The impact of visual field loss on activities of daily living performance among adults with acute stroke: A prospective cohort study

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Abstract

Title: The impact of visual field loss on activities of daily living performance among adults with acute stroke: A prospective cohort study

Background: Visual field loss (VFL) is the most common visual problem following a stroke, occurring in as many as 49%. Studies have highlighted the negative impact of VFL on driving, mobility and reading with less attention paid to the impact of VFL on activities of daily living (ADL). The purpose of this study was to investigate the ADL performances of people with VFL after an acute stroke using an observation-based evaluation of ADL skills, the Assessment of Motor and Process Skills (AMPS).

Objective: This study aims to illustrate what performance limitations on ADL exist for people with VFL after an acute stroke.

Method: This is a prospective cohort study where a sample of 58 adults with a stroke diagnosis were recruited consecutively from admission to the In-Patient Stroke Unit, Neurology and Rapid Access Stroke Prevention Clinic, and Early Supported Discharge Service of Tallaght University Hospital (TUH) over a 13-month period. Baseline measurements included the Modified Barthel Index, Article reading subtests and the AMPS. The AMPS was the only measure administered at follow-up. Descriptive statistics and non-parametric tests were used to compare ADL performances.

Results: No clinically significant differences were noted when comparing the median ADL ability scores of people post stroke with and without VFL on initial assessment and follow up. Clinically significant improvements were noted on both groups from initial assessment to follow-up at 7 weeks. Patients with a complete VFL and those with left VFL were likely to display reduced ADL performance.

Conclusion: The findings of this study showed that while patients with VFL had an overall reduction in ADL performance as measured by the AMPS, the performance was similar to patients with mild to moderate disability after stroke without VFL. This information urges occupational therapists to include tools like the AMPS in measuring ADL performance of patients with VFL after a stroke.
Declaration

I declare that this thesis, which I submit to the University of Limerick for examination in consideration of the award of master’s in research, is my own personal effort with the support of the supervisors assigned to me.

Furthermore, I took reasonable care to ensure that the work is original, and, to the best of my knowledge and has not been taken from other sources except where such work has been cited and acknowledged within the text

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<th>Description</th>
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<tr>
<td>AMPS</td>
<td>Assessment of Motor and Process Skills</td>
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<td>OT</td>
<td>Occupational Therapy</td>
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<tr>
<td>VFL</td>
<td>Visual Field Loss</td>
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<tr>
<td>ESD</td>
<td>Early Supported Discharge</td>
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<tr>
<td>RASP</td>
<td>Rapid Access Stroke Prevention</td>
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<tr>
<td>MMSE</td>
<td>Mini Mental State Examination</td>
</tr>
<tr>
<td>MBI</td>
<td>Modified Barthel Index</td>
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<tr>
<td>ADL</td>
<td>Activities of Daily Living</td>
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<tr>
<td>PADL</td>
<td>Basic Activities of Daily Living</td>
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<tr>
<td>IADL</td>
<td>Instrumental Activities of Daily Living</td>
</tr>
<tr>
<td>TUH</td>
<td>Tallaght University Hospital</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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<td>SAFE</td>
<td>Stroke Alliance for Europe</td>
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<tr>
<td>RCPI</td>
<td>Royal College of Physicians Ireland</td>
</tr>
<tr>
<td>IHF</td>
<td>Irish Heart Foundation</td>
</tr>
<tr>
<td>AHA</td>
<td>American Heart Association</td>
</tr>
<tr>
<td>IE</td>
<td>Initial Evaluation</td>
</tr>
<tr>
<td>TIA</td>
<td>Transient Ischaemic Attack</td>
</tr>
<tr>
<td>VISTA</td>
<td>Virtual International Stroke Trials Archive</td>
</tr>
<tr>
<td>EHP</td>
<td>Ecology of Human Performance</td>
</tr>
<tr>
<td>PEO</td>
<td>Person Environment Occupation</td>
</tr>
<tr>
<td>NEI-VFQ</td>
<td>National Eye Institute Visual Functioning Questionnaire</td>
</tr>
<tr>
<td>VA LV VFQ</td>
<td>Veterans Affairs Low Vision Visual Function Questionnaire</td>
</tr>
<tr>
<td>SRAFVP</td>
<td>Self-Report Assessment of Functional Visual Performance</td>
</tr>
<tr>
<td>ALI</td>
<td>Activities Limitation Interview</td>
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<tr>
<td>TUH</td>
<td>Tallaght University Hospital</td>
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<tr>
<td>ASU</td>
<td>Acute Stroke Unit</td>
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<tr>
<td>CNS</td>
<td>Clinical Nurse Specialist</td>
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<tr>
<td>TOAST</td>
<td>Trial of Org 10172 in Acute Stroke Treatment</td>
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<tr>
<td>ARTS</td>
<td>Article Reading Test Score</td>
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<tr>
<td>ARTT</td>
<td>Article Reading Test Time</td>
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<tr>
<td>CIOTS</td>
<td>Centre for Innovative Occupational Therapy Solutions</td>
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Chapter 1: Introduction

This chapter will place this study in context, beginning with a brief overview of stroke, the impact of stroke on people who survive it and their experience of rehabilitation, particularly in relation to VFL assessment and rehabilitation. Firstly, this chapter will focus on normal vision, impaired visual search that follows after a visual impairment and outlines the types, prevalence and the recovery of visual field loss (VFL). The importance of assessment and rehabilitation of VFL after stroke is explored. The chapter seeks to draw attention to the distinct role of VFL in the performance of activities of daily living (ADL) and how the study addresses the gaps in the current literature.

To this end, the chapter details the significance of this study and its potential contribution to the literature and to occupational therapists working with patients with VFL following a stroke.

1.1 Background

Stroke is the second leading cause of death and the third leading cause of disability in the developed nations affecting 17 million people across the globe (Stroke Alliance for Europe (SAFE 2017). Stroke is most common among older adults, for example, the National Stroke Register Report 2017 of the Royal College of Physicians in Ireland (RCPI) reported that 75% of stroke patients are over the 65 years old (McElwaine et al. 2016) With the population of older adults expected to rise to 2 billion in 2050, the number of people with stroke is also expected to increase ((WHO) 2011).

In the European Union, the overall estimated prevalence of stroke is 613,148 per year with some variance between the 27 individual countries. The highest incidence rate of stroke per 100, 000 inhabitants were recorded in Ukraine (194.6) and the lowest rate were recorded in the United Kingdom (39.3) (RCP-UK 2016; UK 2016; SAFE 2017).
In Ireland, there are 2,771 people newly diagnosed with stroke per year which is equivalent to 28.2 stroke per 100,000 inhabitants (SAFE 2017). Although the incidence of stroke in Ireland is higher than in the UK, the mortality rate in Ireland is lower, that is, 35.2 versus 41.4 deaths per 100,000 inhabitants. Differences in healthcare provision and immediate access to dedicated hyper acute stroke units may have affected the differences in these mortality rates. Therefore, there will be more people here in Ireland that will be living with the long-term effects of stroke. Since the incidence of stroke is also set to rise in the next decade making stroke a health emergency (McElwaine et al. 2016; SAFE 2017), effective health care and resource allocation are needed to prevent stroke and to provide better support for those affected by stroke including their families (Kelly and Harbison 2012; RCP-UK 2016; SAFE 2017).

To reduce mortality and morbidity due to stroke, the provision of dedicated stroke units in major hospitals have been put in place for early detection and treatment of patient with stroke (Powers William et al. 2018). Most patients with stroke are being brought to these stroke units to optimise their chances for timely appropriate medical intervention/therapy and rehabilitation, both of which significantly reduces the mortality and the morbidity associated with stroke (Jauch Ec Fau - Saver et al. 2013). A Cochraine review of 28 trials (2013) involving 5855 patients with stroke that evaluated the effects of dedicated stroke unit care compared to alternative forms of care showed that patients who receive an organised stroke unit care are more likely to survive their stroke, return home and become independent in looking after themselves (Trialists’Collaboration 2013).

After the rapid detection and medical management of stroke that reduces brain injury, the patient usually receives a period of rehabilitation. Rehabilitation, according to the World health Organisation (WHO), are any set of measure that help individuals to achieve and maintain optimum functioning ((WHO) 2011). Rehabilitation has been recommended to commence as soon as practicable after suffering stroke to optimize function and recovery (Hill 2008; Kelly and Harbison 2012; Hebert et al. 2016; RCP-UK 2016; SAFE 2017). Although there are many approaches to stroke rehabilitation, the overall goal is to relearn the skills that has been lost due to the stroke afflicted part of the brain (Langhorne et al. 2011). The learning of the skills that has been lost due to a stroke is crucial in enabling people to live independently and remain in or return to their work and community ((WHO) 2011).
1.2 Stroke rehabilitation

Multidisciplinary team care is the basis for delivery of stroke rehabilitation. Most stroke units in Ireland have a dedicated health and social care professions mainly composed of an occupational therapists, physiotherapist, speech and language therapist, dietician, social work and neuropsychologist. These professions together with the medical doctor and the clinical nurse specialist (CNS) make up the stroke multi-disciplinary team (Langhorne et al. 2011; Clarke 2013).

Maximization and prevention of the deterioration of the performance of activities of daily living (ADL) is a major component of treatment for people who have had a stroke (Legg et al. 2007). The resultant loss of these function after a stroke can have implications for one’s ability to return home and is therefore a key role or rehabilitation. Levels of dependence in such activities is a measure of success of stroke rehabilitation and is often used as an outcome in most stroke trials (Walker et al. 2004).

Occupational therapy is an important element in optimising ADL performance after a stroke. This is not limited to personal ADLs (PADL) (feeding, washing, grooming, dressing) but extends to the performance of instrumental-ADL (IADL) (domestic chores such as preparing a meal, shopping, cleaning home environment). Findings from a systematic review and meta-analysis by Legg at al. (2007) that analysed 9 studies involving 1258 patients with stroke showed that patients who received occupational therapy were significantly more independent in their PADL skills than those that received standard or no care (Legg et al. 2007). A recent updated Cochrane systematic review involving 9 studies with 994 patients with stroke suggested that OT can improve ADL and prevent deterioration of such abilities (Legg et al. 2017). Both the systematic review and meta-analysis by Legg et al. (2007) and Walker et al. (2004) involving combined sample of 1990 patient with stroke showed significantly improved IADL skills after receiving OT. The recent American Heart Association (AHA) stroke guideline recommends that individuals with stroke should be provided with a formal assessment of their PADL and IADL before discharge from the acute care hospitalizations. The results of these reviews and recommendation benchmark the need for occupational therapy to improve ADL of patients with stroke particularly in the acute stage of stroke care (Powers William et al. 2018). Thus, it is essential that valid and reliable ADL outcome measures are used by occupational therapists to evaluate ADL skills.
Traditionally, stroke rehabilitation has focused mainly on the amelioration of speech, motor, sensory, cognitive and perceptual impairments brought about by stroke. Little attention has been paid to the role vision and visual impairment plays in rehabilitation. This is exacerbated by traditional thinking that treatment of language, speech and motor problems are unequivocally necessary, and so the role vision on patient’s outcome is often neglected (Kerkhoff 2000). A multi-centre prospective cohort study by Rowe et al. (2009) of 323 patients with stroke reported that only eight percent were found to have normal vision (Rowe et al. 2009b). This shows that the visual impairment may be more common that previously thought and it is possible that these visual impairments are under reported in most stroke rehabilitation units.

Vision is a vital channel that inputs information to many regions in the brain due to its connection to many non-visual areas of the brain, therefore, vision impairment can affect rehabilitation of other non-visual functions such as the cognitive, perceptual and motor functions. When this multifaceted view of vision is adopted in a rehabilitation context, vision can have an important impact on the overall outcome of rehabilitation (Kerkhoff 2000; Patel et al. 2000; Rowe et al. 2013). Thus, the absence of assessment and treatment of vision will deny patients with visual impairments the opportunities to recover or adapt following a stroke.

Recent years have shown a growing recognition of the importance of the role of vision on rehabilitation. There is consensus in several stroke clinical guidelines that all patients with should be screened for visual impairments such as visual acuity, visual field, eye movement disorder and visual spatial neglect and referred to experts where necessary (Hill 2008; IHF 2010; RCP-UK 2016). Some of the guidelines have recommended treatment options but there was disagreement about the type of intervention recommended. In a survey by Pollock et al. (2012), vision has been voted by stroke survivors, their carers and health care professionals as one of the top six priorities for research for life after stroke (Pollock et al. 2012). Despite these recommendation and emerging priority of vision in rehabilitation, assessment of vision and vision rehabilitation is still seen as a low priority in most stroke in-patient settings. In a survey of 55 occupational therapist in 55 Scottish stroke in-patient settings, only 9% of the respondents reported that they used a protocol for the assessment and management of visual impairments. (Alex Pollock et al. 2011)
1.3 Visual impairments after stroke

Visual impairments, or the deficit of visual function, are common after stroke. Stroke-related visual impairments include altered acuity, disruption of eye movements causing diplopia, nystagmus, blurred vision, visual field loss (VFL) and loss of depth perception (Rowe et al. 2009a; Hepworth et al. 2016). Early studies have included other visual functions such as visual spatial neglect as a visual impairment, but recent studies have cautioned the inclusion of visual neglect and visual agnosia due to the more cognitive element of these impairments (RCP-UK 2016).

The reported prevalence of visual impairments in stroke varies considerably in the literature. Incidence rate can range from 62% - 92% (Rowe et al. 2009b; Hepworth et al. 2016). The type of visual impairment and factors such as the age, the timing of assessment and the diversity of measurement tools used in prevalence studies in this area have affected the estimates (Gilhotra et al. 2002; Rowe et al. 2009b; Hepworth et al. 2016). One such cohort study that used a simple screening tool was successful in identifying visual problems among stroke patients (Rowe et al. 2009b). Of the 297 patients who complained of visual problems, 26% had low visual acuity, 35% had ocular pathologies, 68% had eye movement deficits, 49% had VFL and 20% had perceptual deficits. Fifty-five percent of these patients have a combination of two or more visual impairments. A similar but a larger scale prospective study, the Vision in Stroke (VIS) conducted in the UK, found that 92% of stroke patients had a documented visual impairment and, of these, a total of 55% of the patients had more than one visual impairment (Rowe et al. 2013). Reading was cited the most frequent complaint following a visual impairment after a stroke in all these studies (Rowe et al. 2013). The high incidence of visual impairment among stroke survivors should be an impetus for health care professionals dealing with patients with stroke to highlight the importance of assessment of visual impairment as part of the overall rehabilitation assessment process.

1.4 Erroneous visual search after visual field loss

Human vision is the product of the rhythmic alteration between looking intently at a particular point (fixation) and rapidly moving the eyes to find the next target (saccade) (Leff et al. 2000). Saccade endpoints during searches are determined by bottom up image properties such as colour, object size and orientation, and spatial arrangement, and top down factors such as
knowledge of prior experiences along with fine interplay between all of these factors (Kerkhoff 2000; Leff et al. 2001).

Under most circumstances, a normative sample of people will explore the left upper quadrant when searching or scanning the environment and will demonstrate a remarkably similar eye movement patterns in the first instance of exposure to a scene (Pambakian et al. 2000).

The areas of high contrast – namely edges (line ends), corners (angles) or symmetry and irregular contours are areas of importance that attract fixations and induce these aforementioned stereotyped eye movements (Ishiai et al. 1987). This was supported by a study conducted Pambakian et al. (2000) and reported that normal subjects make fixations in discrete and highly conserved locations of an image. Normal subjects search from left to right and begin in a circular movement that often commences in the left upper quadrant (Pambakian et al. 2000). These are determined primarily of the perceptual features but also of semantic content. Finally, the visual system in the occipital lobe integrates all this information to minimise the next plan of saccade to find the next target (Neumann et al. 2016).

VFL is the visual impairment that distorts this normal search pattern by disrupting eye fixation and saccadic eye movements when searching the environment (Ishiai et al. 1987; Pambakian et al. 2000; Zhang et al. 2006). When searching for target objects, patients with VFL repeats saccades and fixations to the same objects when searching resulting in longer search times and longer unsystematic scan paths. In addition, their fixation dwell in their intact hemifield and their saccades are less regular, inaccurate and too small to allow rapid organized scanning (Ishiai et al. 1987). Consequently, such patients omit objects or relevant parts of a scene located in their affected hemifield (Pambakian et al. 2000). Pambakian et al. (2000) found that patients with VFL have longer scan paths and spent more time scanning their blind fields when compared to a control group but no difference on the duration of their initial fixation or percentage of refixations (Pambakian et al. 2000). In contrast, an earlier study by Zihl (1995) found that patients with VFL have significantly longer scan paths and significantly higher number of fixations on the affected side and the intact visual field (Zihl 1995b). Furthermore, this study also found that the repetition rates of fixation and scan path did not differ on both patient with left of right VFL when searching both the affected and intact hemifield.

