both	.	2	.			

Table E9

Normality testing between previous stroke and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Yes	.21	9	.20	.88	9	.19
	No	.25	35	<.00	.79	35	<.00
TOM Activity Phase 1	Yes	.15	9	.20	.93	9	.60
	No	.20	35	.00	.87	35	<.00
TOM Participation Phase 1	Yes	.19	9	.20	.92	9	.49
	No	.22	35	<.01	.84	35	<.00
TOM Wellbeing Phase 1	Yes	.32	9	.01	.76	9	.01
	No	.31	35	<.00	.72	35	<.00
MAST Total Score Phase 1	Yes	.29	9	.04	.87	9	.15
	No	.20	35	.00	.86	35	<.00
MAST Comprehension Score Phase 1	Yes	.27	9	.08	.81	9	.04
	No	.18	35	.00	.87	35	<.00
MAST Expression Score Phase 1	Yes	.25	9	.13	.87	9	.18
	No	.16	35	.01	.85	35	<.00
ASRS Phase 1	Yes	.26	9	.10	.89	9	.27
	No	.24	35	<.00	.82	35	<.00

Table E10

Normality testing between thrombolysis and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Yes	.26	14	.00	.85	14	.02
	No	.27	30	<.00	.79	30	<.00
TOM Activity Phase 1	Yes	.18	14	.20	.89	14	.09
	No	.20	30	.00	.86	30	.00
TOM Participation Phase 1	Yes	.26	14	.00	.87	14	.04
	No	.28	30	<.00	.83	30	<.00
TOM Wellbeing Phase 1	Yes	.33	14	<.00	.74	14	.00
	No	.33	30	<.00	.68	30	<.00
MAST Total Score Phase 1	Yes	.23	14	.03	.87	14	.04
	No	.18	30	.00	.86	30	.00
MAST Comprehension Score Phase 1	Yes	.17	14	.20	.88	14	.07
	No	.22	30	<.00	.86	30	.00
MAST Expression Score Phase 1	Yes	.25	14	.01	.86	14	.03
	No	.15	30	.06	.89	30	.00
ASRS Phase 1	Yes	.18	14	.18	.90	14	.13
	No	.20	30	.00	.86	30	.00

Table E11

Normality testing between mechanical thrombectomy and outcomes in Phase 1

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 1	Yes	.20	10	.20	.90	10	.22
	No	.26	34	<.00	.78	34	<.00
TOM Activity Phase 1	Yes	.27	10	.03	.85	10	.06
	No	.22	34	<.00	.85	34	<.00
TOM Participation Phase 1	Yes	.28	10	.01	.81	10	.02
	No	.24	34	<.00	.86	34	<.00
TOM Wellbeing Phase 1	Yes	.31	10	.00	.80	10	.01
	No	.33	34	<.00	.69	34	<.00
MAST Total Score Phase 1	Yes	.18	10	.20	.89	10	.20
	No	.21	34	<.00	.84	34	<.00
MAST Comprehension Score Phase 1	Yes	.19	10	.20	.92	10	.41
	No	.24	34	<.00	.84	34	<.00
MAST Expression Score Phase 1	Yes	.24	10	.09	.88	10	.14
	No	.17	34	.01	.88	34	.00
ASRS Phase 1	Yes	.24	10	.09	.88	10	.13
	No	.21	34	<.00	.85	34	<.00

Table E12

Normality testing between gender and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Sex	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Male	.34	20	<.00	.76	20	<.00
	Female	.20	16	.07	.90	16	.10
TOM Activity Phase 2	Male	.25	20	.00	.79	20	<.00
	Female	.18	16	.13	.88	16	.05
TOM Participation Phase 2	Male	.26	20	<.00	.74	20	<.00
	Female	.20	16	.07	.90	16	.10
TOM Wellbeing Phase 2	Male	.30	20	<.00	.73	20	<.00
	Female	.19	16	.11	.87	16	.02
ASRS Phase 1	Male	.31	20	<.00	.73	20	<.00
	Female	.19	16	.09	.91	16	.11
EQ-5D-5L Health Score Phase 2	Male	.15	20	.86	.86	20	.00
	Female	.16	16	.91	.91	16	.14

Table E13

Normality testing between handedness and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Right	.29	30	<.00	.82	30	<.00
	Left	.28	6	.13	.75	6	.02
TOM Activity Phase 2	Right	.22	30	<.00	.85	30	<.00
	Left	.40	6	.00	.70	6	.00
TOM Participation Phase 2	Right	.25	30	<.00	.84	30	<.00
	Left	.40	6	.00	.70	6	.00
TOM Wellbeing Phase 2	Right	.23	30	<.00	.80	30	<.00
	Left	.40	6	.00	.64	6	.00
ASRS Phase 2	Right	.29	30	<.00	.84	30	<.00
	Left	.30	6	.09	.83	6	.11
EQ-5D-5L Health Score Phase 2	Right	.18	30	.01	.89	30	.00
	Left	.32	6	.05	.72	6	.01

Table E14

Normality testing between age group and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Age	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	40-49 years	.20	6	.20	.90	6	.41
	50-59 years	.26	2	.		2	
	60-69 years	.30	11	.00	.79	11	.00
	70-79 years	.40	10	<.00	.72	10	.00
	80-89 years	.21	6	.20	.95	6	.80
TOM Activity Phase 2	40-49 years	.20	6	.20	.90	6	.41
	50-59 years	.	2	.		2	
	60-69 years	.31	11	.00	.63	11	<.00
	70-79 years	.23	10	.13	.82	10	.02
	80-89 years	.23	6	.20	.95	6	.73
TOM Participation Phase 2	40-49 years	.26	6	.20	.82	6	.09
	50-59 years	.	2	.		2	
	60-69 years	.35	11	<.00	.66	11	<.00
	70-79 years	.29	10	.01	.80	10	.01
	80-89 years	.23	6	.20	.95	6	.73
TOM Wellbeing Phase 2	40-49 years	.40	6	.00	.69	6	.00
	50-59 years	.26	2	.		2	
	60-69 years	.36	11	<.00	.69	11	<.00
	70-79 years	.21	10	.19	.85	10	.06
	80-89 years	.31	6	.06	.79	6	.05
ASRS Phase 2	40-49 years	.28	6	.13	.75	6	.02
	50-59 years	.26	2	.		2	
	60-69 years	.31	11	.00	.63	11	<.00
	70-79 years	.30	10	.01	.81	10	.02
	80-89 years	.20	6	.20	.90	6	.42
EQ-5D-5L Health Score Phase 2	40-49 years	.23	6	.20	.90	6	.40
	50-59 years	.	2	.		2	
	60-69 years	.19	11	.20	.86	11	.07
	70-79 years	.25	10	.07	.84	10	.04
	80-89 years	.20	6	.20	.95	6	.81

* All outcomes are constant when Age = 90-99 years therefore they have been omitted.

Table E15

Normality testing between education and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Education	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Primary	.35	16	<.00	.78	16	.00
	Secondary	.30	12	.00	.77	12	.00
	Post-Secondary	.20	6	.20	.85	6	.16
	University	.26	2	.			
TOM Activity Phase 2	Primary	.26	16	.00	.81	16	.00
	Secondary	.30	12	.00	.76	12	.00
	Post-Secondary	.16	6	.20	.98	6	.96
	University	.26	2	.			
TOM Participation Phase 2	Primary	.27	16	.00	.75	16	<.00
	Secondary	.28	12	.00	.77	12	.00
	Post-Secondary	.22	6	.20	.90	6	.42
	University	.26	2	.			
TOM Wellbeing Phase 2	Primary	.29	16	<.00	.71	16	<.00
	Secondary	.27	12	.01	.76	12	.00
	Post-Secondary	.28	6	.13	.75	6	.02
	University	.26	2	.			
ASRS Phase 2	Primary	.23	16	.02	.80	16	.00
	Secondary	.27	12	.01	.82	12	.01
	Post-Secondary	.31	6	.06	.76	6	.02
	University	.26	2	.			
EQ-5D-5L Health Score Phase 2	Primary	.24	16	.01	.84	16	.01
	Secondary	.14	12	.20	.93	12	.45
	Post-Secondary	.21	6	.20	.92	6	.52
	University	.26	2	.			

Table E16

Normality testing between language knowledge and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Monolingual	.33	14	<.00	.838	14	.01
	Bilingual	.26	20	<.00	.810	20	.00
	Multilingual	.26	2	.			
TOM Activity Phase 2	Monolingual	.24	14	.02	.800	14	.00
	Bilingual	.24	20	.00	.839	20	.00
	Multilingual	.26	2	.			
TOM Participation Phase 2	Monolingual	.27	14	.00	.772	14	.00
	Bilingual	.23	20	.00	.845	20	.00
	Multilingual	.26	2	.			
TOM Wellbeing Phase 2	Monolingual	.28	14	.00	.728	14	<.00
	Bilingual	.21	20	.01	.845	20	.00
	Multilingual	.26	2	.			
ASRS Phase 2	Monolingual	.21	14	.06	.799	14	.00
	Bilingual	.30	20	<.00	.829	20	.00
	Multilingual	.26	2	.			
EQ-5D-5L Health Score Phase 2	Monolingual	.25	14	.014	.840	14	.01
	Bilingual	.15	20	.20	.931	20	.16
	Multilingual	.26	2	.			