There are two strategies that patients with stroke with VFL have developed to compensate for the defected field (Pambakian et al. 2000; Martin et al. 2007). One is to make repeated search movements towards the blind side increasing the size of their search saccade and the other is
to wait for the target on the blind side where it is expected to appear (Pambakian et al. 2000). People with VFL after stroke first shift their gaze to the intact half-field spending much more time there than in the affected hemi-field (Meienberg et al. 2004). Their oculomotor behaviour is characterised by less regular and accurate saccades directed towards the affected side, and by an increased number of fixations resulting in an unsystematic irregular and a visual exploration that is more consuming.

Overall, the disorganised search pattern, the elevated search times and the compensatory strategies after VFL may be highly time-consuming and can affect performance of tasks particularly those that require an extensive visual search.

1.5 Visual Field Loss (VFL), types, prevalence and adverse prognosis

Normal visual field with both eyes allows us to see 60 degrees superiorly, 75 degrees inferiorly, 60 degrees nasally, and 100 degrees temporally. When combined, it makes a total of 160-180 degrees horizontally and 130 degrees vertically. VFL is a loss of a part of the visual field which can occur centrally or peripherally. It is the most common visual impairment after a stroke (Ali et al. 2013; Rowe et al. 2013). And the most common VFL is the complete type or homonymous hemianopia. The high incidence of complete VFL after a stroke has been supported by several studies (Gray et al. 1989; Zihl 1995b; Suchoff et al. 2008; Ali et al. 2013; Rowe et al. 2013). But there were two studies that did not support this finding. The studies by Zhang et al. (2006) and Falke et al. (1991) reported that the most common type of VFL was the incomplete type, or quadrantanopsia, particularly affecting the superior fields (superior quadrantanopia) (Falke et al. 1991; Zhang et al. 2006). Both authors reported that this incomplete type of VFL accounted nearly two thirds of patients with stroke with VFL recruited in their respective studies. Other non-stroke conditions like traumatic brain injury, certain types of cancer, multiple sclerosis, brain tumours, myasthenia gravis and Alzheimer’s disease can also cause VFL.

VFL after a stroke is caused by the damage to the optic radiations or the geniculocalcarine tracts which carry the visual information, or to the occipital lobe, which receives the visual information (Rowe et al. 2013). The right hemisphere carries information from the left half of the visual field in both eyes, and the left hemisphere carries information from the right half of the visual field in both eyes. The geniculocalcarine tracts consists of a parietal loop and a
temporal loop (Wolter and Preda 2006). The parietal loop carries information from the inferior fields and the temporal loop carries information from the superior fields. If the lesions affect both the temporal and parietal loops, the results will be a complete VFL, or homonymous hemianopsia. Homonymous hemianopia involves the loss of half of the visual field in each eye. When the lesions only involve parietal loop, the results will be an incomplete VFL. Lesions below the parietal loop produces inferior quadrantanopia or inferior quadrant field loss, and lesions above the parietal loop superior quadrantanopia or superior quadrant field loss (Jacobson 1997; Sweinton and Thomas 2014). Other types of VFL after a stroke include constricted visual fields, scotomatous defects, altitudinal defects, sectoranopia and the unilateral loss of temporal crescent (Falke et al. 1991; Zhang et al. 2006; Rowe et al. 2013).

Lesions affecting the occipital lobe account for nearly half of the homonymous field defects with infarction, secondary to middle cerebral and posterior cerebral artery supply, accounting for nearly 75% of the lesions (Ali et al. 2013; Rowe et al. 2013; Hepworth et al. 2016). Pambakian and Kennard (1997) reported VFL due to parietal lobe in 30%, temporal lobe in 25% and 5% with damage to the optic tract and lateral geniculate nucleus (Pambakian and Kennard 1997). Zhang et al. (2006) reported a smaller incidence after damage to the lower optic tract (6%) and lateral geniculate nucleus (1%) but reported high occurrence of VFL after damage to the optic radiations in (33%) (Zhang et al. 2006).

In summary, lesions due to interruption to the blood supply of the structures of the visual system posterior to the optic chiasm, that is, those of the optic tracts, lateral geniculate nucleus, optic radiations, or the primary visual cortex following a stroke, produces VFL. The type, feature and clinical presentation of the VFL can be predicted based on the location of the visual pathway that was affected after a stroke.

1.5.1 Prevalence

The reported prevalence of VFL after a stroke varies considerably in literature and were reported to range from 7% to 69%. Two population based study, the Rotterdam Study in the Netherlands and the Blue Mountain Eye Study in Australia, reported a very small prevalence rate of 7 – 8% of VFL with stroke being the third cause of this impairment (Ramrattan et al. 2001; Gilhotra et al. 2002). The nature of these studies with the inclusion of other conditions affecting vision may have resulted to the underestimation of the incidence of VFL associated
with stroke. Three studies ((Zhang et al. 2006; Suchoff et al. 2008; Rowe et al. 2013) reported a higher VFL incidence of 49.5% to 69.7%. In contrast to the population based studies, the recent studies were conducted in specialized units and this type of the setting may have potentially resulted in a higher reported incidence of VFL.

An earlier study by Zihl and Cramon (1985) that used a perimetric test reported a high incidence of 80% of VFL after a stroke to measure VFL in their sample of 55 patients (Zihl 1995b). The use of perimetric testing is more sensitive to changes in visual field and may have resulted to higher incidence of VFL in their cohort of stroke patients. In contrast, the study by Ali et al. (2013) that used confrontation test reported a lower incidence rate. The Virtual International Stroke Trials Archives (VISTA) reported VFL as the most common visual impairment after stroke and reported that 5,978/11,900 (50.23%) of these patients have VFL that included patients with complete, incomplete and bilateral VFL (Ali et al. 2013). The use of different testing methods to measure VFL in these two studies have resulted in the estimate differences.

Visual field loss has also been reported to occur in non-symptomatic stroke, a group of patients who are often overlooked. One study that explored the prevalence of VFL in minor non-symptomatic stroke and transient ischaemic attacks (TIA) found that up to 57% of this cohort of patients have VFL (Falke et al. 1991). In contrast to most studies of symptomatic stroke, the most common VFL in non-symptomatic stroke is quadrantanopia.

Overall, the differences in sampling methods, clinical setting, outcome measures used, the type of VFL and the timing of assessment have resulted in the high variability of incidence of VFL in patients following a stroke.

1.5.2 Recovery of Visual Field Loss

Early studies reported that VFL in stroke patients tends to be permanent, and recovery tends to be rare (Gray et al. 1989; Zihl 1995b). However, recent studies have shown that partial recovery of visual field after a stroke can occur in a small number of patients (Tiel and Kolmel 1991; Cassidy et al. 2001; Zhang et al. 2006; Ali et al. 2013). The reported recovery rates in these studies varied from 3% to 63%. Although these studies have shown that potential restoration of the visual field is possible, there are differences about the extent of restoration of the visual field due to heterogeneity in the inclusion criteria (stroke onset), number of
participants, timing of assessments, assessment intervals, outcome measures used in these studies resulting in high variability in reported rates of recovery of VFL following a stroke. A retrospective analysis by Ali et al. (2015) extracted data from the Virtual International Stroke Trials Archive (VISTA) on 11,900 participants, reported that the number of patients with VFL dropped from 50% to 26% after 30 days and from 26% to 21% after 90 days. The results of this estimate had to be interpreted with caution however. This study used the National Institute of Health Stroke Scale (NIHSS) confrontation test using finger waggling and/or finger threat to verify the presence of VFL instead of perimetry as the gold standard clinical measure of VFL (Rowe et al. 2013). This may have resulted in the study’s overestimation of the recovery of visual field after a stroke. The presence of VFL in stroke may have been overestimated by routine confrontational test during initial assessment and follow-up. The confrontation test has been reported to become less reliable and less sensitive during follow-up (Anderson et al. 2009).

A prospective study of by Tiel and Kolmel (1991) of 69 patients with stroke with complete VFL documented patterns of recovery using a confrontation test followed by kinetic perimetry during follow-up (Tiel and Kolmel 1991). They found that the most common recovery was that of the lower quadrant first (33.4%) followed by complete recovery (25%). This is followed by recovery of the upper quadrant (21.9%) and finally improvement in both quadrants with (18.7%) (Tiel and Kolmel 1991). Another study by Cassidy et al (2001) used optokinetic perimetry to examine patterns of recovery of VFL among 75 patients with complete VFL after a stroke in 4-week interval for 12 weeks. The study found that maximum recovery happened in the first four weeks of stroke with complete recovery in 16%, quadrant recovery in 5% and central recovery in 42% of patients (Cassidy et al. 2001).

This body of evidence, though conflicting at times, suggests that VFL is not always a permanent loss as previously cited. Recovery of VFL appears to be possible and occurs very early after stroke but tapers off after three months. There is consensus however that improvements seen after six months are usually small in magnitude and improvements after a year are negligible (Zihl 1995b; Cassidy et al. 2001; Zhang et al. 2006; Ali et al. 2013).

VFL has been associated with less favourable outcomes after a stroke like poor functional recovery and high fatality rate (Gray et al. 1989; Sand et al. 2018), social isolation leading to depression (Gall et al. 2010), increased risk of falls and institutionalization (Patel et al. 2000). VFL can have negative impact on a patient’s ability to participate in rehabilitation. An
observational study by Patel et al. (2000) involving 459 patients with stroke showed that having VFL significantly affected the time and likelihood of improving functional scores as measured by the Functional Independence Measures (FIM), the Barthel Index (BI), the Lawton Instrumental Activities of Daily Living (IADL) and a health survey instrument (Patel et al. 2000). The author reported that the probability of achieving an MBI score of 60/100 (able to go home with significant help) for patients with a combination of motor, sensory, and VFL at 6 months is only 52%, suggesting a higher probability of discharging patients with VFL to a long-term care facility and/or discharge home with significant help. Thus, VFL combined with other stroke symptoms is associated with longer hospital stay and risk of discharge to nursing homes (Gray et al. 1989; Patel et al. 2000).

The high rate of VFL among patients following a stroke, uncertain recovery rates of VFL and its association with several negative outcomes should encourage clinicians to consider this impairment as one that requires urgent assessment and rehabilitation. This evidence should reinforce the importance of immediate clinical assessment of VFL using a range of objective functional outcome measures following a stroke as the first line of management strategy for patient with VFL.

### 1.6 Clinical Evaluation of Visual Field Loss

The most widely used test for screening for VFL is the confrontation visual field test (Ali et al.; Goodwin 2014). Confrontation visual field testing is a crude test to ascertain the presence of VFL, however, in most cases, the confrontation test may be the only method available in most clinic (Goodwin 2014) as it is embedded in the NIHSS test to verify the presence of VFL in patients following a stroke (Townend et al. 2007). This simple screening tool has been used separately (Gray et al. 1989; Townend et al. 2007; Ali et al. 2013; Sand et al. 2018) or in conjunction with perimetry (Cassidy et al. 2001; Zhang et al. 2006; Suchoff et al. 2008; Rowe et al. 2013) in several cohort studies to identify and quantify VFL among patients with stroke.

Confrontation test involves the patient sitting directly in front of an examiner and fixing his or her vision on one of the examiner’s eye, one eye is tested at a time (patient closes his right eye with his right hand and vice versa). Using a stationary or moving objects, the examiner moves the target from the outside the usual 180 degrees of visual field to a more central position until the patient confirms seeing the target. There are many methods or types of confrontation test
used to gauge the extent of VFL. The most sensitive individual method of visual field testing is kinetic testing using a 5mm red bead (Rowe et al. 2013; Goodwin 2014). This picks up 43% of mild defects and 89% of severe defects. The overall sensitivity of using the kinetic red bead to improves to 78% when combined with static finger wiggle test (Goodwin 2014). Verification of VFL through confrontation test should be followed by a perimetric testing to quantify the VFL. The confrontation test is less sensitive to subtle changes in the recovery of visual field that can occur over time compared to perimetric testing (Anderson et al. 2009).

Perimetry is the golden standard in objectively measuring the extent of VFL. During a perimetry test, a patient sits in front of a white bowl and positions his or her head in a head and chin piece with a 30 cm standard distance between the patient’s eye and the background. The perimetrists looks at the patient’s eyes through the observer’s tube as a stimulus of varying sizes and intensity is projected into a bowl with a standard background light. The stimulus is moved from the non-seeing area to the seeing area at about 3-5 degrees per second. The patient indicates whether he/she sees the stimulus by pressing a buzzer or by responding verbally. The perimetrist then makes a mark at the point where a stimulus is seen along the circles on a graph called isopters. At the conclusion of the test, the marks are connected by lines to form smooth boundaries of the visual field (Dersu et al. 2006). The Goldmann manual perimeter is the most popular test in detecting neurological VFL but the Humphrey automated perimetry is also widely used (Rowe et al. 2009a). The Goldmann perimeter and the Humphrey’s perimeter measures the entire visual field, one eye at a time, and reports the size and the side of the VFL. Eighty eight percent of VFL cases are detected more accurately with these types of perimetry than with other perimetry test making it an accurate measure VFL (Goodwin 2014). Other clinical tests for mapping VFL include the Campimeter (Gall et al. 2010), High Resolution Perimeter (Zihl 1995b) Manual Kinetic Tubingen Perimetry (Tiel and Kolmel 1991), and Oculokinetic perimetry (Cassidy et al. 2001).

There are a number of patients who cannot undergo a confrontation test and formal perimetry due to communication problems or significant cognitive and motor impairments. Some patients are not assessed for the presence of VFL when the care staff fail to suspect visual impairment (Rowe et al. 2009a). Equally, both patients and hospital staff do not identify the functional difficulties to VFL and therefore fail to report the presence of this problem to a medical doctor (Papageorgiou et al. 2007; Rowe et al. 2009b).
One aspect that has received attention in the last decade is the impact of VFL on ADL. A group of stroke survivors and their carers in one survey highlighted the importance of addressing one’s ability to participate in daily or recreational activities after a stroke rather than addressing stroke-related impairments alone (Pollock et al. 2012). This substantiates the need to report the negative impact of VFL on activities that are valued by patients. The outcome of such report can substantiate the urgency of functional clinical assessment of VFL after a stroke.

1.7 Visual field loss and daily activities

The Ecology of Human Performance (EHP) framework and the Person Environment and Occupation (PEO) model, postulate that occupational performance is the product of the interaction of the person, the context and the tasks/occupation (Dunn et al. 1994; Strong et al. 1999). A negative change in any of the three components disrupts the balance between them with the effect of reducing the person’s performance, which includes tasks (including activities of daily living (ADL) the person can competently perform. The disruption of the visual search that accompanies VFL can cause an inaccurate and erroneous perception of the physical environmental context (Kerkhoff 2000; Warren 2009). Without the benefit of an accurately constructed physical context, according to these models, the people with VFL would likely experience a reduction of the range of ADL’s they could successfully complete. In addition, the observed ADL limitation will be related to the amount of visual search needed for the tasks, so that an ADL that requires a wide visual search or a search of a complex visual array would be more likely to be impaired than an ADL made up of tasks with simple features and limited search field (Warren 2009). Thus, people with VFL will experience specific limitations in ADL performance that are directly related to the effect of vision and the search requirements of the tasks.

There are several studies that explored the impact of VFL on specific tasks. These studies have focused primarily on the changes on reading, mobility and driving.

A literature search of the impact of VFL on reading, driving, mobility and ADL performance were completed in three databases: Medline (EBSCOHost), Cinahl (EBSCOHost) and PubMed (Ovid). The search strategy that was used for computerised database searches for reading, driving, mobility and ADL are listed in Appendix 1-2.
1.7.1 VFL and reading

Reading can be disrupted at several stages of visual processing. Adults with normal visual field recognise and read familiar words of differing letter lengths and at uniform speeds: the letter of the whole words and are processed in parallel, and not letter by letter (Leff et al. 2001). Reading demands at least two degrees of visual angle to the left and right of central fixation point and one degree up and below (McDonald et al. 2006). This affords the reader the acuity to discern words up to nine letters without the reader having to make an eye movement within a word (Leff et al. 2000).

Readers of left to right orthographies acquire more information from the right side of fixation than from the left, making the perceptual window asymmetric. This perceptual window extends far more to the right (up to 15 characters) than to the left (3 to 4 characters (Kerkhoff et al. 1992; Zihl 1995b). Perceptual window also corresponds to the fixation time and gaze duration and is defined as the total period of fixation on a word before another word or part of a text is fixed upon (Upton et al. 2003). In fluent readers, the length of perceptual window was found to be in the range of 200-250 milliseconds (Leff et al. 2000). Both foveal and parafoveal text information is used by the reader to maintain continuous text information acquisition and to reduce recognition time (Zihl 1995a). Thus, reading English text depends on both foveal and parafoveal vision and moving attention after fixation from left to right (Leff et al. 2001).

VFL affects reading because it disturbs initial fixation, disrupts word recognition, interrupts the planning of the next saccade and impairs access to the representation of words in the grapheme and orthographic input buffers (Zihl 1995b; McDonald et al. 2006). Zihl (1995) was the first to establish the importance of the role of visual fields in word recognition and guidance of eye movements in reading (Zihl 1995a). He reported that patients with complete VFL have longer fixation duration in general. The resulting impairment is characterised by reduced amplitude of saccades to the left, an increase in number of saccades to the left and a high repetition of saccades and fixations to the left. People with right sided VFL, in contrast, find it difficult to shift their gaze in a systematic order in the direction of the reading ie. from left to right. Their reading appears to be more impaired and their eye movement pattern more disorganised, which can be characterised by high number of saccades to the right, with a high repetition rate, a reduced amplitude of these saccades and considerably increased durations of fixations (Zihl 1995a). This finding was supported by another study by McDonald et al. (2006) that compared the reading performance of 18 patients with stroke with right sided VFL to 10
participants with no stroke and found that patients with VFL make initial fixation at the start of the word, fixate for longer, re-fixate on a word and were likely to skip over shorter words (McDonald et al. 2006).

Although there are striking differences in the reading behaviours of patients with VFL according to the location of the field loss, there is a consensus among studies that patients with right VFL are more disabled when reading than patients with left VFL (Kerkhoff 2000; Leff et al. 2000; McDonald et al. 2006). The asymmetry of the perceptual window plays in part for the difference, as right-sided VFL cuts a larger part of the reading window (15 characters on the right compared to 4 characters on the left) and therefore impair reading more than the left-sided VFL (Zihl 1995a).

Ninety percent of patients with VFL complain of significant reading impairment (Susanne Schuett et al. 2009). Warren’s study (2009) found 79% reported difficulties reading words, 59% reported reading numbers and 40% reported difficulty writing legibly from a sample of 46 patients with VFL. The study used the Visual Skills for Reading Test (VSRT) to measure reading performance. She reported deficiencies in both the accuracy and the reading rate of the participants. The median reading rate of the participants were 74 words per minutes (wpm) which is very low compared to the normal reading rate of 250-300 wpm (Leff et al. 2000). Reading, being an integral part of daily activities, can potentially affect important activities such as meal preparation, financial management medication management and using a phone (Blaylock et al. 2016). The significant number of patients with VFL that have reading problems further reinforces the need for appropriate assessment of this condition, as well as its impact on everyday tasks.

1.7.2 VFL and mobility

VFL reduces one’s orientation of the environment when mobilising. This reduction in orientation is caused by incomplete overview of surroundings including potential obstacles and people when moving from one point to another (Turano et al. 2004). Mobility is often measured according to the level of assistance needed to perform the task. However, mobility after sustaining VFL has been quantified using walking speed in some studies (Turano et al. 2004; de Haan et al. 2015). The Salisbury Eye evaluation study by Turano et al. (2004) used other parameters to measure mobility performance including bumping into objects and walking in the right direction or not (Turano et al. 2004).
The ability to find one’s way in a dynamic environment when walking is also affected after VFL (de Haan et al. 2015). This could lead to someone with stroke losing their way on a once familiar route. Dual attention tasks, where a person is required to carry out another task other than walking, like when a person is shopping in a supermarket or walking through a pedestrian crossing may become distressful to a patient with VFL (Kasnci et al. 2014).

Mobility is one area that has been reported by patients with VFL to be severely affected, even when visual acuity is intact (Noe et al. 2003; Turano et al. 2004; Warren 2009; Mennem et al. 2012; de Haan et al. 2015). One study reported that 90% of participants (n= 46) identified mobility as their main challenge (Warren 2009). People with VFL have reduced walking speed, have increased bumps and trips and are at high risks of falling (Turano et al 2004). These, in turn, have a negative impact on their ability to mobilise, increasing their loss of independence.

Other than difficulty characterised by collision with objects when mobilising, patients with VFL also reported experiencing symptoms of anxiety when moving about in crowded community environments, including shortness of breath rapid heartbeat, excessive perspiration, dry mouth, a sense of foreboding, and nausea. One participant described his anxiety as “crowd-it is” and he reported he became physically ill if he required to go into a crowded store or community event (Warren 2009).

1.7.3 VFL and Driving
Peripheral vision required for mobility is similar to peripheral vision required for safe driving (i.e. to be able to detect vehicles or persons to avoid collision or falls) (Papageorgiou et al. 2012). Traffic safety regulations in the European Union require an assessment of the visual field to confirm that the horizontal extent of the binocular visual field of 120 degrees (Poole et al. 2008). The guidelines in Ireland and the UK precludes any drivers who do not meet these criteria (Ireland 2016; UK 2018) Most patients with VFL do not meet the minimum standards of these guidelines prohibiting them from driving on the roads. Studies have alternated between supporting and rebuking the ability of patients with VFL to drive safety on our roads (Papageorgiou et al. 2007; Wood et al. 2009; Tant et al. 2002; Elgin et al. 2015).

These studies that looked at the effect of VFL on the areas of reading, mobility and driving, have given clinicians a better understanding of the far-reaching repercussions of VFL on
educational and vocational lives of patients with stroke. Unfortunately, resumption of these 
skills is not the priority of stroke services in acute hospitals. To date, little is known about the 
impact of VFL on Personal ADL (PADL) and Instrumental ADL (IADL), and whether VFL 
can reduces one’s independence level. Thus, studies that explored ADL performance of 
patients with VFL after stroke are lacking.

The use of assessments that measures limitation in function on patients with VFL after a stroke 
is necessary to help clinicians, particularly occupational therapists, to prioritize these patients 
and to provide appropriate intervention. The outcome of such assessments has the potential to 
predict the burden of care and predict the number of services patients with VFL may require. 
This is also the much-needed information in planning for their discharge, a common priority 
of acute hospitals (Kelly and Harbison 2012).

1.7.4 Visual Field Loss and Activities of Daily Living

The literature search for VFL and ADL only included cohort studies that examined ADL 
performances of patients with VFL after stroke that used outcome measures with items of P- 
ADL or I-ADL, and that were either used as the primary outcome measure or in combination 
with other measures were selected. Studies that were published earlier than 2000 and those that 
used outcome measures that only dealt with driving, reading or mobility were removed from 
the result of the search. Only six studies met these criteria.

A total of four assessment tools that measured the impact of VFL on the ADL were pooled 
from these studies. These were the 25-item National Eye Institute Visual Functioning 
Questionnaire (NEI-VFQ -25), 48-item Veterans Affairs Low Vision Visual Function 
Questionnaire (VA LV VFQ-48), the Self Report Assessment of Functional Visual Performance (SRAFVP) and the ADL Limitation Interview (ALI). Three studies used the NEI- 
VFQ-25 assessment tool (Papageorgiou et al. 2007; Chen et al. 2009; Gall et al. 2010). One 
study used the VA LV VFQ-48 (Chen et al. 2009), the SRAFVP (Mennem et al. 2012 and the 
ALI (Warren 2009).
1.7.4.1 NEI VFQ 25

The NEI-VFQ-25 was designed to assess the dimensions of self-reported vision-targeted health status that are important for persons with chronic eye diseases but was used with patients with VFL after a cerebral damage (McKean-Cowdin et al. 2007; Gall et al. 2010). The NEI-VFQ 25 is the shorter version of the original 51-item version that was developed by the National Eye Institute to measure the influence of visual disability and visual symptoms on generic health domains such as emotional well-being and social functioning, in addition to task-oriented domains related to daily visual functioning (Mangione et al. 2001). The 25-item version is composed of 12 vision targeted scales: general vision, near and distant vision activities, ocular pain, vision related social function, vision related role function, vision related mental health, vision related dependency, driving difficulties, color vision, and peripheral vision. The NEI-VFQ 25 also has a general health item. Each subscale consisted of minimum of one and a maximum of four items. The standard algorithm was used to calculate the scale scores, which have a possible range from 0 to 100. Higher scores represent a better visual functioning and well-being. Eleven of the 12 scale scores (excluding the general health item) are averaged to yield a composite score. Reliability and validity of this measure has been reported to be good and comparable to the 51-item version (Mangione et al. 2001).

The three remaining studies that used the NEI-VFQ 25 used samples that comprised of different types of VFL except for one study (Chen et al. 2009) where only participants with complete VFL were recruited. Two studies compared the scores of patients with VFL to a reference of a healthy sample (Papageorgiou et al. 2007; Gall et al. 2010) but only one study compared the scores to an age and gender matched control. The studies that used the NEI-VFQ 25 reported that patients with VFL after a stroke have consistently lower scores on general health and general vision except for the study by Gall et al. (2009) who did not report a reduction of score on general health. There was a consensus among these studies and showed significant lower score on the subscale of mental health (embarrassment when doing tasks, losing control on doing tasks because of eyesight), peripheral vision (difficulty noticing people or items on the side when walking) and driving. The reported statistical difference in the subscale of near-vision activities (reading newspaper, cooking, sewing, finding items in a crowded shelf), distance vision (reading street signs, managing steps or curbs and watching a movie), social function (reaction to people when talking and visiting people in their house or attending parties/restaurants), dependency on others (needing a lot of help, relying on people and staying at home) and colour vision (picking up and matching own clothes) varied. The difference in
the sample sizes of these studies, with the study by Gall et al. (2009) having had the largest sample (n= 315), may explain the variance in the NEI VFQ 25 results. Overall, the NEI VFQ 25 was able to show that patients with VFL have significantly lower scores on all the subscales suggesting that VFL impact is not restricted to vision-related activities but can also affect one’s general and mental health.

1.7.4.2 VA LV VFQ 48

The VA LV VFQ- 48 questionnaire assesses visual ability to perform ADLs across four domains including reading, mobility, visual motor function and visual processing where patient’s responses are recorded using Likert scale with 1 indicating not difficult at all to 4 indicating impossible to perform. The response categories are then entered onto an Excel spreadsheet with a built-in formula that transforms the rating category ranks to average functional reserve. Stelmack et al. (2004) reported good reliability and validity of the VA LV VFQ 48 (Stelmack et al. 2004).

The study by Chen et al (2009) reported that patients with VFL garnered lower scores on the visual ability, mobility and visual motor functioning subscale of the VA LV VFQ-48 compared to an age and gender matched healthy group (Chen et al. 2009). However, the authors also reported that mobility was the only subscale that showed a statistically significant difference between the control group and he VFL group. No differences were noted on the subscale of reading and visual information.

1.7.4.3 Self-Report Assessment of Functional Visual Performance (SRAFVP)

Mennem et al. (2012) used the SRAFVP in a pilot prospective observational study with an aim of validating this instrument with patients with VFL (Mennem et al. 2012). The study reported no significant difference in performance difficulty in 30 patients with VFL in the subscales of reading, eye hand coordination but reported difference on the subscale of mobility. It also found that participants with a complete VFL had more difficulty in the subscale of reading than those with incomplete VFL. The study also reported good reliability and validity of the SRAFVP (Mennem et al. 2012).
1.7.4.4 ADL Limitation Interview

The ADL interview, a semi-structured interview, addresses five basic or PADL skills and five IADL skills: driving, shopping, meal preparation, financial management, telephone use personal hygiene and feeding. Warren (2009) reported that less than half of the participants (n=46) identified grooming and feeding as problematic P-ADL (Warren 2009). More than 90% of the participants reported difficulty in driving, shopping and money management. Half of the participants reported problems with meal preparation. No study has reported the reliability and validity of this measure.

The NFV VFQ-25, the VA LV VFQ-48 and the SRAVFPO have well established validity and reliability. In contrast, the ALI was reported to be in the preliminary stages of instrument development and was used primarily to identify the needs of patient with VFL after a stroke in the study (Warren 2009; Mennem et al. 2012). The results of these outcome measures should be interpreted with caution. Nevertheless, the outcome of these studies reinforced the negative influence of VFL on quality of life and tasks that are difficult to perform as a result. There is a need to measure these difficulties objectively. Assessments that rate the level of performance and assistance can be more sensitive in the changes in ADL after VFL and will be more useful for occupational therapists that deal with patient with VFL in clinical settings.

All of the assessments used in these studies were subjective, rather than objective measures, of ADL. Thus, these assessments described the difficulties of some ADL tasks but did not rate the level of performance (independent or dependent) and the level of assistance (minimal or total assistance) the participants required when performing the tasks. In fact, few studies have reported that the participants continue to perform the tasks that they themselves rated to have difficulty with. For example, nine out of ten participants with VFL in a study by Chen et al. (2009) continued to perform the tasks listed in the NEI VFQ 25 despite rating lower scores. Another study by Warren (2009) reported that all except one participant (n=46) continued manage their daily affairs and was able to live alone or with their spouse after sustaining VFL. These findings suggest that subjective rate of performance was not related to and different from “actual” performance.
To date no study had exclusively assessed the ADL performance of patients with VFL using a standardised objective outcome measure. To bridge the above gap, an investigation of the limitations in the ADL performance of patients with VFL, using objective instruments with well-established validity and reliability, is a necessity. The results of such evaluations will assist clinicians to understand the level of performance and assistance that patients with VFL require. These evaluations will help occupational therapists to advocate for and prioritize patients with VFL. The evaluations will provide invaluable tools to occupational therapists to plan for the assessment and rehabilitation of patients. To this end, this study aimed to explore the ADL limitations of patients with VFL after a stroke using a standardized objective measure used by occupational therapists in the Assessment of Motor and Process Skills (AMPS).

1.8 Potential significance of this study

This study has four aims. First, this study proposes to bridge the gap in literature and use an observation-based assessment that is used by occupational therapists, the Assessment of Motor and Process Skill (AMPS), to assess the quality of ADL performance of patients with VFL after stroke. The AMPS is different to most assessment tool in that it is not norm referenced but criterion referenced, with the criterion being competent ADL performance. In the AMPS, even healthy or well adults will receive lower scores on some items for sufficiently challenging tasks, but this does not indicate ineffective ADL performance. Thus, ceiling and floor effects are not exhibited in the AMPS. This feature of the AMPS makes it sensitive to detect even the small to modest changes in ADL compared to other assessments used in the stroke population that measures ADL.

The result of this study can help occupational therapists who work with stroke patients with VFL to ascertain if they are likely to have deficits in ADL motor skills (bends, reach, grips etc.) or ADL process skills (continues, inquires, notice/responds etc.) or both. The results could potentially assist occupational therapist who work with patients with VFL to focus their treatment on improving either the motor and process skills or both.

The AMPS can measure the potential need for assistance for community living. The result of this study from this standpoint can help occupational therapists to ascertain what level of assistance patient with VFL after stroke will require. Such information can increase awareness
and understanding about the negative impact VFL can have on safe discharge home. One study had reported that dependence on others have been shown to be significantly related to presence of visual disorders when combined with motor deficits after a stroke (Patel et al. 2000). Patel et al. (2000) reported that patients with stroke and VFL are only 0.3 times as likely at 6 months to be able to go home (Patel et al. 2000). At present, there are no studies that investigated the level of assistance required by patients with VFL after stroke. Thus, this study could contribute novel insight into this aspect of care and planning services for patients with VFL after a stroke.

Second, the study proposes to compare a group of stroke patients with VFL with a group of people with stroke that do not have VFL (Non-VFL group) to be able to illustrate if the VFL group perform better or worse than the Non-VFL group. Using a comparator group will assist in understanding the true impact of VFL compared to having a stroke more generally, on ADL. The results of which could provide guidance on whether to, and how to, prioritise patients with VFL in assessment and treatment, both in the hospital and when they return home in the community.

Third, the study proposes to ascertain if ADL performance also varies between the laterality of the VFL (left versus right) and the topography of VFL (complete versus incomplete). Previous studies have explored the differences of patient performance in some tasks like reading (Zihl 1995b; Leff et al. 2000) and driving (Elgin et al. 2010) depending on the laterality of VFL and topography of VFL. In a manner similar to these studies, we would like to extend this investigation to establish if differences in ADL performance exist between these categories of VFL. The result of this finding has the potential to assist occupational therapists to predict ADL performances of patients with VFL based from these categories.