Table E17

Normality testing between stroke type and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Stroke type	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Ischaemic	.27	32	<.00	.84	32	<.00
	Haemorrhagic	.44	4	.	.63	4	.00
TOM Activity Phase 2	Ischaemic	.22	32	<.00	.83	32	<.00
	Haemorrhagic	.25	4	.	.94	4	.68
TOM Participation Phase 2	Ischaemic	.23	32	<.00	.83	32	<.00
	Haemorrhagic	.28	4	.	.86	4	.27
TOM Wellbeing Phase 2	Ischaemic	.26	32	<.00	.80	32	<.00
	Haemorrhagic	.44	4	.	.63	4	.00
ASRS Phase 2	Ischaemic	.26	32	<.00	.84	32	<.00
	Haemorrhagic	.25	4	.	.94	4	.68
EQ-5D-5L Health Score Phase 2	Ischaemic	.16	32	.02	.88	32	.00
	Haemorrhagic	.2	4	.	.86	4	.27

Table E18

Normality testing between lesion location affected and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Posterior Occlusion	.26	2.	.			
	Left MCA	.17	3	.	1.00	3	1.00
	Right MCA	.25	4	.	.94	4	.68
	Multiple Infarcts	.19	9	.20	.93	9	.48
	Haemorrhagic	.	2	.			
TOM Activity Phase 2	Posterior Occlusion	.26	2	.			
	Left MCA	.38	3	.	.75	3	.00
	Right MCA	.28	4	.	.86	4	.27
	Multiple Infarcts	.18	9	.20	.93	9	.54
	Haemorrhagic	.26	2	.			
TOM Participation Phase 2	Posterior Occlusion	.26	2	.			
	Left MCA	.38	3	.	.75	3	.00
	Right MCA	.28	4	.	.86	4	.27
	Multiple Infarcts	.25	9	.10	.83	9	.05
	Haemorrhagic	.	2	.			
TOM Wellbeing Phase 2	Posterior Occlusion	.26	2	.			
	Left MCA	.25	3	.	.96	3	.63
	Right MCA	.27	4	.	.84	4	.22
	Multiple Infarcts	.24	9	.13	.83	9	.05
	Haemorrhagic	.26	2	.			
ASRS Phase 2	Posterior Occlusion	.	2	.			
	Left MCA	.38	3	.	.75	3	.00
	Right MCA	.28	4	.	.86	4	.27
	Multiple Infarcts	.24	9	.12	.85	9	.08
	Haemorrhagic	.26	2	.			
EQ-5D-5L Phase 2	Posterior Occlusion	.26	2	.			
	Left MCA	.34	3	.	.84	3	.22
	Right MCA	.30	4	.	.79	4	.08
	Multiple Infarcts	.27	9	.05	.84	9	.07
	Haemorrhagic	.26	2	.			

Table E19

Normality testing between hemisphere effected and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
	Hemisphere	Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Left	.24	21	.00	.86	21	.00
	Right	.33	14	<.00	.73	14	<.00
TOM Activity Phase 2	Left	.18	21	.05	.87	21	.01
	Right	.26	14	.00	.70	14	<.00
TOM Participation Phase 2	Left	.20	21	.01	.85	21	.00
	Right	.30	14	<.00	.74	14	.00
TOM Wellbeing Phase 2	Left	.24	21	.00	.81	21	.00
	Right	.26	14	.00	.73	14	<.00
ASRS Phase 2	Left	.32	21	<.00	.79	21	<.00
	Right	.24	14	.02	.87	14	.05
EQ-5D-5L Health Score Phase 2	Left	.17	21	.11	.88	21	.01
	Right	.25	14	.01	.83	14	.01

* All outcomes are constant when Hemisphere effected = Both therefore they have been omitted.

Table E20

Normality testing between previous stroke and outcomes in Phase 2

	Kolomogrov-Smirnov	Shapiro-Wilk

		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Yes	.28	6	.	.86	6	.27
	No	.30	31	<.00	.80	31	<.00
TOM Activity Phase 2	Yes	.28	6	.	.86	6	.27
	No	.22	31	<.00	.83	31	<.00
TOM Participation Phase 2	Yes	.28	6	.	.86	6	.27
	No	.26	31	<.00	.79	31	<.00
TOM Wellbeing Phase 2	Yes	.15	6	.	.99	6	.97
	No	.27	31	<.00	.75	31	<.00
ASRS Phase 2	Yes	.15	6	.	.99	6	.97
	No	.29	31	<.00	.80	31	<.00
EQ-5D-5L Phase 2	Yes	.26	6	.	.87	6	.32
	No	.18	31	.01	.87	31	.00

Table E21

Normality testing between thrombolysis and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		

		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Yes	.20	12	.15	.87	12	.06
	No	.31	24	<.00	.83	24	<.00
TOM Activity Phase 2	Yes	.19	12	.20	.88	12	.10
	No	.25	24	<.00	.80	24	<.00
TOM Participation Phase 2	Yes	.17	12	.20	.88	12	.10
	No	.26	24	<.00	.80	24	<.00
TOM Wellbeing Phase 2	Yes	.24	12	.04	.84	12	.03
	No	.24	24	<.00	.79	24	<.00
ASRS Phase 2	Yes	.25	12	.03	.86	12	.06
	No	.27	24	<.00	.81	24	<.00
EQ-5D-5L Health Score Phase 2	Yes	.19	12	.20	.88	12	.09
	No	.19	24	.02	.89	24	.01

Table E22

Normality testing between mechanical thrombectomy and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		

		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Yes	.19	8	.20	.91	8	.42
	No	.29	28	<.00	.83	28	<.00
TOM Activity Phase 2	Yes	.19	8	.20	.93	8	.52
	No	.24	28	<.00	.79	28	<.00
TOM Participation Phase 2	Yes	.20	8	.20	.88	8	.20
	No	.24	28	<.00	.82	28	<.00
TOM Wellbeing Phase 2	Yes	.29	8	.03	.81	8	.04
	No	.25	28	<.00	.79	28	<.00
ASRS Phase 2	Yes	.28	8	.05	.80	8	.03
	No	.24	28	<.00	.87	28	.00
EQ-5D-5L Health Score Phase 2	Yes	.22	8	.20	.88	8	.19
	No	.16	28	.05	.91	28	.02

Table E23

Normality testing between gender and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		

		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Male	.38	18	<.00	.64	18	<.00
	Female	.25	12	.03	.86	12	.05
TOM Activity Phase 3	Male	.37	18	<.00	.69	18	<.00
	Female	.28	12	.01	.82	12	.01
TOM Participation Phase 3	Male	.42	18	<.00	.60	18	<.00
	Female	.29	12	.00	.80	12	.01
TOM Wellbeing Phase 3	Male	.29	18	<.00	.68	18	<.00
	Female	.21	12	.13	.81	12	.01
MAST Total Score Phase 3	Male	.18	18	.09	.83	18	.00
	Female	.22	12	.10	.37	12	.07
MAST Comprehension Score Phase 3	Male	.21	18	.03	.82	18	.00
	Female	.25	12	.02	.82	12	.01
MAST Expression Score Phase 3	Male	.13	18	.20	.91	18	.11
	Female	.22	12	.09	.86	12	.04
ASRS Phase 3	Male	.25	18	.00	.78	18	<.00
	Female	.15	12	.20	.91	12	.23
EQ-5D-5L Health Score Phase 3	Male	.20	18	.04	.84	18	.00
	Female	.29	12	.00	.72	12	.00

Table E24

Normality testing between handedness and outcomes in Phase 3

	Kolomogrov-Smirnov	Shapiro-Wilk

		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Right	.29	25	<.00	.75	25	<.00
	Left	.36	5	.03	.76	5	.04
TOM Activity Phase 3	Right	.27	25	<.00	.74	25	<.00
	Left	.34	5	.04	.77	5	.04
TOM Participation Phase	Right	.37	25	<.00	.67	25	<.00
3	Left	.34	5	0.46	.77	5	.04
TOM Wellbeing Phase 3	Right	.23	25	.00	.74	25	<.00
	Left	.22	5	.20	.84	5	.17
MAST Total Score Phase	Right	.23	25	<.00	.86	25	.00
3	Left	.14	5	.20	.98	5	.96
MAST Comprehension	Right	.23	25	<.00	.74	25	<.00
Score Phase 3	Left	.28	5	.20	.91	5	.50
MAST Expression Score	Right	.21	25	.00	.86	25	.00
Phase 3	Left	.14	5	.20	.99	5	.99
ASRS Phase 3	Right	.20	25	.01	.85	25	.00
	Left	.22	5	.20	.86	5	.25
EQ-5D-5L Health Score	Right	.23	25	<.00	.75	25	<.00
Phase 3	Left	.31	5	.10	.80	5	.081

Table E25

Normality testing between age group and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	40-49 years	.36	5	.02	.68	5	.00
	50-59 years	.26	2	.			
	60-69 years	.51	9	<.00	.39	9	<.00
	70-79 years	.27	9	.04	.76	9	.00
	80-89 years	.23	5	.20	.96	5	.81
TOM Activity Phase 3	40-49 years	.36	5	.02	.68	5	.00
	50-59 years	.	2	.			
	60-69 years	.39	9	<.00	.68	9	<.00
	70-79 years	.33	9	.00	.76	9	.00
	80-89 years	.27	5	.20	.85	5	.20
TOM Participation Phase	40-49 years	.47	5	<.00	.55	5	<.00
	50-59 years	.26	2	.			
	60-69 years	.51	9	<.00	.39	9	<.00
	70-79 years	.30	9	.01	.71	9	.00
	80-89 years	.22	5	.20	.90	5	.42
TOM Wellbeing Phase 3	40-49 years	.36	5	.02	.68	5	.00
	50-59 years	.	2	.			
	60-69 years	39	9	<.00	.68	9	<.00
	70-79 years	.23	9	.17	.81	9	.02
	80-89 years	.30	5	.16	.88	5	.32
MAST Total Score Phase 3	40-49 years	.43	5	.00	.62	5	.00

	50-59 years	.26	2	.			
	60-69 years	.22	9	.20	.91	9	.32
	70-79 years	.22	9	.20	.82	9	.03
	80-89 years	.18	5	.20	.94	5	.66
MAST Comprehension Score Phase 3	40-49 years	.44	5	.00	.66	5	.00
	50-59 years	.26	2	.			
	60-69 years	.22	9	.19	.80	9	.02
	70-79 years	.20	9	.20	.86	9	.11
	80-89 years	.21	5	.20	.88	5	.34
MAST Expression Score Phase 3	40-49 years	.43	5	.00	.63	5	.00
	50-59 years	.26	2	.			
	60-69 years	.20	9	.20	.89	9	.23
	70-79 years	.17	9	.20	.91	9	.32
	80-89 years	.20	5	.20	.93	5	.62
ASRS Phase 3	40-49 years	.23	5	.20	.88	5	.31
	50-59 years	.26	2	.			
	60-69 years	.30	9	.01	.71	9	.00
	70-79 years	.17	9	.20	.89	9	.24
	80-89 years	.25	5	.20	.91	5	.49
EQ-5D-5L Health Score Phase 3	40-49 years	.17	5	.20	.99	5	.97
	50-59 years	.26	2	.			
	60-69 years	.25	9	.08	.89	9	.21
	70-79 years	.19	9	.20	.86	9	.11
	80-89 years	.36	5	.02	.82	5	.13

* All outcomes are constant when Age = 90-99 years therefore they have been omitted.

Table E26

Normality testing between education and outcomes in Phase 3

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Primary	.25	13	.01	.78	13	.00
	Secondary	.43	10	<.00	.59	10	<.00
	Post-Secondary	.27	5	.20	.85	5	.20
	University	.26	2	.			
TOM Activity Phase 3	Primary	.28	13	.00	.73	13	.00
	Secondary	.43	10	<.00	.59	10	<.00
	Post-Secondary	.23	5	.20	.88	5	.31
	University	.26	2	.			
TOM Participation Phase 3	Primary	.36	13	<.00	.69	13	<.00
	Secondary	.43	10	<.00	.59	10	<.00
	Post-Secondary	.24	5	.20	.82	5	.11
	University	.	2	.			
TOM Wellbeing Phase 3	Primary	.33	13	<.00	.70	13	<.00
	Secondary	.36	10	<.00	.71	10	.00
	Post-Secondary	.23	5	.20	.88	5	.31
	University	.26	2	.			
MAST Total Score Phase 3	Primary	.15	13	.20	.93	13	.34
	Secondary	.27	10	.03	.84	10	.04
	Post-Secondary	.22	5	.20	.86	5	.25
	University	.26	2	.			
MAST Comprehension Score Phase	Primary	.23	13	.04	.89	13	.09
	Secondary	.20	10	.20	.91	10	.28
	Post-Secondary	.21	5	.20	.94	5	.68
	University	.	2	.			
MAST Expression Score Phase 3	Primary	.17	13	.20	.91	13	.24
	Secondary	.25	10	.05	.77	10	.00
	Post-Secondary	.24	5	.20	.85	5	.22
	University	.26	2	.			
ASRS Phase 3	Primary	.19	13	.17	.87	13	.06
	Secondary	.30	10	.00	.75	10	.00
	Post-Secondary	.28	5	.20	.91	5	.49
	University	.26	2	.			
EQ-5D-5L Health Score Phase 3	Primary	.21	13	.08	.79	13	.00
	Secondary	.16	10	.20	.94	10	.55
	Post-Secondary	.15	5	.20	.98	5	.94
	University	.26	2	.		2	

Table E27

Normality testing between language knowledge and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Monolingual	.35	12	<.00	.74	12	.00
	Bilingual	.27	16	.00	.71	16	<.00
	Multilingual	.26	2				
TOM Activity Phase 3	Monolingual	.28	12	.00	.77	12	.00
	Bilingual	.31	16	<.00	.75	16	<.00
	Multilingual	.26	2	.			
TOM Participation Phase 3	Monolingual	.35	12	<.00	.74	12	.00
	Bilingual	.35	16	<.00	.64	16	<.00
	Multilingual	.	2	.			
TOM Wellbeing Phase 3	Monolingual	.31	12	.00	.67	12	<.00
	Bilingual	.22	16	.02	.77	16	.00
	Multilingual	.26	2	.			
MAST Total Score Phase 3	Monolingual	.12	12	.20	.94	12	.52
	Bilingual	.28	16	.00	.82	16	.00
	Multilingual	.26	2	.			
MAST Comprehension Score Phase 3	Monolingual	.23	12	.07	.84	12	.03
	Bilingual	.27	16	.00	.80	16	.00
	Multilingual	.26	2	.			
MAST Expression Score Phase 3	Monolingual	.17	12	.20	.90	12	.18
	Bilingual	.22	16	.02	.90	16	.08
	Multilingual	.26	2	.			
ASRS Phase 3	Monolingual	.30	12	.00	.78	12	.00
	Bilingual	.20	16	.07	.90	16	.10
	Multilingual	.26	2	.			
EQ-5D-5L Health Score Phase 3	Monolingual	.21	12	.14	.77	12	.00
	Bilingual	.15	16	.20	.89	16	.06
	Multilingual	.26	2	.			

Table E28

Normality testing between stroke type and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Ischaemic	.30	27	<.00	.75	27	<.00
	Haemorrhagic	.38	3	.	.75	3	.00
TOM Activity Phase 3	Ischaemic	.29	27	<.00	.74	27	<.00
	Haemorrhagic	.38	3	.	.75	3	.00
TOM Participation Phase 3	Ischaemic	.37	27	<.00	.69	27	<.00
	Haemorrhagic	.38	3	.	.75	3	.00
TOM Wellbeing Phase 3	Ischaemic	.23	27	<.00	.74	27	<.00
	Haemorrhagic	.38	3	.	.75	3	.00
MAST Total Score Phase 3	Ischaemic	.19	27	.01	.89	27	.01
	Haemorrhagic	.17	3	.	.99	3	.94
MAST Comprehension Score Phase 3	Ischaemic	.19	27	.00	.85	27	.00
	Haemorrhagic	.30	3	.	.90	3	.40
MAST Expression Score Phase 3	Ischaemic	.16	27	.07	.89	27	.01
	Haemorrhagic	.25	3	.	.96	3	.63
ASRS Phase 3	Ischaemic	.20	27	.00	.84	27	<.00
	Haemorrhagic	.17	3	.	1.00	3	1.00
EQ-5D-5L Health Score Phase 3	Ischaemic	.19	27	.01	.82	27	<.00
	Haemorrhagic	.34	3	.	.83	3	.19

Table 29

Normality testing between lesion location affected and outcomes in Phase 3

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Posterior Occlusion	.26	4	.		4	
	Left MCA	.38	6	.	.75	6	.00
	Right MCA	.30	4	.	.72	4	.02
	Multiple Infarcts	.27	11	.16	.77	11	.03
	Haemorrhagic	.	2	.		2	
TOM Activity Phase 3	Posterior Occlusion	.26	4	.		4	
	Left MCA	.38	6	.	.750	6	.00
	Right MCA	.44	4	.	.630	4	.00
	Multiple Infarcts	.31	11	.05	.683	11	.00
	Haemorrhagic	.26	2	.		2	
TOM Participation Phase 3	Posterior Occlusion	.26	4	.		4	
	Left MCA	.	6	.	.	6	.
	Right MCA	.	4	.	.	4	.
	Multiple Infarcts	.37	11	.00	.66	11	.00
	Haemorrhagic	.	2	.		2	
TOM Wellbeing Phase 3	Posterior Occlusion	.26	4	.		4	
	Left MCA	.38	6	.	.75	6	.00
	Right MCA	.30	4	.	.81	4	.12
	Multiple Infarcts	.29	11	.11	.82	11	.09
	Haemorrhagic	.	2	.		2	
MAST Total Score Phase 3	Posterior Occlusion	.26	4	.		4	
	Left MCA	.30	6	.	.91	6	.42
	Right MCA	.30	4	.	.90	4	.47
	Multiple Infarcts	.31	11	.06	.74	11	.01
	Haemorrhagic	.26	2	.		2	
MAST Comprehension Score Phase 3	Posterior Occlusion	.26	4	.	.99	4	
	Left MCA	.18	6	.	.99	6	.91
	Right MCA	.14	4	.	.70	4	.99
	Multiple Infarcts	.35	11	.01		11	.00
	Haemorrhagic	.26	2	.		2	

	Posterior Occlusion	.26	4	.	.75	4	
MAST	Left MCA	.38	6	.	.70	6	.00
Expression	Right MCA	.38	4	.	.77	4	.01
Score Phase 3	Multiple Infarcts	.27	11	.15		11	.03
	Haemorrhagic	.26	2	.		2	
	Posterior Occlusion	.26	4	.	.75	4	
ASRS Phase 3	Left MCA	.38	6	.	.99	6	.00
	Right MCA	.15	4	.	.72	4	.97
	Multiple Infarcts	.33	11	.03		11	.01
	Haemorrhagic	.26	2	.		2	
EQ-5D-5L	Posterior Occlusion	.26	4	.	.75	4	
Phase 3	Left MCA	.38	6	.	.82	6	.00
	Right MCA	.29	4	.	.73	4	.14
	Multiple Infarcts	.35	11	.01		11	.01
	Haemorrhagic	.26	2	.		2	

Table E30

Normality testing between hemisphere affected and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Left	.31	19	<.00	.77	19	<.00
	Right	.33	10	.00	.67	10	<.00
TOM Activity Phase 3	Left	.24	19	.00	.80	19	.00
	Right	.39	10	<.00	.60	10	<.00
TOM Participation Phase 3	Left	.31	19	<.00	.77	19	<.00
	Right	.46	10	<.00	.50	10	<.00
TOM Wellbeing Phase 3	Left	.26	19	.00	.79	19	<.00
	Right	.27	10	.03	.74	10	.00
MAST Total Score Phase 3	Left	.20	19	.03	.90	19	.05
	Right	.17	10	.20	.87	10	.11
MAST Comprehension Score Phase 3	Left	.22	19	.01	.85	19	.00
	Right	.20	10	.20	.84	10	.05
MAST Expression Score Phase 3	Left	.17	19	.14	.90	19	.06
	Right	.23	10	.13	.84	10	.04
ASRS Phase 3	Left	.23	19	.00	.88	19	.02
	Right	.35	10	<.00	.74	10	.00
EQ-5D-5L Health Score Phase 3	Left	.24	19	.00	.82	19	.00
	Right	.22	10	.15	.84	10	.05

* All outcomes are constant when Hemisphere affected = Both therefore they have been omitted.