Lastly, the study aims to ascertain if ADL performances of patients with VFL, as measured by the AMPS, improve over time. The study will compare the performances of patients with and without VFL from initial assessment to follow-up. One study has shown that potential recovery is possible for some functions after acquiring VFL, reflecting cortical plasticity or functional recovery after brain damage and compensatory strategies or a combination of both (Kerkhoff 2000). The comparison of scores from initial assessment to follow-up will permit the examination of the degree of improvement in ADL and give us some insight if ADL performance of patients with stroke with and without VFL improves overtime or not. This insight can establish the need for services for patients with VFL after a stroke.
1.9 Summary

This chapter sought to place this study in context. It began with an overview of stroke, prevalence of VFL and natural history of this impairment. This was followed by detailing the argument of the importance of the assessment and rehabilitation of vision with emphasis on the consequences of VFL particularly in the areas of reading, mobility and driving.

This chapter high-lighted the gap in literature that there is no observation-based outcome measure that has been used to ascertain the ADL performance of patients with VFL. It described the study’s proposal to bridge some of these gaps and the potential significance of the study.

The aim of this study is to explore the ADL performance of patients with VFL after a stroke using an observation-based outcome measure that can be used by occupational therapists in clinical practice.
Chapter 2. Methodology

2.1. Introduction

This chapter describes the study’s aims and objectives. It outlines the study design, the setting of the study, the recruitment process, the sampling method, and described the outcome measure to define the participants baseline PADL and reading skills. It also describes the main outcome measure, the AMPS, that was used to evaluate the participants’ ADL skills at baseline and at follow up. Lastly, it described the methods used for data collection and data analysis.

2.2. Aim of the study

The primary aim of this study was to explore the ADL performances of patients with VFL using the Assessment of Motor and Process Skills (AMPS), an observation-based evaluation of ADL skill (Fisher and Jones 2011). Furthermore, the study also aims to examine if there are differences in the AMPS ADL motor and ADL process ability scores, when comparing patients with and without VFL after a stroke. This can be achieved by comparing the ADL scores of patients with and without VFL on initial assessment and on follow up.

A secondary aim of the study was to examine whether the classification of VFL (topography and laterality of VFL) causes differences on the ADL performances of patients with VFL. This can be achieved by comparing the scores between patients with stroke with complete versus incomplete VFL, and between patients with stroke with right versus left VFL.

Finally, this study sought to determine if patients with VFL after a stroke improve their ADL performances during post-acute recovery. This was achieved by comparing the scores of patients with and without VFL at initial assessment and again at follow-up at ≥ 7 weeks.
2.3 Objectives
The main objectives of this study are:

1. Describe the ADL motor and ADL process ability scores of patients with VFL
2. and without VFL.
3. Compare the ADL motor and ADL process ability scores of patients with VFL according to the category of laterality and topography.
4. Compare the AMPS ADL motor and ADL process ability scores of patients with stroke with and without VFL from initial assessment and follow-up at ≥ 7 weeks.

The AMPS ADL motor and ADL process ability scores were interpreted based from the AMPS competence cut-off scores and AMPS independence cut-off scores as per standard procedures described in the AMPS manual (Fisher and Jones 2011)

2.4 Study design
This study used a prospective cohort design. A prospective cohort study is a study that follows a group of individuals overtime who are similar in many ways but differ by a certain characteristic and compares them using a particular outcome (Peat et al. 2002). In this case, the study follows a sample of adult patients with stroke who were consecutively recruited from admissions to the In-Patient Stroke Unit, the Out-Patient Stroke Clinic/the Rapid Assessment Stroke Prevention (RASP) Clinic and the Stroke Early Supported Discharge (ESD) of Tallaght University Hospital, in Dublin, Republic of Ireland. In this study, the presence of VFL is the exposure and the outcome is ADL performance. The STROBE Guidelines was followed to ensure the appropriate conduct and reporting of this study (www.strobe-statement.org).

2.5. Setting
The study was conducted in Tallaght University Hospital (TUH), an urban teaching hospital. It is an acute hospital with 625 beds with specialities ranging from adult surgery and medicine, care of the elderly, paediatrics, psychiatry and emergency medicine.

There were three main clinical departments where the participants were recruited from for this study. The first area was the Acute Stroke Unit (ASU), an acute neurological ward providing specialist services for patients with suspected stroke. Some patients with a suspected stroke
who presented in the Accident and Emergency (A&E) Department were transferred to ASU for active treatment and monitoring. ASU is comprised of nine dedicated beds among 26 beds dedicated to rehabilitation of patients with stroke and age-related medical conditions.

The ASU is covered by two stroke consultants and two clinical nurse specialists (CNS). It has a dedicated multi-disciplinary rehabilitation team consisting of an occupational therapist, physiotherapist, speech and language therapist, dietician, a medical social worker and a neuropsychologist.

Facilities in the unit include a physiotherapy gym, an occupational therapy workshop, individual treatment rooms, and an ADL suite. The ADL suite consists of an assessment kitchen, bedroom and bathroom. These facilities allow for a wide range of assessment and treatment modalities used for rehabilitation.

The second area where participants was recruited from is the Out-Patient Clinic/ RASP Clinic. This service is an out-patient services that provided follow up assessment for patients who were diagnosed with stroke. Normally, patients with stroke attended these clinics for follow-up assessments and review by the consultants. This clinic is run by a consultant and one CNS.

The third area where patients was recruited from is the ESD. ESD is a dedicated acute stroke service for patients who have suffered a stroke that allows their care to be transferred from the in-patient hospital environment to the comfort of their own home. The ESD team can accommodate patients in their service as early as 3 days from admission to the hospital once they meet their inclusion criteria. ESD enables patients with stroke to continue their rehabilitation with similar intensity and frequency as they would receive if they were still in the hospital. The ESD team is comprised of an occupational therapist, a physiotherapist, a speech and language therapist and a medical social worker. The service extends only to potential patients within 15-kilometer radius of TUH.

### 2.6 Participant Recruitment

Recruitment commenced on July 2017 and ran until March 2018. Follow-up at ≥7 weeks post baseline assessment for recruited participants commenced on September 2017 and ran until June 2018. Recruitment and the follow-up stages combined mean data collection ran for a total
time of 13 months. Follow-up assessment were carried out either in the participants’ houses or in the hospital when the participants opted for an out-patient appointment.

For participant who were recruited through the Stroke ESD, an out-patient service, initial assessment and follow up assessments took place in either in the hospital OT clinic or in their house.

This study employed a consecutive sampling method and recruited participants through consecutive admissions on the areas mentioned above until the require sample was achieved (Bowers et al. 2017). The population recruited was identified from patient lists based on the inclusion and exclusion criteria described below. The primary researcher and the Clinical Specialist Nurse identified potential participants by reviewing the Stroke Referral List under two Stroke Consultants daily for the In-patient stroke unit. The researcher and the Clinical Nurse Specialist also reviewed potential participants by reviewing the Out-Patient Clinic/RASP Stroke Clinic list twice a week.

The researcher and the ESD OT reviewed potential participants from the ESD caseload list.

The inclusion criteria for this study included were that participants:

1. Were ≥ 18 years old
2. Had clinical diagnosis of stroke ≤ 4 weeks confirmed by MRI or CT scan
3. Had no previous history of stroke
4. Had no pre-existing ocular pathology affecting visual field,
5. Had no evidence of hemi-inattention or spatial neglect,
6. Had good visual acuity or corrected acuity with glasses,
7. Obtained a Mini Mental State Examination (MMSE) score of ≥19/30 (Folstein et al. 1975),
8. Had sufficient communication to follow instructions in English,
9. Had no significant physical impairment that may substantially affect ambulation.
10. Post-stroke modified Rankin Score (mRS) of ≤ 3 suggesting mild to moderate disability.

These cohort of patients were chosen on the basis that these patients with stroke were amenable to rehabilitation and can follow complex instruction imbedded in the administration of the AMPS.
The exclusion criteria included:

(1) Were ≤18 years old
(2) stroke diagnosis ≥ 4 weeks
(3) Had a previous history of stroke
(4) Had pre-existing ocular pathology affecting visual field.
(5) Have an evidence of hemi-inattention or spatial neglect
(6) Have poor visual acuity even with the aid of glasses
(7) MMSE score ≤19/30
(8) Insufficient communication to follow instructions in English
(9) requires significant physical assistance to walk.
(10) nursing homes residents or
(11) patients who required significant assistance to perform basic ADL skills before the stroke.
(12) patients who had a mRS of 0 (no disability) and ≥ 4 suggesting severe disability.

2.7 Ethical Considerations

i. Prior to starting this study, the researcher sought ethical approval from the Tallaght University Hospital and St. James Joint Research Ethics Committee (REC).

ii. Informed voluntary consent. Potential participants were given written information sheet outlining the nature of voluntary consent, the right to withdraw from the study, anonymity of all information held, data protection issues and how the results will be disseminated. Full consent from the participants was obtained from all participants prior to the start of the study.

iii. Data Protection. Electronic data was held in an encrypted USB and a specified computer in the OT office that only the researcher had access to. All other data was held in a locked cabinet accessible only to the researcher in a lockable room in the OT office. Access to data was restricted to the researcher and his supervisors.
Any computer data file and paper document that contains data of the study will be retained for a maximum of five years. All the data will be deleted after five years.

iv. Although absolute anonymisation was not possible, participation was anonymised using a codebook so as the participants were only identifiable to the researcher. Patient identifiers were not used in documentation, analysis or reporting.

v. Insider research. The researcher was known to the potential participants as he is a staff member (OT) working in the same department they have access as a result of their stroke. The gate-keepers were the Neurology Senior occupational therapist and the ESD occupational therapist who made the initial contact with the participants and provided them with the patient information sheet.

vi. AMPS raw data was to Centre of Innovative Occupational Therapy Solutions (CIOTS) to ensure that all data was valid. This service can be accessed using the Occupational Therapy Assessment Package (OTAP)/AMPS Software that was already installed on three computer outlets in the office. All data stored in the OTAP software are encrypted and password-protected to ensure that only the authorised occupational therapist can access his or her client data. No sensitive information related to the patient was stored in the software (www.innovativesolutions.com/software/otapPrivacyOverview).

A copy of the Ethical Approval Letter can be located on Appendix 7.

2.8 Process to obtain consent

Nominated gatekeepers, the Neurology OT and ESD OT, who were not otherwise involved in the study, approached all potential participants who met the inclusion criteria. The gatekeepers provided participants with Patient Information Leaflet (See Appendix 3). Participation was voluntary. For patients with VFL that affected their reading ability, the gatekeeper read the information sheet to the patient, a strategy that has been previously accepted for ensuring that this population can give consent appropriately (Warren 2009). If a patient expressed an interest in the study, the researcher met with the patient and discussed any questions or concerns that
they had. All participants were made aware that they could withdraw from the study at any point.

Patients who had difficulty signing the consent form due to VFL or patients who had difficulty writing their name due to weakness of the dominant hand were given the option to write their initials only or mark an (x) on the signature line. If these options were unattainable, the patient’s next of kin (NOK) was asked to sign the form on the patient’s behalf (See Appendix 4). Consent was reviewed periodically as the study progressed from initial assessment to follow-up.

Once consent was obtained, the researcher proceeded with collecting participant demographics information using the Participant Demographic Form (See Appendix 5).

Participants were made aware that if any of the study procedures caused any distress or if the participant raised questions or concern, the participant could contact the researcher. Contact details of the researcher can be found in the Patient Information Leaflet, a copy of which was provided to every participant (See Appendix 3).

2.9 Assessment

2.9.1 Screening participants

The NIHSS was administered by the medical team to all patients who presented with neurological symptoms to the Accidents and Emergency (A&E) and subsequently to the ASU. The NIHSS includes the confrontation test to rule out or verify the presence of VFL.

Routine occupational therapy assessment involves an OT initial interview (home situation, social support, pre-admission ADL skills and IADL skills) and an OT Stroke Initial Evaluation (IE) (history of presenting complaint, formal assessment of cognition, perception, sensation and motor skills, PADL skills (MBI), and goal setting). Any visual complaints from the patient brought about by their stroke were recorded by the ward occupational therapist in the OT IE. It is usually indicated by the ward occupational therapist if further assessment of these components using standardized outcome measures were warranted.

As part of the usual screening process of all patients with stroke, the Star Cancellation Test and the Line Crossing Test, and the Mini Mental State Examination (MMSE) were administered to
screen perceptual skills and cognitive skills respectively by the occupational therapist. The scores on these tests were recorded on the OT IE. The star cancellation test and the line crossing test are parts of the conventional subtests of the Behavioural Inattention Test (BIT) (Hartman-Maier and Katz 1994). The sensitivity of these subtests when used in isolation to discriminate against patients with visual inattention has been reported in previous studies (Halligan et al. 1991; Lindell et al. 2007; Rengachary et al. 2011). These conventional subtests of the BIT has also been used in studies of patients with VFL after a stroke to discriminate patients with VFL from those with visual inattention (Warren 2009; Gall et al. 2010). A score below 51/54 on the star cancellation test and a score below 34/36 on the line crossing tests indicates the presence of inattention. The MMSE is a 30-point questionnaire that is used to evaluate cognitive impairment. A score of 19/30 suggests sufficient cognitive ability to follow instructions (Folstein et al. 1975).

The ward occupational therapists ascertained the participant’s mobility status by reviewing physiotherapy notes or by direct consultation with the physiotherapist. The participant should be able to walk independently, with supervision, with or without a walking aid. Patients who required physical assistance to walk were excluded from the study.

Their ability to follow instructions in English language were ascertained by reviewing speech and language therapy (SLT) notes or by direct consultation with the speech and language therapist. The participant should be able to follow simple commands despite the presence of communication disorders such as dysarthria or expressive and receptive aphasia which are common after a stroke (Langhorne et al. 2011). The ability to follow commands is important in the administration of the AMPS. Although the AMPS manual has some recommendations for the administration of the test for patients with communication disorders, participants with severe communication disorder prevent them to follow instructions were excluded from the study. Participants who are not primarily English speakers should be able to follow instruction in English as the inability to do so would mean that an interpreter are appointed for a non-English speaking participant all throughout the conduct of the study.

The above cognitive and communication skills were chosen on the basis that they are crucial for providing informed consent and for the administration of the AMPS. The absence or impairment of these skills will render the participants incapable of understanding the complex instructions involved in the administration of the AMPS.
2.9.2 Exposure on key variable – confirmation of VFL

Patients with a suspected VFL after confirmation from the NIHSS confrontation testing were referred to an orthoptist from the Ophthalmology Department by the presiding stroke consultant to receive an automated perimetry test (Goldmann Perimetry). This perimetry will measure their visual field objectively and to classify the topography and laterality of the VFL. Patients who were recruited from a different hospital or service were either referred to the Ophthalmology department in TUH or information collated from the hospital where their perimetry was carried out. All the participants were grouped according to the presence of VFL. Patients with any type of VFL were grouped and are referred to as the VFL group (exposed group) and those that did not present with a VFL are grouped and are referred to as the Non-VFL group (unexposed group).

2.9.3 Demographic Data

After screening all potential participants, the demographic data of all patients recruited to the study were collected by the primary researcher using the Participant Demographic Form (Appendix 6). The data collected included their age, gender, previous known stroke/TIA history, nationality, educational level, self-reported health status, social status, employment status, community services use, dwelling type (urban or rural), drives or not, and if the participant was a medical card holder. Some of these data are potential confounding variables. However, all these information will be used to describe the participants recruited to the study.

The length of stay (LOS) and the classification of stroke using the TOAST (Trial of Org 10172 in Acute Stroke Treatment) (Adams Jr et al. 1993) of all the participants were also collected.

2.9.4 Baseline assessment

The MBI and Article Reading Test score (ARTS) and the Article Reading test time (ARTT) were used to describe baseline personal-ADL and reading abilities of all the participants.

The Modified Barthel Index (Shah et al. 1989) measured the participants’ performance in 10 ADL functions. It is an empirically derived scale with proven inter-observer and test-retest
reliability, improved sensitivity and validity which measures a person’s functional ability using a 5-point scale (Hoking et al. 1999). The MBI has been used in many stroke trials and conditions other than stroke (Quinn et al. 2011) and can be administered by self-report, telephone interviews or by direct observation (Duffy et al. 2013). The MBI was administered through direct observation in the settings where the participants were recruited from in this study.

The Article Reading Test, a behavioural subtest of the Behavioral Inattention Test (BIT), is a test that looks at reading ability of patients with inattention (Hartman-Maeir and Katz 1994). Three short columns of the text are presented which the patient is instructed to read. The paper is placed in the middle of the patient’s view. Scoring is based on the percentage of words omitted across all three columns. Word omissions and partial or entire word substitutions are scored as errors. According to the BIT manual, the cut-off score for the Article reading subtest is 8 and a score of 7 or below is indicative of reading impairment. The researcher added time to complete this task to measure speed of completing the subtest.

The administration of MBI is part of routine initial OT assessment. Therefore, the researcher only collected the MBI Total score form the OT Stroke IE form and did not collect this data directly from the participants. The researcher administered, scored and recorded the time of the Article Reading test for all the participants.