Table E31

Normality testing between previous stroke and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Yes	.38	4	.	.75	4	.00
	No	.34	26	<.00	.64	26	<.00
TOM Activity Phase 3	Yes	.38	4	.	.75	4	.00
	No	.37	26	<.00	.69	26	<.00
TOM Participation Phase 3	Yes	.	4	.	.	4	.
	No	40	26	<.00	.58	26	<.00
TOM Wellbeing Phase 3	Yes	.17	4	.	1.00	4	1.00
	No	.27	26	<.00	.69	26	<.00
MAST Total Score Phase 3	Yes	.33	4	.	.86	4	.27
	No	.18	26	.04	.82	26	<.00
MAST Comprehension Score Phase 3	Yes	.34	4	.	.83	4	.20
	No	.26	26	<.00	.74	26	<.00
MAST Expression Score Phase 3	Yes	.21	4	.	.99	4	.80
	No	.14	26	.20	.88	26	.10
ASRS Phase 3	Yes	.25	4	.	.96	4	.63
	No	.24	26	<.00	.82	26	<.00
EQ-5D-5L Health Score Phase 3	Yes	.18	4	.	.99	4	.90
	No	.14	26	.20	.84	26	.00

Table E32

Normality testing between thrombolysis and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Yes	.25	9	.08	.84	9	.06
	No	.32	21	<.00	.70	21	<.00
TOM Activity Phase 3	Yes	.29	9	.02	.75	9	.00
	No	.30	21	<.01	.76	21	<.00
TOM Participation Phase 3	Yes	.33	9	.00	.77	9	.01
	No	.38	21	<.00	.64	21	<.00
TOM Wellbeing Phase 3	Yes	.35	9	.00	.65	9	<.00
	No	.22	21	.00	.76	21	<.00
MAST Total Score Phase 3	Yes	.16	9	.20	.91	9	.32
	No	.19	21	.03	.90	21	.04
MAST Comprehension Score Phase 3	Yes	.19	9	.20	.89	9	.21
	No	.22	21	.00	.91	21	.06
MAST Expression Score Phase 3	Yes	.16	9	.20	.89	9	.24
	No	.16	21	.13	.89	21	.03
ASRS Phase 3	Yes	.28	9	.03	.80	9	.02
	No	.23	21	.00	.86	21	.00
EQ-5D-5L Health Score Phase 3	Yes	.26	9	.08	.84	9	.06
	No	.18	21	.06	.94	21	.27

Table E33

Normality testing between mechanical thrombectomy and outcomes in Phase 3

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Yes	.27	5	.20	.85	5	.20
	No	.32	25	<.00	.70	25	<.00
TOM Activity Phase 3	Yes	.30	5	.16	.83	5	.14
	No	.30	25	<.00	.75	25	<.00
TOM Participation Phase 3	Yes	.27	5	.20	.85	5	.20
	No	.39	25	<.00	.63	25	<.00
TOM Wellbeing Phase 3	Yes	.36	5	.02	.68	5	.00
	No	.22	25	.00	.74	25	<.00
MAST Total Score Phase 3	Yes	.16	5	.20	.97	5	.92
	No	.20	25	.00	.89	25	.01
MAST Comprehension Score Phase 3	Yes	.23	5	.20	.96	5	.82
	No	.21	25	.00	.88	25	.00
MAST Expression Score Phase 3	Yes	.24	5	.20	.90	5	.44
	No	.17	25	.04	.89	25	.01
ASRS Phase 3	Yes	.25	5	.20	.78	5	.05
	No	.20	25	.00	.86	25	.00
EQ-5D-5L Health Score Phase 3	Yes	.19	5	.20	.94	5	.72
	No	.17	25	.05	.94	25	.21

Table E34

Normality testing of the NIHSS in Phase 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
NIHSS	.10	44	.20	.93	44	.01

The below figure show that the distribution of marks in the NIHS Score is skewed to the left and do not satisfy the normality assumption.

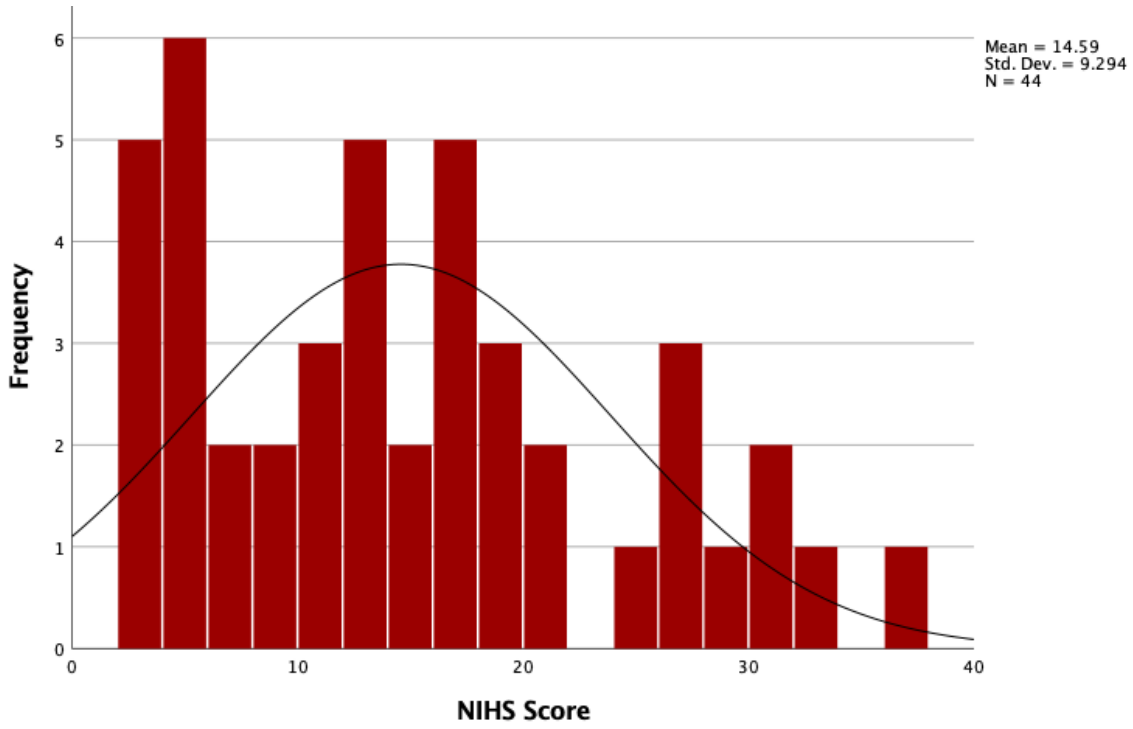


Figure E1: Distribution of NIHSS

Table E35

Normality testing of BLS in Phase 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
BLS	.32	44	<.00	.72	44	<.00

Moreover, Figure E2 illustrates that the distribution of the BLS scores.

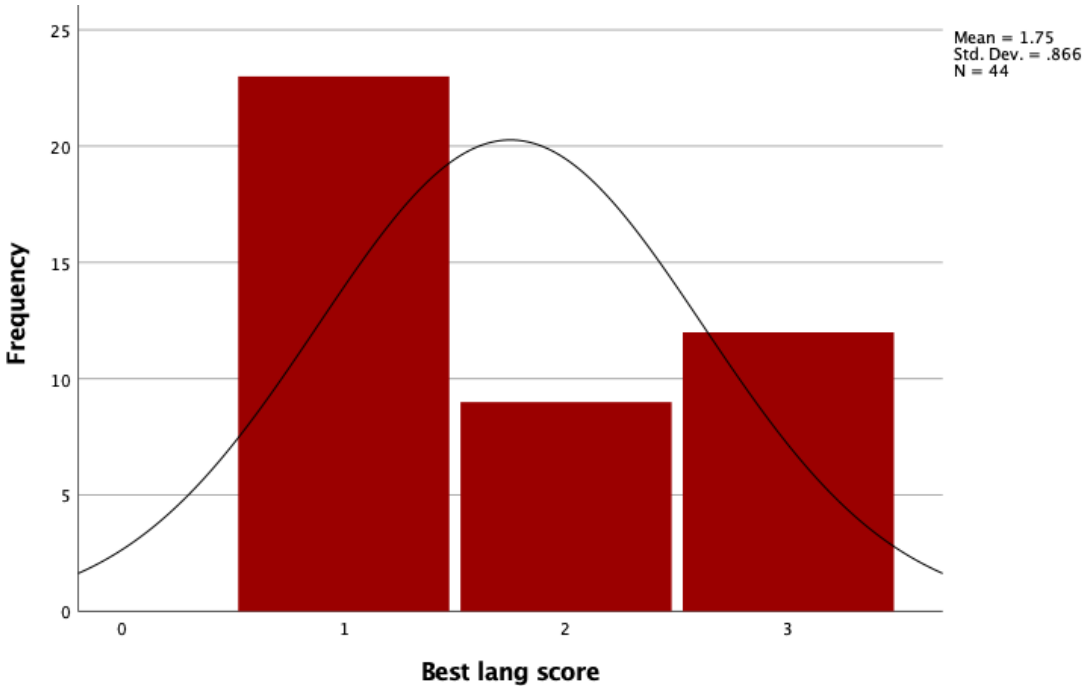
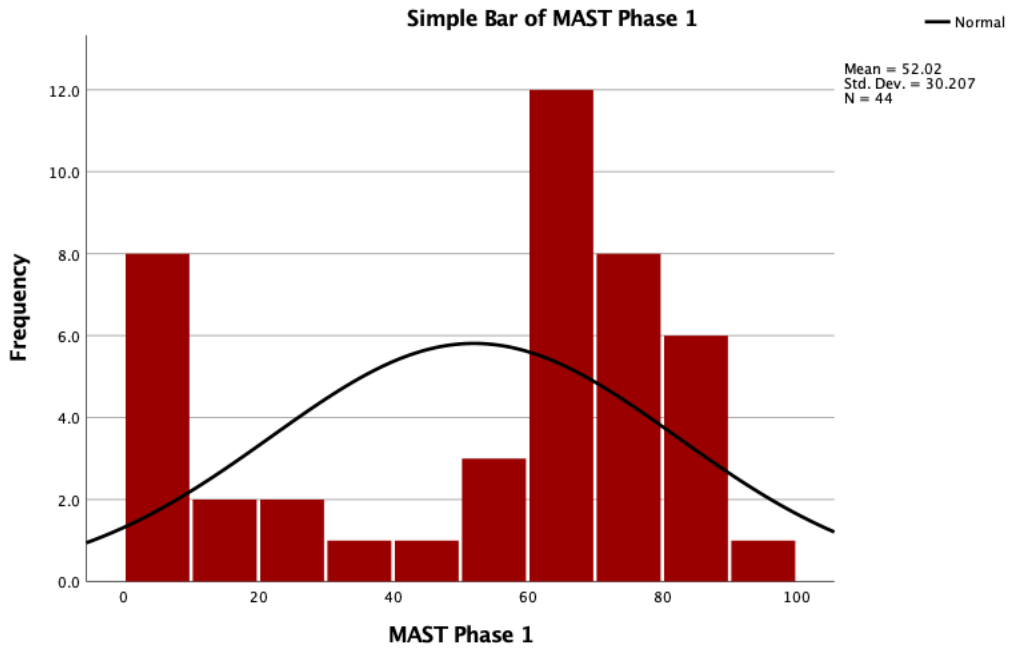


Figure E2: Distribution of NIHSS

Table E36

Normality testing of MAST Total Scores in Phase 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
MAST Total Scores	Statistic	df	Sig	Statistic	df	Sig
	.21	44	<.00	.86	44	<.00



E37

Normality testing of MAST Comprehension in Phase 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
MAST Comprehension	Statistic	df	Sig	Statistic	df	Sig
	.20	44	<.00	.87	44	<.00

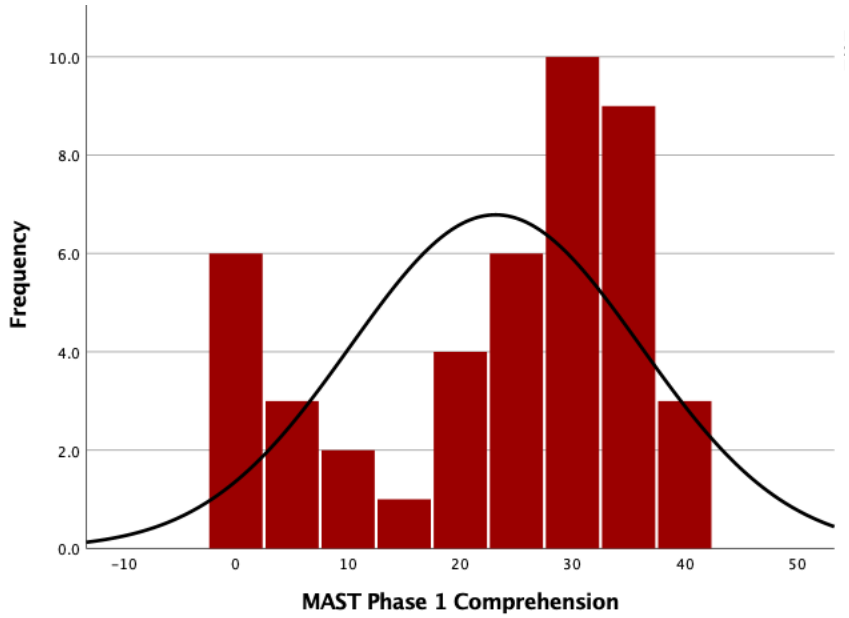


Table E38

Normality testing of MAST Expression in Phase 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
MAST Expression	Statistic	df	Sig	Statistic	df	Sig
	.17	44	<.00	.86	44	<.00

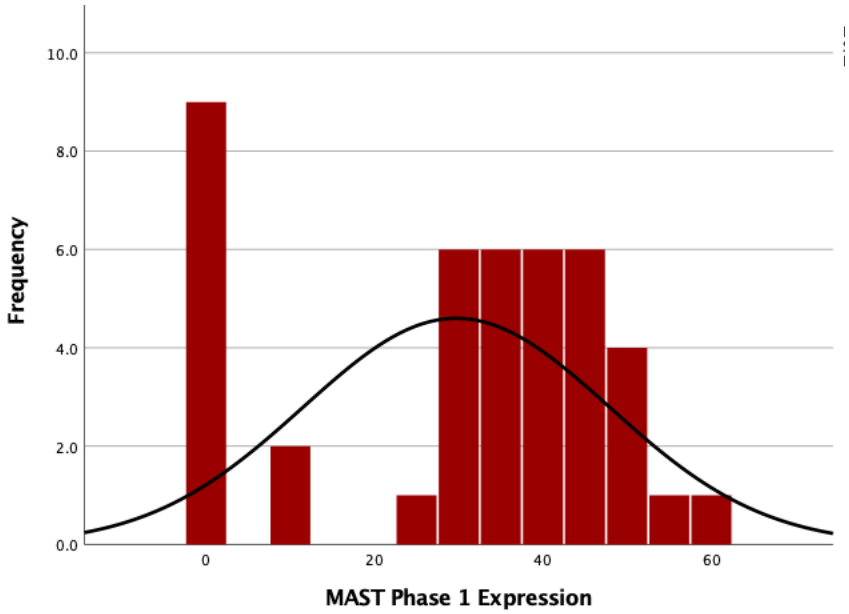


Table E39

Normality testing of ASRS in Phase 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
MAST Expression	Statistic	df	Sig	Statistic	df	Sig
	.17	44	<.00	.86	44	<.00

Table E40

Normality testing between aphasia therapy and outcomes in Phase 2

		Kolomogrov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Yes	.25	27	<.00	.86	27	.00
	No	.32	10	.00	.65	10	<.00
TOM Activity Phase 2	Yes	.22	27	.00	.86	27	.00
	No	.32	10	.00	.65	10	<.00
TOM Participation Phase 2	Yes	.20	27	.01	.85	27	.00
	No	.36	10	<.00	.73	10	.00
TOM Wellbeing Phase 2	Yes	.26	27	<.00	.79	27	<.00
	No	.28	10	.02	.79	10	.01
ASRS Phase 2	Yes	.24	27	<.00	.89	27	.02
	No	.38	10	<.00	.64	10	<.00
EQ-5D-5L Phase 2	Yes	.17	27	.07	.89	27	.02
	No	.12	10	.200	.95	10	.69

Table E41

Normality testing between therapeutic approach and outcomes in Phase 2

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 2	Communication Strategies	.21	3	.	.98	3	.78
	Semantic Processing	.35	7	.07	.77	7	.02
	CILT	.28	6	.13	.83	6	.11
	Functional Communication	.26	2	.			
	MIT	.28	4	.	.86	4	.27
TOM Activity Phase 2	Communication Strategies	.17	3	.	1.00	3	1.00
	Semantic Processing	.31	7	.03	.75	7	.01
	CILT	.40	6	.00	.70	6	.00
	Functional Communication	.26	2	.			
	MIT	.25	4	.	.94	4	.68
TOM Participation Phase 2	Communication Strategies	.29	3	.	.92	3	.46
	Semantic Processing	.31	7	.03	.75	7	.01
	CILT	.28	6	.13	.75	6	.02
	Functional Communication	.26	2	.			
	MIT	.30	4	.	.72	4	.02

TOM Wellbeing Phase 2	Communication Strategies	.38	3	.	.75	3	.00
	Semantic Processing	.42	7	<.00	.64	7	<.00
	CILT	.27	6	.16	.80	6	.05
	Functional Communication	.26	2	.			
	MIT	.15	4	.	.99	4	.99
ASRS Phase 2	Communication Strategies	.21	3	.	.98	3	.79
	Semantic Processing	.35	7	.00	.71	7	.00
	CILT	.17	6	.20	.95	6	.78
	Functional Communication	.26	2	.			
	MIT	.44	4	.	.63	4	.00
EQ-5D-5L Phase 2	Communication Strategies	.17	3	.	1.00	3	.97
	Semantic Processing	.29	7	.06	.79	7	.03
	CILT	.33	6	.03	.76	6	.03
	Functional Communication	.26	2	.			
	MIT	.30	4	.	.82	4	.14

* Therapeutic Approach = Lexical Processing therefore has been omitted.

Table E42

Normality testing of SLT time in the first 6 months and 12months post-stroke.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
SLT time in the first 6 months	.38	26	<.00	.53	26	<.00
SLT time in after 12 months	.43	21	<.00	.51	21	<.00

Table E43

Normality testing between delivery approach and outcomes in Phase 2

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig	Statistic	df	Sig
ASRS Phase 2	Qualified SLP with <2 years of experience	.18	6	.20	.92	6	.05
	Qualified SLP with 3-5 years of experience	.36	8	.00	.79	8	.02
	Qualified SLP 5< years of experience	.20	8	.20	.84	8	.09
TOM Impairment Phase 2	Qualified SLP with <2 years of experience	.26	6	.20	.82	6	.09
	Qualified SLP with 3-5 years of experience	.30	8	.02	.82	8	.05
	Qualified SLP 5< years of experience	.23	8	.20	.87	8	.17
TOM Activity Phase 2	Qualified SLP with <2 years of experience	.28	6	.13	.75	6	.02
	Qualified SLP with 3-5 years of experience	.30	8	.02	.86	8	.12
	Qualified SLP 5< years of experience	.27	8	.08	.78	8	.02
TOM Participation Phase 2	Qualified SLP with <2 years of experience	.32	6	.04	*.82*	6	.10
	Qualified SLP with 3-5 years of experience	.19	8	.20	.87	8	.17
	Qualified SLP 5< years of experience	.27	8	.08	.78	8	.02

TOM	Qualified SLP with <2 years of experience	.28	6	.13	.75	6	.02
Wellbeing	Qualified SLP with 3-5 years of experience	.26	8	.11	.77	8	.01
Phase 2	Qualified SLP 5< years of experience	.28	8	.04	.76	8	.01
EQ-5D-5L	Qualified SLP with <2 years of experience	.19	6	.20	.92	6	.52
	Qualified SLP with 3-5 years of experience	.21	8	.20	.90	8	.29
Phase 2	Qualified SLP 5< years of experience	.27	8	.08	.86	8	.13

Table E44

Normality testing between aphasia therapy and outcomes in Phase 3

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Yes	.29	20	<.00	.70	20	<.00
	No	.47	10	<.00	.53	10	<.00
TOM Activity Phase 3	Yes	.36	20	<.00	.71	20	<.00
	No	.35	10	.00	.65	10	<.00
TOM Participation Phase 3	Yes	.40	20	<.00	.58	20	<.00
	No	.47	10	<.00	.53	10	<.00
TOM Wellbeing Phase 3	Yes	.24	20	.00	.72	20	<.00
	No	.33	10	.00	.74	10	.00
MAST Total Score Phase 3	Yes	.16	20	.200	.87	20	.02
	No	.20	10	.00	.87	10	.14
MAST Comprehension Score Phase 3	Yes	.27	20	.00	.75	20	<.00
	No	.21	10	.200	.93	10	.48
MAST Expression Score Phase 3	Yes	16	20	.200	.89	20	.04
	No	.21	10	.200	.88	10	.19
ASRS Phase 3	Yes	.32	20	<.00	.78	20	.00
	No	.35	10	.00	.78	10	.01
EQ-5D-5L Health Score Phase 3	Yes	.21	20	.04	.87	20	.02
	No	.239	10	.14	.85	10	.09

Table E45

Normality testing between therapeutic approach and outcomes in Phase 3

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
TOM Impairment Phase 3	Communication Strategies	.25	3	.	.94	3	.63
	Semantic Processing	.49	6	<.00	.49	6	.00
	CILT	.30	4	.	.72	4	.02
	Functional Communication	.26	2	.			
	MIT	.26	2	.			
TOM Activity Phase 3	Communication Strategies	.38	3	.	.75	3	.00
	Semantic Processing	.49	6	<.00	.49	6	.00
	CILT	.30	4	.	.72	4	.00
	Functional Communication	.26	2	.			
	MIT	.26	2	.			
TOM Participation Phase 3	Communication Strategies	.38	3	.	.75	3	.00
	Semantic Processing	.49	6	<.00	.49	6	.00
	CILT	.44	4	.	.72	4	.02
	Functional Communication	.26	2	.			