### 2.9.5 Outcome Measure: Assessment of Motor and Process Skills

The Assessment of Motor and Process Skills (AMPS) is an occupational therapy-specific evaluation tool that measures the quality of a person’s ADL skills (Fischer and Jones 2009). It utilises a standardized ADL performance analysis to clinically assess performance skills rather than underlying body functions, personal factors or environmental factors that may limit ADL task performance (Fisher and Jones 2011). The AMPS can only be conducted by a calibrated AMPS rater. Occupational therapists have to attend a verified training course and undergo stringent calibration training to qualify as a calibrated AMPS rater (Fisher and Jones 2011). This ensures valid and reliable administration and scoring of the AMPS by the occupational therapist.
The AMPS manual has 125 standardized ADL tasks with varying levels of difficulty. The occupational therapist performs a semi-structured AMPS interview to identify several standardized ADL tasks from the manual that are familiar, relevant and performed as part of a person’s typical routine. From this selection, the person chooses and performs two standardised AMPS ADL tasks. This is a unique feature of the AMPS: the patients have a choice of which two tasks to perform for the assessment that are familiar and relevant to them. By offering this choice, the assessment is client-centred and more accurately reflects the person’s routine abilities than performance on tasks arbitrarily assigned by the assessor (Fisher and Jones 2011). During the performance of the chosen tasks, the AMPS rater observes two domains of ADL tasks performance operationalised and defined by observable and goal-directed actions, ie. 16 ADL motor skills and 20 ADL process skills. ADL motor skills are those actions that a person performs in order to move self and tasks objects during ADL task performance. ADL process skills are actions observed as the person (i) selects, interacts with and use tools and materials during task performance; (ii) logically carries out steps of an ADL tasks; and (iii) modifies the performance when a problem occurs. These 36 AMPS items represent the small observable units of ADL task performance that are observed by the AMPS rater. Table 1 lists the AMPS ADL motor and ADL process skill items.

When the AMPS rater has observed the performance of the two chosen standardised ADL tasks by the person, the quality of the ADL task performance is scored according to the criteria in the AMPS manual (Fisher and Jones 2014). Scoring for the AMPS is criterion referenced based on a criterion of competence. Each ADL skill item is scored in terms of ease, efficiency, safety and independence using a four-point ordinal scale. Each AMPS item is scored as 4 (competent, no problem), 3 (questionable, possible disruption), 2 (ineffective, clear disruption) or 1 (severe; marked physical effort/fatigue; marked inefficiency, marked safety, need for verbal or physical assistance).

The scores are then entered into a password-protected individualised copy of the OT Assessment Package (OTAP). This software was installed in three computer outlets in the OT department. Licence to use this software has been purchased by the AMPS calibrated raters in the department.

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**Table 1 AMPS ADL Motor and Process Skill Items**

<table>
<thead>
<tr>
<th>Motor Skills</th>
<th>Process Skills</th>
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<tbody>
<tr>
<td><strong>Body Position</strong></td>
<td>Sustaining Performance</td>
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<tr>
<td>Stabilizes</td>
<td>Paces</td>
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<tr>
<td>Aligns</td>
<td>Attends</td>
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<tr>
<td>Positions</td>
<td>Heeds</td>
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<tr>
<td><strong>Obtaining and Moving Objects</strong></td>
<td>Applying Knowledge</td>
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<tr>
<td>Reaches</td>
<td>Chooses</td>
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<tr>
<td>Bends</td>
<td>Uses</td>
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<td>Grips</td>
<td>Handles</td>
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<td>Coordinates</td>
<td>Inquires</td>
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<tr>
<td>Manipulates</td>
<td>Temporal Organization</td>
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<tr>
<td><strong>Moving Self and Objects</strong></td>
<td>Initiates</td>
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<tr>
<td>Moves</td>
<td>Continues</td>
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<td>Lifts</td>
<td>Sequences</td>
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<td>Walks</td>
<td>Terminates</td>
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<tr>
<td>Transports</td>
<td>Organizing Space and Objects</td>
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<tr>
<td>Calibrates</td>
<td>Searches/Locates</td>
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<tr>
<td>Flows</td>
<td>Gathers</td>
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<tr>
<td>Sustaining Performance</td>
<td>Organizes</td>
</tr>
<tr>
<td>Endures</td>
<td>Restores</td>
</tr>
<tr>
<td>Paces</td>
<td>Navigates</td>
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<tr>
<td><strong>Temporal Organization</strong></td>
<td>Adapting Performance</td>
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<td></td>
<td>Notice/Responds</td>
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<td></td>
<td>Accommodation</td>
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<td>Adjusts</td>
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<td>Benefits</td>
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OTAP is a software program that enables AMPS administrators/users to perform complex analyses of the raw test scores. This computer scoring software is a specialised application of the many-faceted Rasch analysis model for the AMPS and converts the raw ordinal scores into two overall linear ADL measures: one for ADL motor ability and one for ADL process ability.
The software adjusts the final ADL ability scores to simultaneously account for skill item difficulty, severity of the rater and challenge of the task. This provides a frame of reference when examining and accounting for each facet (challenge of the task, severity of the rater, difficulty of skill item) so that the resulting ADL ability measures are not biased by the individual rater who observed the performance or by the tasks the person performed. The OTAP software produces an AMPS observation report that includes the ADL motor ability and the ADL process ability for each participant that are placed on linear continua of ADL motor and process ability scale. This allows the comparison of the ADL motor and process abilities in relation to the ADL motor skill and ADL process skill competence cut-off measures. When the AMPS ability measures are placed along the ADL motor and process ability scales, their locations indicate the level of observed quality of ADL performance. The lower the person’s measure is on the motor scale, the more clumsiness, physical effort and/or fatigue the person is demonstrating during ADL task performance. Similarly, the lower the person’s measure was on the ADL process scale, the less efficient the person is during ADL task performance. The cut-off measures indicate a minimal level of competent ADL task performance or at a point where a person is likely to begin demonstrating slight clumsiness, increased physical effort, decreased efficiency, safety risk, and/or the need for assistance.

The ADL ability measures can also be interpreted using the “level of assistance” or independence cut-off. While the AMPS ADL competence cut-offs are used to identify people demonstrating increased effort and/or inefficiencies during ADL performance, the independence cut-offs are used to predict person in need of assistance to live safely in the community. Table 2 shows the competence cut-off and independence cut-off for ADL motor and process ability.

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<th>ADL Motor Ability</th>
<th>ADL Process Ability</th>
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<tr>
<td>Competence cut-off</td>
<td>2.0 logits</td>
<td>1.0 logits</td>
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<tr>
<td>Independence cut-off</td>
<td>1.5 logits</td>
<td>1.0 logits</td>
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</table>

ADL motor ability scores below the 2.0 logit cut-off indicates that the person is demonstrating increased effort when performing ADL tasks. ADL process ability scores below 1.0 logit cut-
off indicates that the person is less efficient when performing ADL tasks (Merritt 2010; Merritt 2011).

The ADL motor independence cut-off used to determine the need for assistance is 1.50 logits (sensitivity = 0.67 and specificity = 0.72 i.e. 67% of an independent sample was correctly classified and 72% of the sample in need of assistance was correctly classified) (Fisher and Jones 2011). The ADL process independence cut-off is 1.0 logits to determine the need for assistance (sensitivity 0.81 and specificity 0.70). The combined use of the ADL motor and process ability scores enhances the prediction of independence and the need for assistance when discharge to the community (Fisher and Jones 2011). That is, scores above the independence cut-off are likely to be independent (86% chance) and scores below the independence cut-offs will need assistance (82% chance). To make the most accurate predictions of the level of independence, the ADL motor and ADL process scores should match in relation to the independence cut-off. When these scores do not match (ie. ADL motor ability score is above while the ADL process is below the independence cut-off), the ADL process ability is the most accurate predictor of the need for assistance (Merritt 2010; Merritt 2011).

The psychometric properties of the AMPS are well documented and unparalleled (Rexroth et al.; Stauffer et al.; Rexroth et al. 2005; Merritt 2011). Several studies have supported the validity of the AMPS across cultures (Bernspång and Fisher 1995; Stauffer et al. 2000), between genders (Duran and Fisher 1996; Merritt and Fisher 2003) and with different diagnostic groups (Pan and Fisher 1994) including stroke (Rexroth et al. 2005). Test re-test reliability scores are high, r = 0.70 – 0.91, allowing occupational therapists to use this tool to measure change over time, making it a particularly useful clinical assessment (Doble et al. 1999). Fischer (20011) reported that 95% of all AMPS calibrated raters showed an acceptable goodness of fit to the many-faceted Rasch model for the AMPS indicating a high rater validity.

These properties of the AMPS have the potential to increase occupational therapists’ understanding of the ADL performance limitation demonstrated by patients with VFL after a stroke and make subsequent inferences about their ability to live independently in the community.
In order to determine clinically relevant group differences in observed ADL ability, the general guidelines in the AMPS manual were applied. According to the AMPS manual, a difference of $\geq 0.3$ logits indicates a clinically relevant difference in ADL motor and ADL process ability.

The AMPS ADL competence cut-offs are used to identify persons demonstrating increased effort and/or efficiencies during ADL task performance, while the independence cut-offs are used to predict persons who need assistance to live in the community. These cut-off measures indicate a minimal level of competent ADL task performance or the point at which a person is likely to initially demonstrate slight clumsiness, increased physical effort and decreased efficiency. We chose to use the competence cut-offs (2.0 logits) for ADL motor ability score and 1.0 logits for the ADL process ability score) to interpret median scores of both groups.

We also used the AMPS independence cut-off measures to predict the participants’ ability to remain living independently in the community. The independence cut-off to live independently in the community is 1.50 logits for AMPS process ability score and 1.0 logits for the AMPS motor ability scores (Fischer 2014). We combined the ADL motor and process ability scores to make a more accurate prediction of level of independence.

2.9.7 Piloting collection of data and administration of outcome measure

The pilot was conducted in the ASU in TUH from November 1 to December 18, 2017 to ascertain the time it will take for the collection of demographic data, administration of the Article Reading Test, AMPS interview and the AMPS observation and scoring. This was conducted to meet the standards of the ethics application process. Three participants with a diagnosis of stroke partook in this pilot study. The primary researcher conducted all the processes involved in this pilot. The first phase involved the primary researcher conducting an interview to collect demographic data, administering and recording the time it took the participant to complete the Article Reading Test and conducting the AMPS semi-structured interview. This was conducted at the bedside for two patients and the ADL suite kitchen for one patient. This first phase took 15 minutes to complete. The next phase involved the AMPS observation including preparing materials for the test. While the first patient took 40 minutes to complete this phase, the other two patients took 60 minutes to complete this part. Scoring of the AMPS observation and entering the raw scores to the computer software took 15 minutes for all three patients. On average, these phases took 90 minutes to complete, with 75 minutes
on average required patient interaction. The first patient finished the two steps in one sitting. The two patients that followed required two sessions, one session for each step, to complete the whole process. All patients completed the collecting demographic data, article reading and AMPS interview in one sitting.

The pilot demonstrated that the protocol for collection of data, administration of the Article reading Test (as a baseline measure of reading performance) and administration of the main outcome measure was feasible. We acknowledge, however, that some patients may require more time to complete each phase or more breaks in between phases due to factors that are inherent in people recovering from stroke such as the presence of communication difficulties, fatigue and cognitive deficits.

Although the processes involved in the initial assessment took 90 minutes on average to complete, it was envisaged that follow-up would take less than 90 minutes as this would only involve the administration of the AMPS.

2.10 Data sources

The demographic characteristics of all eligible participants were collected using the Demographic Data Form (See Appendix 6). Some of the data are dichotomous (previous known stroke, community service use, type of dwelling, medical card-holder, drives) while others are nominal values (gender, ethnicity, educational level, self-reported health status, social status and employment status). All these variables were collected from the participants during an interview. In situations where a patient had a communication problem, a consent to ask a NOK was sought to gather the information required.

The MBI Total Scores were collected and transferred into a separate MBI Score Sheet. These data were collected from the OT IE.

The primary researcher administered the Article Reading Subtest. The test scores were recorded at the bottom right corner or the Article Reading Subtest sheet together with the time to complete the test. The time to complete the test were recorded in seconds. The ARTS and the ARTT were collected and transferred to an Excel spreadsheet.
The AMPS OTAP software generated a report called the AMPS observation report. The report contained the AMPS ADL motor ability and the ADL process ability scores. These scores were collected from this report and transferred to an Excel Spreadsheet.

2.11 Sample size

As most prospective studies that requires follow-up, as this current study, there was a potential for attrition bias. This study aimed to reduce this bias by increasing the attrition rate (percentage) to 20% when generating the sample size for this study. Based on two group comparisons (Daly and Bourke 2000), power calculations indicated that a minimum of 48 participants were required to detect an increase of 0.8 on the AMPS (motor subscale) at a two-sided significance level of 5% and a power of 80%, assuming a $\delta$ of 1 point. Using this output, it was decided that a sample size of 58 participants would be recruited to the cohort study to allow for 20% attrition. The sample size calculation is detailed in Figure 1.

Figure 1: Calculation of the sample size required for the cohort study

<table>
<thead>
<tr>
<th>Number of participants required in each of the comparison groups must be greater than the value calculated using the following formula (Daly and Bourke 2000)</th>
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<tbody>
<tr>
<td>$2 \times (\text{Constant } K) \times (\sigma \text{ of the AMPS})^2$</td>
</tr>
<tr>
<td>(What is considered to be a clinically significant change in the AMPS)$^2$</td>
</tr>
<tr>
<td>$2 \times (7.8 \text{ for two-sided test with significance level of } 0.05 \times 1)^2$</td>
</tr>
<tr>
<td>$0.8^2$</td>
</tr>
<tr>
<td>$2 \times 7.8 \times 0.64$</td>
</tr>
<tr>
<td>$24 \text{ participants per group}$</td>
</tr>
<tr>
<td>Therefore, in order to detect a clinically significant change of 0.8 points on the AMPS, a minimum of 48 participants are required for the prospective cohort study</td>
</tr>
</tbody>
</table>

This study aimed to recruit 28 participants each for the VFL group and the comparison group.
2.12 Data analysis

The researcher sent the AMPS raw data to the Center of Innovative Occupational Therapy Solutions (CIOTS) in Fort Collins, Colorado for quality control analysis to ensure that all data were valid. The data were sent in batches of 10 AMPS evaluations. This service can be accessed using the OTAP AMPS Software that is already installed in the office. The researcher only entered into the OTAP the data required to generate test results. None of the data entered into the OTAP are ever sufficient to be connected to a specific person. The researcher only used a secure Internet connection to send de-identified exported data files to the CIOTS. CIOTS stored the de-identified data that was be used for this study. Anonymised data sent to CIOTS only included codes that represent, for example, the country in which the person was tested, gender, age, tasks and item scores. See Appendix 4 for a sample what the data will look like that will be stored at CIOTS.

The researcher, a trained and calibrated AMPS rater since 2009, administered all AMPS interviews and evaluations as per standard procedures described in the AMPS manual (Fisher 2009). Each ADL motor and ADL process skills item were scored according to the criteria in the manual using a 4-point ordinal scale.

Stroke patients were followed-up in the Out-Patient Stroke Clinic after a minimum of 6-8 weeks (mean of 7 weeks) after admission. The minimum of 7 weeks was adopted by this study for repeat assessment, in line with hospital care pathway timing for follow-up of stroke patients in TUH. After a minimum of 7 weeks after the initial assessment, the researcher contacted the participants in both groups to re-administer the primary outcome measure, the AMPS. The researcher contacted the participants by phone to arrange a time that coincided with their Stroke Out-patient clinic visit. The participants were reminded of their rights in relation to this study at this point. The ADL motor and process ability scores of the participants at follow-up were collected and transferred into a Microsoft Excel spread sheet.

The IBM SPSS program version 25 was used for all statistical analysis. Descriptive statistics were used to describe the characteristics of both the VFL group and the comparison group. These data collected from the Participant Demographic Form included their age, gender, ethnicity, previous known stroke, educational level, social status, employment status, self-reported health status, community service use, type of dwelling, medical card-holder, and if
driving or not. The study also reported the length of stay (LOS) and classification of stroke using the TOAST classification. Data on the characteristics of the participants on either group were transferred to a Microsoft Excel spreadsheet. The Excel Spreadsheet was transferred to IBM SPSS Version 25. The IBM SPSS (Version 25) Codebook was used to convert all information from collected from the participants for ease of analysis on IBM SPSS.

All data was screened for distribution of normality using the Kolmogorov-Smirnov statistic. A non-significant result (Sig. value of more than 0.05) indicates normality. Nominal and ordinal data on the participants characteristics were reported in numbers and percentages. Continuous data were reported in mean, median, standard deviations and Interquartile range (IQR).