	MIT	.26	2	.			
TOM Wellbeing Phase 3	Communication Strategies	.38	3	.	.75	3	.00
	Semantic Processing	.49	6	<.00	.49	6	.00
	CILT	.29	4		.92	4	.58
	Functional Communication	.26	2				
	MIT	.26	2				
ASRS Phase 3	Communication Strategies	.29	3		.92	3	.46
	Semantic Processing	.49	6		.49	6	.00
	CILT	.28	4		.86	4	.27
	Functional Communication	.26	2				
	MIT	.26	2				
EQ-5D-5L Phase 3	Communication Strategies	.19	3		.99	3	.89
	Semantic Processing	.30	6		.89	6	.36
	CILT	.23	4		.94	4	.70
	Functional Communication	.	2				
	MIT	.26	2				
MAST Total Score Phase 3	Communication Strategies	.19	3	.	.96	3	.88
	Semantic Processing	.24	6	.20	.82	6	.10

	CILT	.23	4	.	.92	4	.58
	Functional Communication	.26	2	.	.		
	MIT	.26	2	.			
MAST Comprehension Score Phase 3	Communication Strategies	.24	3	.	.97	3	.68
	Semantic Processing	.45	6	<.00	.65	6	.00
	CILT	.27	4	.	.86	4	.27
	Functional Communication	.26	2	.			
	MIT	.26	2	.			
MAST Expression Score Phase 3	Communication Strategies	.18	3	.	.99	3	.93
	Semantic Processing	.27	6	.19	.49	6	.11
	CILT	.26	4	.	.86	4	.29
	Functional Communication	.26	2	.			
	MIT	.26	2	.			

* Therapeutic Approach = Lexical Processing therefore has been omitted.

Table E46

Normality testing between delivery approach and outcomes in Phase 3

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig	Statistic	df	Sig
ASRS Phase 3	Qualified SLP with <2 years of experience	.23	5	.20	.86	5	.25
	Qualified SLP with 3-5 years of experience	.26	7	.15	.88	7	.26
	Qualified SLP 5< years of experience	.24	5	.20	.86	5	.23
TOM Impairment Phase 3	Qualified SLP with <2 years of experience	.33	5	.07	.75	5	.02
	Qualified SLP with 3-5 years of experience	.30	7	.05	.78	7	.02
	Qualified SLP 5< years of experience	.36	5	.02	.68	5	.00
TOM Activity Phase 3	Qualified SLP with <2 years of experience	.34	5	.04	.77	5	.04
	Qualified SLP with 3-5 years of experience	.36	7	.00	.66	7	.00
	Qualified SLP 5< years of experience	.47	5	<.00	.55	5	<.00
TOM Participation Phase 3	Qualified SLP with <2 years of experience	.47	5	<.00	*.55*	5	<.00
	Qualified SLP with 3-5 years of experience	.30	7	.05	.78	7	.02
	Qualified SLP 5< years of experience	.	5	.	.	5	.

TOM Wellbeing Phase 3	Qualified SLP with <2 years of experience	.26	5	.20	.86	5	.23
	Qualified SLP with 3-5 years of experience	.25	7	.18	.83	7	.08
	Qualified SLP 5< years of experience	.33	5	.06	.67	5	.05
EQ-5D-5L Phase 3	Qualified SLP with <2 years of experience	.33	5	.07	.73	5	.02
	Qualified SLP with 3-5 years of experience	.25	7	.18	.83	7	.08
	Qualified SLP 5< years of experience	.36	5	.03	.76	5	.04
MAST Total Score Phase 3	Qualified SLP with <2 years of experience	.25	5	.20	.89	5	.37
	Qualified SLP with 3-5 years of experience	.17	7	.20	.92	7	.49
	Qualified SLP 5< years of experience	.31	5	.12	.83	5	.14
MAST Comprehension Score Phase 3	Qualified SLP with <2 years of experience	.34	5	.05	.82	5	.11
	Qualified SLP with 3-5 years of experience	.27	7	.13	.76	7	.01
	Qualified SLP 5< years of experience	.40	5	.00	.67	5	.00
MAST Expression Score Phase 3	Qualified SLP with <2 years of experience	.19	5	.20	.93	5	.64
	Qualified SLP with 3-5 years of experience	.20	7	.20	.90	7	.36
	Qualified SLP 5< years of experience	.32	5	.08	.77	5	.48

Appendix F

Friedman Test

Table F1

Friedman Test of TOM Impairment

	N	Std. Dev	Mean	P-value
TOM impairment Phase 1		1.56	2.87	
TOM Impairment Phase 2	30	1.27	3.65	<0.00
TOM Impairment Phase 3		0.99	4.26	
Improvement TOM impairment in the first 6 months post-stroke		0.80	1.79	
Improvement in TOM impairment between 6 months & 12 months post-stroke	30	0.61	1.63	<0.00
Improvement in TOM impairment 12 months post-stroke		0.91	2.58	

Table F2

Friedman Test of TOM activity

	N	Std. Dev	Mean	P-value
TOM activity Phase 1		1.85	3.00	
TOM activity Phase 2	30	1.42	3.67	<0.00
TOM activity Phase 3		0.87	4.30	
Improvement TOM activity in the first 6 months post-stroke		0.75	0.67	
Improvement TOM activity between 6 months & 12 months post-stroke	30	0.61	0.63	<0.00
Improvement in TOM activity 12 months post-stroke		1.23	1.30	

Table F3

Friedman Test of TOM participation

	N	Std. Dev	Mean	P-value
TOM participation Phase 1		1.77	2.77	
TOM participation Phase 2	30	1.59	3.57	<0.00
TOM participation Phase 3		0.93	4.40	
Improvement TOM participation in the first 6 months post-stroke		0.75	0.67	
Improvement TOM participation between 6 months & 12 months post-stroke		0.95	0.83	<0.00
Improvement in TOM participation 12 months post-stroke		1.37	1.63	

Table F4

Friedman Test of TOM wellbeing

	N	Std. Dev	Mean	P-value
TOM wellbeing Phase 1		1.68	3.73	
TOM wellbeing Phase 2	30	1.56	3.67	0.14
TOM wellbeing Phase 3		1.32	3.97	
Improvement TOM wellbeing in the first 6 months post-stroke		1.43	-0.7	
Improvement TOM wellbeing between 6 months & 12 months post-stroke	30	1.26	0.3	1.87
Improvement in TOM wellbeing 12 months post-stroke		1.79	0.23	

Table F5

Friedman Test of ASRS

	N	Std. Dev	Mean	P-value
ASRS Phase 1		1.80	3.13	
ASRS Phase 2	30	1.54	3.55	<0.00
ASRS Phase 3		1.37	4.68	
Improvement ASRS in the first 6 months post-stroke		1.20	0.42	
Improvement ASRS between 6 months & 12 months post-stroke	30	0.92	1.13	<0.00
Improvement in ASRS 12 months post-stroke		1.36	1.55	

Appendix G

Dunn's Post-Hoc Test

Table G1

Hypothesis Test Summary of MAST score

Null Hypothesis	Test	Sig[a,b]	Decision
The distribution of changes in MAST in 12 months is the same across categories of Age Group	Independent-Samples Kruskal-Wallis Test	.04	Reject the null hypothesis

a. The significance level is .05

b. Asymptotic significance is displayed

Table G2

MAST Score Pairwise Comparison of Age Groups

Sample 1- Sample 2	Test Statistics	Std. Error	St Test Statistics	Sig	Adj. Sig
60-69 years – 70-79 years	-6.11	4.13	-1.47	.13	1.00
60-69 years – 80-89 years	-8.94	4.89	-1.82	.06	1.00
60-69 years – 50-59 years	11.44	6.85	1.66	.09	1.00
60-69 years – 40-49 years	14.14	4.89	2.89	.00	.05
70-79 years – 80-89 years	-2.83	4.89	-.57	.56	1.00
70-79 years – 50-59 years	5.33	6.85	.77	.43	1.00
70-79 years – 40-49 years	8.03	4.89	1.64	.10	1.00
80-89 years – 50-59 years	2.50	7.33	.34	.73	1.00
80-89 years – 40-49 years	5.20	5.54	.93	.34	1.00
50-59 years – 40-49 years	2.70	7.33	.36	.71	1.00

Table G3

Hypothesis Test Summary of MAST Comprehension score

Null Hypothesis	Test	Sig[c,d]	Decision
The distribution of changes in MAST Comprehension in 12 months is the same across categories of Age Group	Independent-Samples Kruskal-Wallis Test	.02	Reject the null hypothesis

c. The significance level is .05

d. Asymptotic significance is displayed

Table G4

MAST Comprehension Pairwise Comparison of Age Groups

Sample 1- Sample 2	Test Statistics	Std. Error	St Test Statistics	Sig	Adj. Sig
60-69 years – 70-79 years	-7.38	4.14	-1.78	.07	1.00
60-69 years – 80-89 years	7.94	6.87	1.15	.24	1.00
60-69 years – 50-59 years	-9.74	4.90	-1.98	.04	.70
60-69 years – 40-49 years	15.44	4.90	3.15	.00	.02
70-79 years – 80-89 years	.55	6.87	.08	.93	1.00
70-79 years – 50-59 years	-2.35	4.90	-.48	.63	1.00
70-79 years – 40-49 years	8.05	4.90	1.64	.10	1.00
80-89 years – 50-59 years	-1.80	7.35	-.24	.80	1.00
80-89 years – 40-49 years	7.50	7.35	1.02	.30	1.00
50-59 years – 40-49 years	5.70	5.56	1.02	.30	1.00