The non-parametric test, the Mann Whitney U test was used to analyse and compare group scores due to skewed data and an unequal distribution of number of participants in groups.

The Mann Whitney U test is a non-parametric statistical hypothesis test for differences between two independent groups on a continuous measure. It converts the scores on the continuous variable to ranks across the groups and evaluates whether ranks between the two groups differ significantly. This is an appropriate test to assess the differences between the scores of two independent groups. It is appropriate for smaller sample sizes where data distribution is not likely to be normally distributed (Peat et al. 2002)

In order to measure the differences between the AMPS motor and process ability scores of either group from initial evaluation to follow up, the Wilcoxon sign-ranked test was used.

The Wilcoxon signed rank test is a non-parametric statistical hypothesis test to compare two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ. This is the appropriate test to assess change scores in data from the same participants at two different time points. It is particularly appropriate for smaller sample sizes where data distribution is not likely to be normally distributed (Peat et al. 2002)

The AMPS scores, the ADL motor ability score and the ADL process ability scores, of all participants were also transferred to Microsoft Excel spreadsheet. Data were analysed using IBM SPSS (Version 25 SPSS Inc. Chicago for MacBook). Comparative analysis was performed between the VFL group and the comparison group using the Mann Whitney U test. Comparative analysis was also performed to ascertain the differences in the ADL performance of the VFL group according to the topography and laterality of VFL. The Mann Whitney U
test was used if appropriate numbers per subgroup were recruited. Otherwise, the scores and group differences were reported descriptively. Data were presented in tables.

The effect size for the Mann Whitney U Test and the Wilcoxon Signed Rank Test were calculated, and the guideline was used for interpreting the effect size, $r$, suggested by Cohen (1988):

<table>
<thead>
<tr>
<th>Effect size</th>
<th>$r$ range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>0.10 to 0.29</td>
</tr>
<tr>
<td>Medium</td>
<td>0.30 to 0.49</td>
</tr>
<tr>
<td>Large</td>
<td>0.50 to 1.0</td>
</tr>
</tbody>
</table>

The MBI Total Score, the ARTS and ARTT were transferred to an Excel spreadsheet and analysed using IBM SPSS Version 25. A comparative analysis of the MBI Total score of the VFL group and Non-VFL group were analysed using the Mann Whitney U test.

The ARTS and the ARTT of both groups were presented in median IQR and minimum-maximum. Comparative analysis of these scores were carried out using the Mann Whitney U test. Significance value levels was set at $p<0.05$. Data were presented in tables.

2.13 Summary

This chapter described the quantitative methods used in this study. It described the study design and the primary outcome measure used in the study: the AMPS.

It described the sampling method, outlined data gathering employed, the method used in gathering baseline characteristics of the participants and the proposed techniques that will be used for analysis.

The next chapter will describe the process from recruitments to follow-up, and presents the result of the outcomes of the study.
Chapter 3: RESULTS

This chapter presents the findings obtained in this study. The first section describes the recruitment process and the process that followed from beginning to analysis. This is followed by describing the main characteristics of the sample population. It describes the data that was collected and provides an overview of the key findings.

3.1. Participant Recruitment

Fifty-eight participants with acute stroke met the inclusion criteria for this study and were recruited from July 2017 and May 2018. Follow-up assessments commenced on the September 2017 with the final of these completed in July 2018.

All the participants in this study received medical care and a combination of one or more services from allied health professions including dietician, occupational therapy, physiotherapy, speech and language therapy, social work and neuropsychology during and/or after recruitment and follow-up.

3.2. Sample

Forty-eight (82.8%) of the participants were recruited from the Acute Stroke/Stroke service, six (10.3%) from Neurology service/Rapid Access Stroke Prevention (RASP) clinic and four (6.9%) from the Early Supported Discharge (ESD). Of the 58 participants, 16 (27.5%) had VFL. Fifteen patients with suspected VFL were referred to the Ophthalmology Department of TUH and were seen by the Orthoptists for a formal visual field test. The Goldmann perimetry was used to measure the extent of VFL of the participants in the VFL group. One participant in the VFL group who was recruited from ESD had his visual field test completed at St. James’s hospital. St. James’s hospital used the Humphrey’s Visual Field Analyzer to measure his VFL. All the visual field test graphs/reports were reviewed by the researcher and the TUH Senior Orthoptist for classification. The agreed classification was either that the participant’s VFL was complete or incomplete, and either lateralized to the left or right. Both the Goldmann perimetry and the Humphreys Field analyser were able to give the classification of the VFL that was agreed for this study. The median time interval from admission to Orthoptic assessment of VFL in the VFL group was 2 weeks (IQR 1 week – 6 weeks; Minimum 1 week, Maximum 16 weeks).
Figure 2 shows the process of data collection from recruitment to analysis. Seven participants were lost to follow up: three of the participants withdrew from follow up due to a change in their medical status, two lost contact with the researcher; one died and one participant dropped out due to lack of interest in the study. The time from initial assessment to follow up ranged from 7 weeks to 20 weeks (Mean time 10.35 weeks SD 2.70). There were two outliers in the detected in the time interval between initial assessment and follow-up. Participant 23 (VFL group) had a time interval of 20 weeks and participant 44 (Non-VFL group) had a time interval of 17 weeks.

3.3. Participant Demographics

Participant population demographics and characteristics are summarised in Table 4. The total sample’s median age was 69 years. In terms of ethnic background, the majority of the participants identified as Irish participants (87.9%) and most had completed secondary education (85.2%). A little over half of the sample reported good to fair health status (51.2%) and three quarters of the sample (75.9%) lived with their partner and/or family. More than half were retired (60.3%), were driving prior to their stroke (55.2%) and most participants lived in urban areas (91.4%). Half of the sample were males and 50% were also medical card holders. The prevalent type of stroke in the sample fitted the TOAST Classification 5 (25.9%).

The demographic characteristics of the participants in the VFL group and the Non-VFL group were also presented in Table 4. The median age in the VFL group was 68.5 years while the Non-VFL group was 69.5 years. The VFL group comprised primarily of males (62.5%) while the Non-VFL group consisted slightly more of females (54.8%). There were some detectable differences relating to participants’ demographic characteristics between groups. Both groups were primarily Irish, urban dwellers and did not use any form of community-based services. Half of the participants in the Non-VFL group reported good to fair health status and a little over than half had a medical card. The participants in the VFL group, however, had a higher percentage of participants who reported good-fair health status prior to admission. It is no surprise, therefore, that there were a higher number of participants in this group who did not possess a medical card. Both groups had a large percentage who had previous stroke history.
Recruitment of potential participants

Inclusion Criteria:
(1) ≥ 18 years old,
(2) visual field loss from documented stroke,
(3) no other presence of ocular pathology affecting visual field or acuity,
(4) no evidence of hemi-inattention or spatial neglect,
(5) good visual acuity or corrected acuity with glasses,
(6) MMSE score of ≥19/30 or over,
(7) sufficient communication to follow instructions
(8) no significant physical impairment that may substantially affect ambulation.
(9) mRS ≤ 3

Stroke Unit/Stroke Services  Neurology/RASP Clinic  ESD
48/58  6/58  4/58

Visual Field Loss Group  Non-VFL Group
16/58  42/58

Initial Assessment
Baseline characteristics: MBI, Article Reading subtest, Article Reading Subtest time
Main Outcome Measure: Assessment of Motor and Process Skills

Follow up after ≥ 8 weeks
Repeat Outcome Measure: Assessment of Motor and Process Skills

Loss to follow up
Loss to contact: 2
Declined follow-up: 1
Death: 1
Change in medical status: 3

Analysis

RASP = Rapid Access Stroke Prevention
ESD = Early Supported Discharge
MBI = Modified Barthel Index
MMSE = Mini Mental State Examination
The TOAST classification 5 (stroke of undetermined aetiology) was the most common stroke aetiology in the VFL group and the Non-VFL group.

There were more participants in the VFL group that held a university/college degree (50%), who lived alone (31.3%), and who were employed full or part-time (50%) compared to the Non-VFL group. There were a higher percentage of driver in the VFL group than in the Non-VFL group.

The length of stay (LOS) of the 54 participants who were recruited from the Acute Stroke/Stroke and Neurology service were collected. The other four participants were admitted to a different hospital for their stroke and their data on LOS were not collected due to ethical restrictions. The median LOS of the total sample (n= 54) is 9.0 days ranging from 1-101 days. When the sample was split into groups, the VFL group had shorter LOS (median 8.5 days, ranged from 2- 44 days) than the comparison group (median 9 days, ranged from 1-101 days).
<table>
<thead>
<tr>
<th></th>
<th>Total Group (n=58)</th>
<th>Visual Field Loss Group (n=16)</th>
<th>Comparison Group (n=42)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Mean 69.95, SD 12.05</td>
<td>Mean 68.74, SD 12.27</td>
<td>Mean 71.19, SD 12.93</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Male 53 (91.3)</td>
<td>Male 11 (68.8)</td>
<td>Male 42 (99.5)</td>
</tr>
<tr>
<td></td>
<td>Female 5 (8.7)</td>
<td>Female 5 (31.3)</td>
<td>Female 3 (7.1)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td>Irish 51 (87.9)</td>
<td>Irish 3 (18.8)</td>
<td>Irish 38 (90.5)</td>
</tr>
<tr>
<td></td>
<td>EU 6 (10.3)</td>
<td>EU 3 (18.8)</td>
<td>EU 3 (7.1)</td>
</tr>
<tr>
<td></td>
<td>Non-EU 1 (1.7)</td>
<td>Non-EU 0</td>
<td>Non-EU 1 (2.4)</td>
</tr>
<tr>
<td><strong>Highest Educational Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>University/College 4 (7)</td>
<td>University/College 3 (18.8)</td>
<td>University/College 37 (88.1)</td>
</tr>
<tr>
<td></td>
<td>Secondary 48 (82.8)</td>
<td>Secondary 11 (68.8)</td>
<td>Secondary 1 (2.4)</td>
</tr>
<tr>
<td></td>
<td>Primary 3 (5.2)</td>
<td>Primary 2 (12.5)</td>
<td>Primary 1 (2.4)</td>
</tr>
<tr>
<td><strong>TOAST Classification</strong></td>
<td>Large Artery Atherosclerosis 30 (51.7)</td>
<td>Large Artery Atherosclerosis 9 (55.6)</td>
<td>Large Artery Atherosclerosis 18 (42.9)</td>
</tr>
<tr>
<td></td>
<td>Cardio-embolism 7 (12.2)</td>
<td>Cardio-embolism 2 (12.5)</td>
<td>Cardio-embolism 3 (7.1)</td>
</tr>
<tr>
<td></td>
<td>Small Vessel Occlusion 6 (10.3)</td>
<td>Small Vessel Occlusion 2 (12.5)</td>
<td>Small Vessel Occlusion 1 (2.4)</td>
</tr>
<tr>
<td></td>
<td>Other determined aetiology 15 (25.9)</td>
<td>Other determined aetiology 4 (25.0)</td>
<td>Other determined aetiology 10 (23.8)</td>
</tr>
<tr>
<td></td>
<td>Other undetermined aetiology 12 (20.7)</td>
<td>Other undetermined aetiology 2 (12.5)</td>
<td>Other undetermined aetiology 8 (19)</td>
</tr>
<tr>
<td><strong>Previous Stroke</strong></td>
<td>Yes 47 (81.0)</td>
<td>Yes 14 (87.5)</td>
<td>Yes 33 (78.6)</td>
</tr>
<tr>
<td></td>
<td>No 11 (19)</td>
<td>No 2 (12.5)</td>
<td>No 4 (9.5)</td>
</tr>
<tr>
<td><strong>Self-Reported Health Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excellent 25 (43.1)</td>
<td>Excellent 7 (43.8)</td>
<td>Excellent 18 (42.9)</td>
</tr>
<tr>
<td></td>
<td>Very Good 30 (51.7)</td>
<td>Very Good 9 (56.2)</td>
<td>Very Good 21 (50)</td>
</tr>
<tr>
<td></td>
<td>Good 3 (5.2)</td>
<td>Good 0</td>
<td>Good 1 (2.4)</td>
</tr>
<tr>
<td></td>
<td>Fair - Poor 0</td>
<td>Fair - Poor 0</td>
<td>Fair - Poor 0</td>
</tr>
</tbody>
</table>

Table 4: Participant Demographics
### Social Status

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lives alone</td>
<td>39 (7.2%)</td>
<td>11 (2.0%)</td>
</tr>
<tr>
<td>Lives with Partner/Family</td>
<td>149 (27.9)</td>
<td>288 (52.7)</td>
</tr>
<tr>
<td>Residential Care</td>
<td>3 (0.6%)</td>
<td>1 (0.2%)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (0.6%)</td>
<td>1 (0.2%)</td>
</tr>
</tbody>
</table>

### Employment Status

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retired</td>
<td>35 (60.3%)</td>
<td>7 (12.1%)</td>
</tr>
<tr>
<td>Employed Full/Part time</td>
<td>15 (25.9%)</td>
<td>8 (14.3%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>7 (12.1%)</td>
<td>5 (9.4%)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1 (2.4%)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Use Community Service

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2 (6.9%)</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>40 (95.2%)</td>
<td>18 (45.2)</td>
</tr>
</tbody>
</table>

### Driving

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>28 (50.0%)</td>
<td>21 (50.0)</td>
</tr>
<tr>
<td>No</td>
<td>21 (50.0%)</td>
<td>21 (50.0)</td>
</tr>
</tbody>
</table>

### Medical Card Holder

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>29 (50.0%)</td>
<td>19 (45.2)</td>
</tr>
<tr>
<td>No</td>
<td>29 (50.0%)</td>
<td>10 (24.4)</td>
</tr>
</tbody>
</table>

### Dwelling Type

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>5 (8.6%)</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>Urban</td>
<td>53 (91.4%)</td>
<td>52 (98.1)</td>
</tr>
</tbody>
</table>

### LOS after Stroke

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med 9.0 days</td>
<td>3 (5.4%)</td>
<td>1 (2.0%)</td>
</tr>
<tr>
<td>IQR 9.0 days</td>
<td>1 (1.6%)</td>
<td>0</td>
</tr>
<tr>
<td>Med 8.5 days</td>
<td>4 (6.7%)</td>
<td>0</td>
</tr>
<tr>
<td>IQR 7.25 days</td>
<td>1 (1.9%)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Employment Status

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulltime</td>
<td>2 (3.4%)</td>
<td>0</td>
</tr>
<tr>
<td>Parttime</td>
<td>56 (96.6%)</td>
<td>18 (45.2)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1 (2.4%)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Homeowner

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>11 (18.8%)</td>
<td>13 (18.8)</td>
</tr>
<tr>
<td>No</td>
<td>32 (51.3%)</td>
<td>26 (37.5)</td>
</tr>
</tbody>
</table>

### Employment Status

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retired</td>
<td>11 (18.8%)</td>
<td>13 (18.8)</td>
</tr>
<tr>
<td>Employed Full</td>
<td>18 (29.3%)</td>
<td>13 (18.8)</td>
</tr>
<tr>
<td>Parttime</td>
<td>25 (40.6%)</td>
<td>26 (37.5)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>4 (6.5%)</td>
<td>4 (5.7%)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1 (1.6%)</td>
<td>1 (1.4%)</td>
</tr>
</tbody>
</table>

### Driving

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>35 (57.1%)</td>
<td>21 (30.6)</td>
</tr>
<tr>
<td>No</td>
<td>27 (42.9%)</td>
<td>39 (54.4)</td>
</tr>
</tbody>
</table>

### Medical Card Holder

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>29 (50.0%)</td>
<td>19 (45.2)</td>
</tr>
<tr>
<td>No</td>
<td>29 (50.0%)</td>
<td>10 (24.4)</td>
</tr>
</tbody>
</table>

### Dwelling Type

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>3 (4.9%)</td>
<td>7 (10.0%)</td>
</tr>
<tr>
<td>Urban</td>
<td>50 (75.1%)</td>
<td>39 (56.2)</td>
</tr>
</tbody>
</table>

### Social Status

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>lives alone</td>
<td>39 (7.2%)</td>
<td>11 (2.0%)</td>
</tr>
<tr>
<td>lives with</td>
<td>149 (27.9)</td>
<td>288 (52.7)</td>
</tr>
<tr>
<td>partner/family</td>
<td>3 (0.6%)</td>
<td>1 (0.2%)</td>
</tr>
<tr>
<td>residential</td>
<td>3 (0.6%)</td>
<td>1 (0.2%)</td>
</tr>
</tbody>
</table>

### Employment Status

<table>
<thead>
<tr>
<th>Status</th>
<th>1-101 days</th>
<th>&gt;101 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>retired</td>
<td>35 (60.3%)</td>
<td>7 (12.1%)</td>
</tr>
<tr>
<td>employed full</td>
<td>15 (25.9%)</td>
<td>8 (14.3%)</td>
</tr>
<tr>
<td>unemployed</td>
<td>7 (12.1%)</td>
<td>5 (9.4%)</td>
</tr>
<tr>
<td>homemaker</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>other</td>
<td>1 (2.4%)</td>
<td>0</td>
</tr>
</tbody>
</table>
3.4. Baseline Characteristics

This section presents a summary of the baseline assessments that were used for this study namely; the Modified Barthel Index (MBI) and the Article Reading Subtest of the Behavioural Inattention Test (BIT) that were used to assess the personal-ADL and the reading skills of the participants respectively. A comparison was made on these baseline assessments to ascertain if the groups differ in their MBI, ARTS and ARTT.