Table G5

Hypothesis Test Summary of changes in TOM activity

Null Hypothesis	Test	Sig[e,f]	Decision
The distribution of changes in TOM activity in the first six months is the same across categories of education	Independent-Samples Kruskal-Wallis Test	.04	Reject the null hypothesis

e. The significance level is .05

f. Asymptotic significance is displayed

Table G6

TOM activity changes in the first time Pairwise Comparison of Education

Sample 1- Sample 2	Test Statistics	Std. Error	St Test Statistics	Sig	Adj. Sig
Secondary - Primary	2.72	3.72	.73	.46	1.00
Secondary – Post-secondary	-11.51	4.92	-2.33	.01	.02
Secondary- University	-14.84	7.58	-1.95	.05	.30
Primary – Post-secondary	-8.79	4.77	-1.84	.06	.39
Primary - University	-12.12	7.48	-1.61	.10	.63
Post-Secondary – University	-3.33	8.15	-.40	.68	1.00

Table G7

Hypothesis Test Summary of changes in TOM participation

Null Hypothesis	Test	Sig[g,h]	Decision
The distribution of changes in TOM participation in the first six months is the same across categories of education	Independent-Samples Kruskal-Wallis Test	.04	Reject the null hypothesis

g. The significance level is .05

h. Asymptotic significance is displayed

Table G8

TOM participation changes in the first time Pairwise Comparison of Education

Sample 1- Sample 2	Test Statistics	Std. Error	St Test Statistics	Sig	Adj. Sig
Secondary - Primary	2.72	3.72	.73	.46	1.00
Secondary – Post-secondary	-11.51	4.92	-2.33	.01	.02
Secondary- University	-14.84	7.58	-1.95	.05	.30
Primary – Post-secondary	-8.79	4.77	-1.84	.06	.39
Primary - University	-12.12	7.48	-1.61	.10	.63
Post-Secondary – University	-3.33	8.15	-.40	.68	1.00

Table G9

Hypothesis Test Summary of changes in MAST expression

Null Hypothesis	Test	Sig[g,h]	Decision
The distribution of improvement in MAST expression in 12 months is the same across categories of Stroke location	Independent-Samples Kruskal-Wallis Test	.04	Reject the null hypothesis

a. The significance level is .05

b. Asymptotic significance is displayed

Table G10

MAST expression changes in the first time Pairwise Comparison of Stroke location

Sample 1- Sample 2	Test Statistics	Std. Error	St Test Statistics	Sig	Adj. Sig
Right MCA – Posterior Occlusion	3.25	5.61	0.57	0.56	1.00
Right MCA – Haemorrhage	-7.25	5.61	-1.29	0.19	1.00
Right MCA- Multiple infarcts	-9.37	3.97	-2.36	0.01	.27
Right MCA -Left MCA	13.30	4.35	3.05	0.00	.03
Right MCA – Occlusion of Vertebral Artery	13.50	7.25	1.86	0.06	.94
Posterior Occlusion – Haemorrhage	-4.00	6.48	-.61	0.53	1.00
Posterior Occlusion – Multiple infarcts	-6.12	5.12	-1.19	0.23	1.00
Posterior Occlusion-Left MCA	-10.05	5.42	-1.85	0.06	.96
Posterior Occlusion – Occlusion of Vertebral Artery	10.25	7.94	1.29	0.19	1.00
Haemorrhage – Multiple infarcts	2.12	5.12	0.41	0.67	1.00
Haemorrhage – Left MCA	6.05	5.42	1.11	0.26	1.00
Haemorrhage – Occlusion of Vertebral Artery	6.25	7.94	.78	0.43	1.00
Multiple infarcts – Left MCA	3.92	3.69	1.06	0.28	1.00
Multiple infarcts- Occlusion of Vertebral Artery	4.12	6.88	0.59	0.54	1.00
Left MCA – Occlusion of Vertebral Artery	0.20	7.20	0.02	0.97	1.00

Appendix H

Additional Statistic Analysis

Table H1

Kruskal-Wallis Test between gender & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Male	27	22.09	.49	.47	.02
	Female	17	23.15			
TOM Impairment	Male	27	28.97	1.51	.35	.00
	Female	17	20.32			
TOM Activity	Male	27	23.59	1.74	.46	.01
	Female	17	20.76			
TOM Participation	Male	27	23.41	1.70	.54	.01
	Female	17	21.06			
TOM Wellbeing	Male	27	22.69	1.70	.89	.02
	Female	17	22.21			
MAST Total Score	Male	27	23.59	30.20	.47	.01
	Females	17	20.76			
MAST Comprehension Score	Male	27	23.72	12.93	.42	.00
	Females	17	20.56			
MAST Expression Score	Male	27	22.62	1.65	.47	.00
	Females	17	19.85			

Table H2

Kruskal-Wallis Test between age & outcomes in Phase 1

		Outcomes 6 months post-stroke				
	Age	N	Mean	Std deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	40-49 years	6	24.33	1.65	.31	0.02
	50-59 years	2	14.00			
	60-69 years	14	26.07			
	70-79 years	14	20.96			
	80-89 years	7	16.71			
	90-99 years	1	40.50			
TOM Impairment	40-49 years	6	20.67	1.51	.11	.10
	50-59 years	2	14.50			
	60-69 years	14	29.21			
	70-79 years	14	20.43			
	80-89 years	7	15.36			
	90-99 years	1	34.50			
TOM Activity	40-49 years	6	23.00	1.74	.19	.06
	50-59 years	2	17.75			
	60-69 years	14	27.89			
	70-79 years	14	19.43			
	80-89 years	7	15.36			
	90-99 years	1	34.50			
TOM Participation	40-49 years	6	21.25	1.70	.54	.02
	50-59 years	2	21.50			
	60-69 years	14	25.29			

	70-79 years	14	20.79			
	80-89 years	7	18.93			
	90-99 years	1	42.00			
TOM Wellbeing	40-49 years	6	23.92			
	50-59 years	2	21.50			
	60-69 years	14	26.14	1.70	.74	.06
	70-79 years	14	18.71			
	80-89 years	7	22.00			
	90-99 years	1	21.50			
MAST Total Score	40-49 years	6	19.33			
	50-59 years	2	20.50			
	60-69 years	14	29.21	30.20	.20	.06
	70-79 years	14	20.29			
	80-89 years	7	15.57			
	90-99 years	1	31.00			
MAST	40-49 years	6	16.75			
Comprehension	50-59 years	2	22.50			
Score	60-69 years	14	29.32	12.93	.17	.06
	70-79 years	14	20.00			
	80-89 years	7	17.21			
	90-99 years	1	33.50			
MAST Expression	40-49 years	6	19.17			
Score	50-59 years	2	16.50			
	60-69 years	14	27.00	18.20	.46	.01
	70-79 years	14	20.11			
	80-89 years	7	16.71			
	90-99 years	1	25.50			

Table H3

Kruskal-Wallis Test between handedness & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Right	36	22.39	1.65	.90	.02
	Left	8	23.00			
TOM Impairment	Right	36	22.85	1.51	.69	.02
	Left	8	20.94			
TOM Activity	Right	36	22.57	1.74	.93	.02
	Left	8	22.19			
TOM Participation	Right	36	22.31	1.70	.82	.02
	Left	8	23.38			
TOM Wellbeing	Right	36	21.88	1.70	.46	.46
	Left	8	25.31			
MAST Total Score	Right	36	23.39	30.20	.32	.00
	Left	8	18.50			
MAST Comprehension Score	Right	36	23.78	12.93	.16	.02
	Left	8	16.75			
MAST Expression Score	Right	36	21.87	18.20	.66	.01
	Left	8	19.64			

Table H4

Kruskal-Wallis Test between Monolingual/Bilingual/Multilingual & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean	Std deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Monolingual	17	19.97			
	Bilingual	25	24.72	1.65	.37	.00
	Multilingual	2	16.25			
TOM Impairment	Monolingual	17	20.12			
	Bilingual	25	24.38	1.51	.50	.50
	Multilingual	2	19.25			
TOM Activity	Monolingual	17	20.94			
	Bilingual	25	24.00	1.74	.60	.02
	Multilingual	2	17.00			
TOM Participation	Monolingual	17	22.29			
	Bilingual	25	23.38	1.70	.54	.01
	Multilingual	2	13.25			
TOM Wellbeing	Monolingual	17	25.24			
	Bilingual	25	21.42	1.70	.30	.00
	Multilingual	2	12.75			
MAST Total Score	Monolingual	17	19.65			
	Bilingual	25	25.28	30.20	.18	.03
	Multilingual	2	12.00			
MAST Comprehension Score	Monolingual	17	20.82			
	Bilingual	25	24.46	12.93	.34	.00
	Multilingual	2	12.25			
MAST Expression Score	Monolingual	17	18.88			
	Bilingual	25	23.96	18.20	.26	.01
	Multilingual	2	13.00			

Table H5

Kruskal-Wallis Test between Education & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean	Std deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Primary	20	22.78	1.65	.18	.04
	Secondary	16	26.22			
	Post-secondary	6	13.75			
	University	2	16.25			
TOM Impairment	Primary	20	23.73	1.51	.37	.00
	Secondary	16	24.25			
	Post-secondary	6	17.25			
	University	2	12.00			
TOM Activity	Primary	20	22.65	1.74	.27	.02
	Secondary	16	25.94			
	Post-secondary	6	14.67			
	University	2	17.00			
TOM Participation	Primary	20	23.95	1.70	.40	.00
	Secondary	16	24.03			
	Post-secondary	6	16.67			
	University	2	13.25			
TOM Wellbeing	Primary	20	22.50	1.70	.64	.03
	Secondary	16	24.19			
	Post-secondary	6	21.25			
	University	2	12.75			
MAST Total Score	Primary	20	20.43	30.20	.26	.02
	Secondary	16	27.41			
	Post-secondary	6	17.50			
	University	2	19.00			
MAST Comprehension Score	Primary	20	20.00	12.93	.17	.04
	Secondary	16	28.03			
	Post-secondary	6	18.08			
	University	2	16.05			
MAST Expression Score	Primary	20	19.73	18.20	.18	.04
	Secondary	16	27≥00			
	Post-secondary	6	15.33			
	University	2	19.25			

Table H6

Kruskal-Wallis Test between stroke type & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Ischaemic	37	23.36	1.65	.29	.00
	Haemorrhagic	7	17.93			
TOM Impairment	Ischaemic	37	23.01	1.51	.52	.01
	Haemorrhagic	7	19.79			
TOM Activity	Ischaemic	37	22.27	1.74	.78	.02
	Haemorrhagic	7	23.71			
TOM Participation	Ischaemic	37	21.80	1.70	.39	.00
	Haemorrhagic	7	26.21			
TOM Wellbeing	Ischaemic	37	21.82	1.70	.39	.00
	Haemorrhagic	7	26.07			
MAST Total Score	Ischaemic	37	22.43	30.20	.93	.02
	Haemorrhagic	7	22.86			
MAST Comprehension Score	Ischaemic	37	21.66	12.93	.31	.02
	Haemorrhagic	7	26.93			
MAST Expression Score	Ischaemic	37	21.47	18.02	.96	.02
	Haemorrhagic	7	21.70			

Table H7

Kruskal-Wallis Test between lesion location & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean	Std deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Occlusion of Vertebral Artery	1	18.00	1.65	.49	.01
	Posterior Occlusion	2	15.25			
	Left MCA	5	10.30			
	Right MCA	4	17.38			
	Multiple Infarcts	9	10.39			
	Haemorrhagic	3	12.33			
TOM Impairment	Occlusion of Vertebral Artery	1	20.50	1.51	.16	.07
	Posterior Occlusion	2	17.25			
	Left MCA	5	7.70			
	Right MCA	4	17.88			
	Multiple Infarcts	9	10.78			
	Haemorrhagic	3	12.67			
TOM Activity	Occlusion of Vertebral Artery	1	18.50	1.74	.16	.07
	Posterior Occlusion	2	16.25			
	Left MCA	5	7.80			
	Right MCA	4	17.63			
	Multiple Infarcts	9	10.06			
	Haemorrhagic	3	16.33			
TOM Participation	Occlusion of Vertebral Artery	1	13.00	1.70	.25	.04
	Posterior Occlusion	2	16.25			
	Left MCA	5	8.90			
	Right MCA	4	18.13			
	Multiple Infarcts	9	10.06			
	Haemorrhagic	3	15.67			
TOM Wellbeing	Occlusion of Vertebral Artery	1	12.00	1.70	.57	.03
	Posterior Occlusion	2	16.25			
	Left MCA	5	11.80			
	Right MCA	4	13.50			
	Multiple Infarcts	9	9.94			
	Haemorrhagic	3	17.67			

MAST Total Score	Occlusion of Vertebral Artery	1	14.00	30.20	.26	.03
	Posterior Occlusion	2	20.75			
	Left MCA	5	7.10			
	Right MCA	4	15.38			
	Multiple Infarcts	9	11.89			
	Haemorrhagic	3	13.50			
MAST Comprehension Score	Occlusion of Vertebral Artery	1	13.00	12.93	.42	.00
	Posterior Occlusion	2	21.25			
	Left MCA	5	8.50			
	Right MCA	4	12.50			
	Multiple Infarcts	9	12.17			
	Haemorrhagic	3	14.17			
MAST Expression Score	Occlusion of Vertebral Artery	1	14.00	18.20	.17	.07
	Posterior Occlusion	2	18.75			
	Left MCA	5	6.20			
	Right MCA	4	15.38			
	Multiple Infarcts	9	11.11			
	Haemorrhagic	3	16.00			

Table H8

Kruskal-Wallis Test between hemisphere affected & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Left	26	22.42			
	Right	16	25.06	1.65	.06	.08
	Both	2	3.00			
TOM Impairment	Left	26	20.85			
	Right	16	27.50	1.51	.02	.11
	Both	2	4.00			
TOM Activity	Left	26	21.02			
	Right	16	27.22	1.74	.04	.11
	Both	2	4.00			
TOM Participation	Left	26	22.00			
	Right	16	25.50	1.70	.08	.07
	Both	2	5.00			
TOM Wellbeing	Left	26	23.88			
	Right	16	22.56	1.70	.08	.07
	Both	2	4.00			
MAST Total Score	Left	26	22.31			
	Right	16	25.19	30.20	.07	.07
	Both	2	3.50			
MAST Comprehension Score	Left	26	24.31			
	Right	16	21,94	12.93	.08	.07
	Both	2	3.50			
MAST Expression Score	Left	26	20.15			
	Right	16	25.66	18.20	.04	.09
	Both	2	4.50			

Table H8

Kruskal-Wallis Test between previous stroke & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	9	17.33	1.65	.16	.02
	No	35	23.83			
TOM Impairment	Yes	9	20.17	1.51	.52	.01
	No	35	23.10			
TOM Activity	Yes	9	20.33	1.74	.56	.01
	No	35	23.06			
TOM Participation	Yes	9	17.78	1.70	.20	.01
	No	35	23.71			
TOM Wellbeing	Yes	9	18.17	1.70	.23	.01
	No	35	23.61			
MAST Total Score	Yes	9	19.00	30.20	.35	.00
	No	35	23.40			
MAST Comprehension Score	Yes	9	19.44	12.93	.42	.00
	No	35	23.29			
MAST Expression Score	Yes	9	19.50	18.20	.60	.01
	No	35	21.97			

Table H10

Kruskal-Wallis Test between thrombolysis & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	14	21.00	1.65	.58	.01
	No	30	23.20			
TOM Impairment	Yes	14	20.00	1.51	.35	.00
	No	30	23.67			
TOM Activity	Yes	14	19.68	1.74	.31	.04
	No	30	23.82			
TOM Participation	Yes	14	20.00	1.70	.36	.00
	No	30	23.67			
TOM Wellbeing	Yes	14	17.61	1.70	.06	.00
	No	30	24.78			
MAST Total Score	Yes	14	19.50	30.20	.28	.00
	No	30	23.90			
MAST Comprehension Score	Yes	14	20.54	12.93	.48	.01
	No	30	23.42			
MAST Expression Score	Yes	14	18.44	18.20	.28	.00
	No	30	22.93			

Table H11

Kruskal-Wallis Test between mechanical thrombectomy & outcomes in Phase 1

		Outcomes in Phase 1				
		N	Mean Rank	Std. Deviation	*P-Value*	Kruskal-Wallis Effect Size
ASRS	Yes	10	17.45	1.65	.14	.02
	No	34	23.99			
TOM Impairment	Yes	10	17.10	1.51	.11	.03
	No	34	24.09			
TOM Activity	Yes	10	15.45	1.74	.04	.07
	No	34	24.57			
TOM Participation	Yes	10	18.05	1.70	.20	.01
	No	34	23.81			
TOM Wellbeing	Yes	10	17.15	1.70	.11	.03
	No	34	24.07			
MAST Total Score	Yes	10	15.70	30.20	.05	.06
	No	34	24.50			
MAST Comprehension Score	Yes	10	16.85	12.93	.11	.03
	No	34	24.16			
MAST Expression Score	Yes	10	15.70	18.20	.08	.04
	No	34	23.31			

Table H12

Spearman's Correlation between the NIHSS score and outcomes in Phase 1

		Outcomes 6 months post-stroke
ASRS	Correlation Coefficient	-.56
	P-value	<.00
TOM Impairment	Correlation Coefficient	-.66
	P-value	<.00
TOM Activity	Correlation Coefficient	-.64
	P-value	<.00
TOM Participation	Correlation Coefficient	-.63
	P-value	<.00
TOM Wellbeing	Correlation Coefficient	-.52
	P-value	<.00
MAST Total Score	Correlation Coefficient	-.59
	P-value	<.00
MAST Comprehension Score	Correlation Coefficient	-.54
	P-value	<.00
MAST Expression Score	Correlation Coefficient	-58
	P-value	<.00

Table H13

Spearman's Correlation between the BLS and outcomes in Phase 1

		Outcomes 6 months post-stroke
ASRS	Correlation Coefficient	-.59
	P-value	<.00
TOM Impairment	Correlation Coefficient	-.69
	P-value	<.00
TOM Activity	Correlation Coefficient	-.63
	P-value	<.00
TOM Participation	Correlation Coefficient	-.61
	P-value	<.00
TOM Wellbeing	Correlation Coefficient	-.43
	P-value	.00
MAST Total Score	Correlation Coefficient	-.63
	P-value	<.00
MAST Comprehension Score	Correlation Coefficient	-.46
	P-value	.00
MAST Expression Score	Correlation Coefficient	-.64
	P-value	<.00

Table H14

Spearman's Correlation between the ASRS and outcomes in Phase 1

		Outcomes 6 months post-stroke
TOM Impairment	Correlation Coefficient	.81
	P-value	<.00
TOM Activity	Correlation Coefficient	.81
	P-value	<.00
TOM Participation	Correlation Coefficient	.76
	P-value	<.00
TOM Wellbeing	Correlation Coefficient	.57
	P-value	<.00
MAST Total Score	Correlation Coefficient	.76
	P-value	<.00
MAST Comprehension Score	Correlation Coefficient	.66
	P-value	<.00
MAST Expression Score	Correlation Coefficient	.74
	P-value	<.00

Table H15

Spearman's Correlation between the MAST and outcomes in Phase 1

		Outcomes 6 months post-stroke
TOM Impairment	Correlation Coefficient	.88
	P-value	<.00
TOM Activity	Correlation Coefficient	.86
	P-value	<.00
TOM Participation	Correlation Coefficient	.79
	P-value	<.00
TOM Wellbeing	Correlation Coefficient	.74
	P-value	<.00
ASRS	Correlation Coefficient	.76
	P-value	<.00