3.4.1. Personal (Basic) Activities of Daily Living

The MBI score of the VFL and the Non-VFL groups are shown in Table 5. The VFL group’s median MBI score is slightly higher than the Non-VFL group. A total score of 100 in the MBI suggests independence and a total score of 97 means slight dependence (Shah et al 1989). The MBI total score of both groups (>85) suggests that both groups were likely to be discharged to community living provided that they could perform transfers independently and could walk or use a wheelchair without assistance.

A comparative analysis of both groups’ MBI scores was carried out to ascertain if there was statistically significant difference between the groups’ scores. The Mann Whitney U test revealed no significant difference between the MBI score of the VFL group (Md = 100, n= 16) and the comparison group (Md = 97, n= 42) U = 263, z = 1.359, p = .174, r = .18).

In summary, there was no statistically significant differences on MBI scores between the VFL and Non-VFL group.

3.4.2. Reading and Reading Speed

The Article Reading Subtest of the Behavioural Inattention Test (BIT) was used to measure the reading skills of the participants in both groups.

The ARTS and ARTT of the VFL and Non-VFL groups are shown in Table 5. Similar to other reading tests that document reading speed, the time taken to complete the Article Reading Subtest was recorded in seconds. The VFL group had a median ARTS of 7, which is below the cut-off suggesting impaired reading skills. The Non-VFL group’s median ARTS of 9 which was above the cut-off suggesting intact reading skills. The VFL group’s median article reading subtest time was 103 seconds and was longer when compared to the Non-VFL group’s time to
complete the test (73.5 seconds) suggesting that the VFL group’s reading speed is slower than that of the Non-VFL group.

Seven participants in the study have a documented communication problem that included dysarthria, word finding difficulty and mild expressive aphasia: participants 5, 15, 21, 27, 31, 38, 52.

Nine outliers were detected in the Non-VFL group when the ARTS between the groups were analysed. Participants 5, 7, 8, 21, 25, 31, 39, 52 and 58 scored below the range of scores for the Non-VFL group.

Five outliers were detected in the groups when the ARTT was analysed between the groups. Participants 21, 31, 43, and 52 had an ARTT that is below the range of the ARTT in the Non-VFL group. One participant (number 51) in the VFL group had an ARTT that is longer than the range of ARTT in the VFL group.

Table 5 Patient Baseline Characteristics: MBI Score Article Reading Score and Reading Time

<table>
<thead>
<tr>
<th></th>
<th>Visual Field Group N = 16 (27.6%)</th>
<th>Comparison Group N = 42 (72.4%)</th>
<th>Difference p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBI Score</td>
<td>Median 100</td>
<td>98</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>IQR 96 – 100</td>
<td>94 – 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min - Max 87 - 100</td>
<td>74 - 100</td>
<td></td>
</tr>
<tr>
<td>Article Reading Subtest Score</td>
<td>Median 7</td>
<td>9</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>IQR 5 – 9</td>
<td>8.5 – 9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min - Max 0 – 9</td>
<td>0 – 9</td>
<td></td>
</tr>
<tr>
<td>Article Reading Subtest Time (seconds)</td>
<td>Median 103</td>
<td>74.5</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>IQR 69 – 177.5</td>
<td>67 – 114.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min - Max 54 - 360</td>
<td>50 – 360</td>
<td></td>
</tr>
</tbody>
</table>

Difference is statistically significant at the 0.05 level.
*Statistically significant difference.

Comparative analysis was carried out to ascertain if there were differences between the groups’ ARTS and ARTT. The Mann Whitney U test revealed statistically significant differences in the ARTS between the VFL group (Md = 7) and the Non-VFL group (Md = 9) (U= 227, p=.02, z=2.28, r=.29). The r values suggested a small to medium effect (Cohen 1998). However, the same test revealed no statistically significant differences between the VFL group (Md = 103
secs) and the Non-VFL group (Md = 74.5 secs) on the ARTT (U= 256, p= 0.16, z= -1.40, r= .18).

In summary, participants in the VFL group showed reduced article reading score and increased reading time compared to the Non-VFL group. Although there was a statistically significant difference in the Article Reading subtests scores, there was no difference in reading speed.

3.5. Primary Outcome Measure: Assessment of Motor and Process Skills

This section describes the findings of the main outcome measure used for this study: Assessment of Motor and Process Skills (AMPS). The AMPS was administered on initial assessment and follow-up. Table 6 lists the AMPS tasks that the participants selected during initial assessment and follow up.

The AMPS ADL motor and process ability scores are described in relation to the AMPS competence cut-off measures and the AMPS independence cut-off measures. Differences between groups will be described using clinically relevant differences (>0.3 logits).

The distribution of the AMPS scores in both groups were not normally distributed and a non-parametric test was therefore used to describe the total sample scores, compare and analyse the group scores.

3.5.1. Initial assessment using the AMPS

Table 7 presents the details of the scores of the total sample and the two groups on initial assessment. The total sample’s median ADL motor ability score was 1.60 logits while the median ADL process ability score was 0.80 logits. When these scores were considered in relation to the ADL motor and process competence cut-off, the scores are below the cut-off suggesting mild to questionable physical effort or clumsiness and mild to questionable inefficiency/disorganization respectively. When these scores are interpreted in relation to the independence cut-off, the ADL motor ability score of the total sample was above the cut-off while the ADL process ability score was below the independence cut-off. When these scores were combined and interpreted according to the independence cut-off, the scores suggested that the total sample will require assistance and/or supervision when they are discharged to the community.
The median ADL motor ability score of the VFL group (1.70 logits) suggests mild to questionable increased physical effort or clumsiness while the Non-VFL group’s median ADL motor ability score (1.60 logits) suggests moderate to mild physical effort or clumsiness. When these scores were considered in relation to the motor competence cut-off, both the scores are below the cut-off suggesting that both groups are experiencing increased physical effort during ADL performance. The VFL group’s median ADL process ability score of 0.90 logits suggests mild to questionable inefficiency or disorganization while the Non-VFL groups’ ADL process
ability score (0.80 logits) suggests moderate to mild inefficiency or disorganization. When these process ability scores were considered in relation to the process competence cut-off, both groups are below the competence cut-off suggesting that both groups were experiencing reduced efficiency when performing ADL tasks. The VFL groups’ median ADL motor and process ability scores are closer to the competence cut-off in contrast to the Non-VFL group’s scores which are farther from competence cut-off. The proximity of the VFL group’s motor and process ability scores to the competence cut-off suggests that they were experiencing less clumsiness or physical effort and less inefficiency or disorganization when matched to the Non-VFL group.

When the median ADL motor ability scores of both groups were interpreted in relation to the independence cut-off, both the group’s scores were above the independence cut-off suggesting that both groups can live independently in the community. However, when both groups’ process scores were interpreted in relation to the independence cut-off, both the groups’ scores are below the independence cut-off suggesting that both groups are likely to require assistance/supervision to live in the community. The mismatch between the ADL motor (both groups’ scores above the motor independence cut-off) and ADL process (both groups’ scores below the independence cut-off) of the VFL group and the Non-VFL group in relation to the independence cut-off suggests that the median ADL process ability scores were better at predicting the groups’ need to live independently in the community. Thus, both groups are likely to require assistance/supervision to live in the community.

The AMPS ADL motor and ADL process ability median scores of both groups were compared and analysed using the Mann Whitney U test to ascertain if there were statistically significant difference between the groups.

There was no significant difference in AMPS motor ability scores between the VFL Group (Median = 1.70 logits, n=16) and the Non-VFL Group (Median =1.60 logits, n =42), U = 236, z = -1.74, p = .082, r = 0.435. The difference between the scores were also not clinically relevant (0.10 logits, below 0.30 logits).

There was no significant difference in the AMPS process ability median scores between the VFL Group (Median = .90, n=16,) and the Non-VFL Group (Median =0.80, n=42), U=305, z= -0.544, p=0.593, r= 0.83. The difference between the median scores were also not clinically relevant (0.10 logits, below 0.30 logits).
Outliers were detected in the Non-VFL group when the ADL process scores were analysed between the groups. Participants 13 and 17 garnered an ADL process ability scores of -0.30 logits and -0.20 logits respectively, which were lower than the ADL process ability score range of the Non-VFL group.

3.5.2. Sub Group Analysis

The VFL group’s ADL motor and ADL process ability scores were further analysed according to two classifications: (1) the topography of VFL (complete versus incomplete) and (2) the lateralisation of the VFL (left versus right). This comparative analysis was performed to ascertain if differences in ADL performance exist when these categories of VFL were employed. There was a small number of patients with complete VFL (3/16) compared to the number of patients with incomplete VFL (13/16) recruited to the study. Therefore, descriptive statistics was used to describe the participants’ AMPS ADL motor and process ability scores according to topography. The data of the VFL subgroup according to lateralisation was not normally distributed and therefore a non-parametric test was used to analyse and compare these data.
The AMPS motor and process ability scores are reported in log-odds probability units (logits).

### Table 7

<table>
<thead>
<tr>
<th></th>
<th>AMPS Motor</th>
<th>AMPS Process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial Assessment</td>
<td>Follow up Assessment</td>
</tr>
<tr>
<td></td>
<td>Total Sample</td>
<td>VFL Group</td>
</tr>
<tr>
<td></td>
<td>N= 58</td>
<td>N= 16 (27.6%)</td>
</tr>
<tr>
<td>AMPS Motor Mean</td>
<td>0.05</td>
<td>0.72</td>
</tr>
<tr>
<td>AMPS Motor Median</td>
<td>0.0</td>
<td>1.60</td>
</tr>
<tr>
<td>AMPS Motor Quartiles</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>AMPS Motor Min</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>AMPS Motor Max</td>
<td>0.0</td>
<td>2.70</td>
</tr>
<tr>
<td>AMPS Process Mean</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>AMPS Process Median</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>AMPS Process Quartiles</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>AMPS Process Min</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>AMPS Process Max</td>
<td>0.0</td>
<td>2.70</td>
</tr>
</tbody>
</table>

Difference is statistically significant at the 0.05 level.
3.5.2.1. Subgroup analysis according to the topography of VFL.

Table 8 presents the AMPS motor and process ability scores of patients with VFL according to topography. In the complete VFL subgroup, 2/3 participants showed moderate to mild physical effort or clumsiness and 1/3 showed mild to questionable increased physical effort or clumsiness. The median ADL motor ability score of this subgroup was 1.50 logits which suggests moderate to mild increased physical effort or clumsiness. In the incomplete VFL subgroup, 5/13 (38.5%) participants showed moderate to mild physical effort or clumsiness, 4/13 (30.8%) participants showed mild to questionable increased physical effort or clumsiness, 1/13 (8%) participant showed questionable physical effort to no physical effort or clumsiness and 3/13 (23.1%) showed no effort or clumsiness. The median ADL motor ability score of the incomplete VFL subgroup was 1.80 logits which suggests questionable to mild increased effort or clumsiness. When the ADL median motor ability scores of both subgroups were considered in relation to the motor competence cut-off, both subgroup scores were below the motor competence cut-off. However, the median ADL motor ability score of the incomplete VFL subgroup was closer to the competence cut off compared to the complete VFL subgroup. This suggests that the participants in the complete VFL subgroup demonstrated more physical effort or clumsiness compared to the participants in the incomplete VFL subgroup.

Of the three participants in the complete VFL subgroup, one patient showed moderate to marked inefficiency/ disorganisation, one showed moderate to mild inefficiency/ disorganisation and one showed questionable inefficiency/ disorganization. The median ADL process ability score of this subgroup was 0.40 logits which suggests mild to moderate inefficiency or disorganization. In the incomplete VFL subgroup, 3 participants showed marked to mild inefficiency or disorganization, 4 showed mild to questionable inefficiency/ disorganization and 4 showed questionable inefficiency/ disorganisation. The median process ability score of this subgroup was 1.0 logits which suggests questionable inefficiency or disorganization.

When the median ADL motor ability scores were considered in relation to the independence cut-off, the median ADL motor ability scores of the complete and incomplete subgroups were above the cut-off. However, when the median ADL process ability measures were considered in relation to this cut-off, complete VFL subgroup was below the independence cut-off and the median ADL process ability score of the incomplete VFL subgroup was level with the cut-off. This indicated that while the incomplete VFL subgroup can live independently based on its
proximity to the independence cut-off, the complete VFL subgroup will require assistance to live in the community. There was a good match between the ADL motor and process ability scores of the incomplete VFL subgroup (both scores are above independence cut-off) but there was a mismatch between scores of the complete VFL group (motor ability score was above the cut-off but and the process ability below the cut-off) in predicting ability to live in the community. In the complete VFL subgroup, the median ADL process ability score is better at predicting assistance required to live in the community. Thus, the complete VFL subgroup will require assistance to live in the community while the incomplete subgroup was likely to live independently.

Table 8 AMPS motor and process ability scores according to topography of VFL.

<table>
<thead>
<tr>
<th></th>
<th>Total N = 16</th>
<th>Complete VFL N = 3 (18.8%)</th>
<th>Incomplete VFL N = 13 (81.2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPS Motor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>1.50</td>
<td>1.50</td>
<td>1.90</td>
</tr>
<tr>
<td>Median</td>
<td>1.50</td>
<td>1.50</td>
<td>1.80</td>
</tr>
<tr>
<td>Quartiles</td>
<td>1.10 – 0.0</td>
<td>1.55 – 2.40</td>
<td></td>
</tr>
<tr>
<td>Min-Max</td>
<td>1.50 – 1.90</td>
<td>1.00 – 2.70</td>
<td></td>
</tr>
<tr>
<td><strong>AMPS Process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.30</td>
<td>0.0</td>
<td>0.85</td>
</tr>
<tr>
<td>Median</td>
<td>0.40</td>
<td>1.0</td>
<td>1.00</td>
</tr>
<tr>
<td>Quartiles</td>
<td>0.0 – 0.0</td>
<td>0.80 – 1.05</td>
<td></td>
</tr>
<tr>
<td>Min-Max</td>
<td>0.0 – 0.50</td>
<td>0 – 1.20</td>
<td></td>
</tr>
</tbody>
</table>

3.5.2.2. Subgroup analysis according to laterality of VFL

Another sub-group analysis was carried out to ascertain if the lateralisation of VFL, i.e. whether lateralisation of the VFL on the left or right side, would yield differences. Table 9 presents the AMPS motor and process ability scores of the subgroup according to lateralisation of VFL. The median ADL motor ability score of patients with right and left VFL groups (1.90 logits versus 1.80 logits) suggests mild to questionable increased physical effort or clumsiness. The median ADL motor ability scores of both VFL were below the competence cut-off suggesting that both subgroups demonstrated increased physical effort or clumsiness when performing ADL.

The median ADL process ability score of the right VFL group (1.60 logits) suggests questionable to mild inefficiency/ disorganization while left VFL group’s ADL process ability
score (0.6 logits) suggests moderate to mild inefficiency/ disorganization. While the ADL process ability score of the right VFL group was above the process competence cut-off, the left VFL group’s score is below the competence cut-off. There was one outlier in the right VFL group who scored below the range of the group: participant 16. This suggests that left VFL group demonstrated reduced efficiency when performing ADL while the right VFL group showed efficient and organized ADL performance.

When the mean ADL motor ability scores of both subgroups were considered in relation to the independence cut-off, both groups’ scores were above the cut-off suggesting that both groups can/could live in the community independently. However, when the groups’ median ADL process ability scores were considered in relation to the independence cut-off, the left VFL subgroup’s score was below the independence cut-off while to the right VFL group’s score was above the independence cut-off. This suggests that the left VFL group were likely to require assistance to live in the community while the right VFL group can/could live in the community independently. There is a good match between the R VFL group’s median ADL motor and process ability scores when predicting their ability to live in the community. In contrast, there was a mismatch between the L VFL group’s median ADL motor (above independence cut-off) and process ability scores (below independence cut-off). In this instance, the process ability score is better at predicting the ability to live in the community. Therefore, when both the median ADL motor and process ability scores of both subgroups were considered in interpreting the need to live in the community the, left VFL group were likely to require assistance while the right VFL group can/ could live in the community independently.

No statistically significant differences in AMPS motor ability scores between left VFL (median= 1.8, n= 9) and right VFL (median 1.9, n= 7) U=17.5, z= -1.49, p= 0.136. r= 0.372. The difference between the median scores were also not clinically relevant (0.10 logits, ≤0.30 logits).

No statistically significant differences in the AMPS process ability scores between left VFL (median= 0.6, n= 9) and right VFL (median 1.10, n= 7) U=20, z= -1.23, p= .218. r= 0.30. However, the difference between the median scores was clinically relevant (0.40 logits, ≥0.30 logits).
The AMPS motor and process ability scores are reported in log-odd probability units (logits). 
Difference is statistically significant at the 0.05 level. 
*score differences are clinically relevant
3.5.3. Results on the AMPS at follow up

Fifty-one participants completed follow-up assessments. While most of the participants attended their follow-up assessments in the hospital (n=), few participants (n= ) availed of having the follow-up assessment carried out in their home when no out-patient clinic was organized that falls at 7 weeks follow up. Follow-up assessment took no more than 60 minutes as it only involved completing the AMPS.

The distribution of the scores in both groups on follow-up were tested for normality using the IBM SPSS Version 25. The test yielded skewed data for the total sample, the VFL and comparison groups. Therefore, a non-parametric tests was used to describe the total sample scores and the compare group scores. The AMPS motor and process ability scores of the total sample, the VFL and the Non-VFL group on follow-up are presented in Table 7 on page 57.

The median ADL motor ability scores of the VFL group (2.1 logits) and the comparison group (2.1 logits) were both above the motor competence cut-off and above the independence cut-off. These suggest that the VFL and Non-VFL groups were performing ADL tasks without physical effort which advanced their ability to live independently in the community.

The median ADL process scores of the VFL group and the Non-VFL group (1.10 logits) were also above the process competence cut-off suggesting that both groups were performing ADL tasks efficiently at follow-up which advanced their ability to live independently in the community.

No statistically significant differences in the AMPS motor ability scores between the VFL group (Median = 2.1, n=15,) and the Non-VFL group (Median = 2.1, n=36), U= 243, z= 0.55, p= 0.582, r= 0.14 were found at follow up. Similar results were demonstrated for the AMPS process ability scores across the two groups, VFL group (Median = 1.1, n=15,) and the Non-VFL group (Median =1.05, n=36), U=255, z= 0.30, p= 0.762, r=0.05 at follow up.

The differences between the median AMPS ADL motor and ADL process ability scores between the groups on follow-up were not clinically relevant ( ≤ 0.30 logits).

3.5.4. Comparison of the AMPS scores from initial assessment and follow up

This section examines whether there was improvement in the ADL performances of the total sample, the participants in the VFL group and the Non-VFL group from initial assessment and
follow-up. Table 12 shows the ADL motor and the process ability scores of the total sample, the VFL and Non-VFL group from initial evaluation and follow-up. To ascertain improvements in the ADL motor and process skills score of the total sample, the VFL group and the Non-VFL groups from initial assessment to follow-up, the Wilcoxon Signed Rank Test was used.

The Wilcoxon signed rank test is a non-parametric statistical hypothesis test that compares two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ. This is the appropriate test to assess change scores in data from the same participants at two different time points. It is particularly appropriate for smaller sample sizes where data distribution is not likely to be normally distributed.

The median ADL motor ability score of the total sample increased from initial assessment (Med= 1.60 logits) to follow-up (Med= 2.10 logits). The Wilcoxon signed rank test revealed a statistically significant improvement in ADL motor ability score of the total sample, \( z = -5.62, p = .000 \), with a large size effect (\( r = .54 \)). The median ADL process scores in the total sample also increased from initial assessment (Med= .80 logits) to follow-up (Med= 1.10 logits). The same test revealed a statistically significant improvement in the ADL process ability score of the total sample \( z = -4.51, p = .000 \) with a medium size effect (\( r = .44 \)). The improvement of the ADL motor and process ability scores of the total sample were also clinically relevant (\( \geq .3 \) logits).

The median ADL motor ability score of the VFL group increased from initial assessment (Median 1.8) to follow up (Median =2.1). The Wilcoxon signed rank test revealed a statistically significant improvement in the ADL motor ability score of the VFL group from initial assessment to follow up, \( z = p <0.013 \) with a medium effect size (\( r = 0.45 \)). The difference between the initial and follow up ADL motor ability scores was also clinically relevant (\( \geq 0.3 \) logits).

The median ADL process ability score of the VFL group increased from initial assessment (Median =0.90) to follow up (Median =1.10). A statistically significant improvement in the AMPS Process Skill Score in the VFL group from initial assessment to follow up, \( z = p <0.002 \) with a large effect size (\( r = 0.57 \)) was also noted. The difference between the initial and follow-up AMPS process ability scores was not clinically relevant however (< 0.3 logits).

Similarly, the median ADL motor ability score of the Non-VFL group increased from initial assessment (Median =1.60) to follow up (Median = 2.1). The Wilcoxon signed rank test
revealed a statistically significant improvement in the ADL motor ability score in the Non-VFL Group from initial assessment to follow up, \( z= p <0.000 \) with a large effect size (\( r= 0.587 \)). The difference between the initial and follow-up ADL motor ability score of the Non-VFL group was clinically relevant (\( \geq 0.3 \) logits).

The median score ADL process ability score of the Non-VFL group increased from initial assessment (Median =0.80) to follow up (Median = 1.05). The same test also revealed a statistically significant improvement in the ADL process ability score of the Non-VFL group from initial assessment to follow up, \( z= p <0.000 \) with a medium effect size (\( r= 0.424 \)). Similar to the VFL group, the improvement of the ADL process ability score of the Non-VFL group from initial assessment to follow-up was not clinically relevant (< 0.3 logits).

In summary, there was a statistically significant improvement and clinically relevant difference of the ADL motor and ADL process ability scores of the total sample from initial assessment to follow-up. There was a statistically significant improvement in the ADL motor and process ability scores of the VFL and Non-VFL groups. Although the improvements of the ADL motor ability scores of both groups were clinically relevant, the improvement of the ADL process ability scores were not.
### Table 10: Comparison of AMPS Motor and Process Ability Scores from Initial Evaluation and Follow-up

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Follow-up</th>
<th>Initial</th>
<th>Follow-up</th>
<th>Initial</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPS Motor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Median rake</td>
<td>0.90</td>
<td>1.60</td>
<td>0.60</td>
<td>0.80</td>
<td>0.90</td>
<td>1.10</td>
</tr>
<tr>
<td>N</td>
<td>16</td>
<td>16</td>
<td>35</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AMPS Process</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Median rake</td>
<td>0.25</td>
<td>0.40</td>
<td>0.35</td>
<td>0.50</td>
<td>0.25</td>
<td>0.45</td>
</tr>
<tr>
<td>N</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ADL motor and process ability scores are reported in log-odds probability units (logits).

- Difference is statistically significant at the 0.05 level.
- *Score differences are clinically relevant.*
- **Statistically significant.**

The table compares AMPS Motor and Process Ability scores from Initial Evaluation and Follow-up between two groups. The median scores are reported in log-odds probability units (logits). The ADL motor and process ability scores are reported in log-odds probability units (logits). The difference is statistically significant at the 0.05 level. Score differences are clinically relevant. Statistical significance is indicated by two asterisks (**) in the p-value column.
3.7. Summary of findings

On initial assessment, the results did not show any statistically significant difference, nor did it show any clinically relevant difference between the ADL motor and ADL process ability scores between the groups with and without VFL.

Subgroup analysis of the VFL group when split according to the category of topography of VFL showed that the participants in the complete VFL subgroup exhibited increased physical effort and reduced efficiency compared to the incomplete VFL subgroup.

Subgroup analysis of the VFL group according to the laterality of VFL revealed that there were no statistically significant differences on the median ADL motor and process ability scores of patients with the left or right VFL. However, the results showed that patients with left VFL have clinically relevant lower scores on both the ADL motor and ADL process ability scores compared to those with right VFL. No significant differences in the ADL motor and ADL process ability scores between the VFL group and the comparison group were noted on follow up.

Lastly, there were a statistically significant improvement of the ADL motor and ADL process ability scores from initial assessment to follow up across the groups.
Chapter 4: DISCUSSION

This chapter discusses the results of the current study in the context of relevant literature in this area. A review of the study aims is followed by the discussion of results starting with the baseline characteristics of the sample and the results of the primary outcome measure: the AMPS. There is a focus on how the results of this study extend theory and practice in the field of ADL rehabilitation after stroke for people with VFL. Finally, the chapter highlights the limitations of the current study and outlines areas which may warrant further research. To our knowledge, no study has used a standardised objective ADL assessment tool like the AMPS in measuring the ADL performance patients with stroke who have VFL.

The primary aim of this study was to investigate the ADL performance of patients with VFL following a stroke using an objectives assessment tool. This research study is important as the outcome will give occupational therapist an insight into the level of assistance and level of performance of patients with VFL after a stroke. The results will complement previous studies that assessed ADL of people with VFL after a stroke that used different methods. Assessment of ADL skills was conducted at two time points using the AMPS: on initial assessments and at ≥ 7 weeks follow-up. The first data collection focused on describing and comparing the ADL performance of patients with VFL and without VFL following a stroke. The comparison of ADL performance between the VFL group and the Non-VFL group was repeated at follow-up.

Differences in the ADL performance of people with VFL was explored when the VFL type can be described in one of two categories: the topography (complete versus incomplete) and lateralisation of VFL (right versus left). Lastly, changes in ADL performance overtime for both those with and without VFL were explored by comparing the scores from initial assessment to follow-up.

4.1. Baseline Measures

4.1.1 Basic ADL skills

The MBI is an established measurement for quantifying functional abilities for people with regards to their personal ADL skills (Shah et al. 1989). While the MBI has been
used either singly or as part of a global measure to evaluate the outcomes of stroke trials that focused on intervention for stroke such as thrombolysis (Hajjar et al. 2011) or the effectiveness of acute stroke units (Quinn et al. 2011; Trialists’Collaboration 2013), it has also been used in research for people with other neurological conditions such as spinal cord injury and other rehabilitation populations such as orthopaedic and age-related based conditions (Shah et al. 1989; Hoking et al. 1999).

In the current study, there was no difference in the MBI scores across those with and without VFL with both groups demonstrating a high level of independence. These finding are in contrast with the findings of studies by Patel et al. (2000) and Sand et al. (2017). A prospective study by Patel et al. (2000) used the MBI to measure the ADL skills of a group of patients with stroke with a group of patients with VFL at one, three and six months (Patel et al. 2000). The authors reported that the group with a motor impairment and VFL (n= 32) had a mean MBI score of 61 SD 29 and the group with motor, sensory and VFL (n= 86) had a mean MBI score of 44 SD 33.2 in the first month after a stroke. These scores are lower than the MBI scores of the patients with VFL in the current study. However, it must be noted that Patel et al. (2000) recruited participants with significant motor impairment using the Fugl-Meyer Index (lower extremity portions) which is not a feature of the study reported in this thesis. This level of motor impairment significantly impacted the ability of participants to mobilise independently which potentially contributed to a significant lower MBI score. In contrast, the current study recruited participants who were able to mobilise without assistance. The difference in the inclusion criteria of the studies may explain the differences in the reported MBI Total scores.

A recent study by Sand et al. (2017) investigated the impact of VFL after a stroke on mortality also used the MBI to measure ADL skills of patients with and without VFL (Sand et al. 2018). The authors reported that the mean MBI score for their group with VFL (n= 506) at 7 days post-stroke was 51.9 SD 39.1 and the sample without VFL (n = 2041) was 84.8 SD 27.1. These reported MBI scores were also lower than the reported MBI scores of patients with and without VFL in this current study. There are a few factors that could explain these differences. One, the study by Sand et al. (2017) confirmed the presence of VFL using the NIHSS confrontation test. As previously noted, the confrontation test is a less sensitive assessment tool when used to measure VFL compared to perimetry testing, a more objective tool that was used in the current
study. Second, Sand et al. (2017) did not screen patients for the presence of visual inattention. It is possible that the patients that showed VFL in the study by Sand et al. (2017) actually have visual inattention or had visual inattention combined with VFL and not VFL alone. These two conditions are difficult to distinguish using a confrontation test only as both conditions require an ability to respond to targets in the affected field. Visual inattention or unilateral spatial neglect is more severe and is associated with poorer functional recovery in stroke compared to VFL in isolation (Rengachary et al. 2011). The use of a less sensitive assessment tool to measure VFL and the absence of tests to rule out visual inattention, in the case of the study by Sand et al. (2017), may explain the lower MBI scores in the study. The current study, on the other hand, used screening tests to establish the presence of inattention which guaranteed that those with VFL only were recruited to the study.

The findings of the current study partially support the finding of the survey by Warren (2009) who reported that, although a small percentage of patients with VFL (n= 49) highlighted particular challenges in feeding (13%) and grooming (41%) these difficulties did not necessarily result in requiring physical assistance to complete them (Warren 2009). As the MBI rates a participant’s personal ADL skills in terms of the level of physical assistance required (Shah et al. 1989), this measure was not able to detect the subtle difficulties one experiences when performing them. The MBI floor and ceiling effects have been noted to limit its sensitivity to change especially at the extremes of disability (Quinn et al. 2011). Thus, the properties of this outcome measure such as floor and ceiling effects may also explain the high MBI scores that either group have garnered in this current study.

One of the inclusion criteria of the current study may also explain the high MBI scores the groups have attained. The study recruited participants that have an MRS of \( \leq 3 \) (mild to moderate disability) indicating that minimal assistance in some tasks are required. Significant differences in the scores may have occurred if patients with substantial assistance (MRS \( \geq 3 \)) were also recruited to this study. Another factor that could explain the lack of significant differences between the groups’ MBI scores was the relatively small search span required to perform PADL. The search span when performing most of the task items included in the MBI is only confined to the space immediately surrounding the body. IADL tasks such as meal preparation or shopping
in the supermarket requires a larger visual search to complete compared to completing PADL that only requires a smaller visual search (Warren 2009).

The presence of other non-identified sensori-motor deficits in the Non-VFL group such as balance, ataxia and weakness of the limbs, which have more significant negative effects on ADL skills (de Haan et al. 2015) may have contributed to the lower scores on the Non-VFL group. Similarly, there was the possibility that some of the participants in the VFL group have only VFL as their main stroke-related symptom. There was a mix of different types of VFL in the VFL group with a predominance of incomplete VFL (n= 13). Prior studies have reported that there is relationship between poorer scores on functional scales and complete VFL (Gall et al. 2010; H. Subhi et al. 2017). One such study by Subhi et al. (2017) examined the relationship of self-reported function measured by the Dutch ICF Activity Inventory to the size of VFL measured by perimetry on 54 participants with VFL (H. Subhi et al. 2017). A similar study by Gall et al. (2006) reported that patients with incomplete VFL scored better on the overall composite score of the NEI VFQ 25 compared to those with complete VFL (Gall et al. 2010). These studies reported that greater VFL was associated with worse self-reported function. Therefore, the preponderance of patients with incomplete VFL (n =13) versus those with complete VFL (n= 3) in the VFL group in the current study may have resulted to a higher MBI score. The VFL group in this study may have achieved a different MBI score had we recruited an equal amount of patients with a complete and incomplete VFL.

4.1.2 Reading and Reading Speed

Reading is one of the few areas that has been found to be severely affected by VFL (Rowe et al. 2009b; Rowe et al. 2013). Like previous studies in this area, the current study demonstrated that there were statistical differences in reading performance among people with stroke with and without VFL.

There are several reading tests used to assess reading skills after a visual impairment including VFL (Rubin 2013). The Article Reading test, a subtest of the BIT, was used in this study because it is a standardised evaluation package with reported good reliability and validity (Hartman-Maeir and Katz 1994). The BIT evaluates inattention
after a stroke. Because both VFL and visual inattention creates a reading deficit, the Article Reading Test was considered appropriate to measure reading performance for patients with VFL (Hartman-Maeir and Katz 1994; Rubin 2013). The time to complete a reading task reflects reading speed and was crucial in calculating the total score of reading performance in some reading tests (Leff et al. 2000; McDonald et al. 2006). As reading speed is not captured in the Article Reading Subtests, the time to complete the test was recorded to conform with previous studies (Leff et al. 2000; Rubin 2013; Blaylock et al. 2016).

There was a difference between the ARTS of patients with (Med= 7) and without VFL (Med= 9). This finding supports the results of previous studies where VFL significantly impairs reading accuracy (Leff et al. 2000; McDonald et al. 2006; Warren 2009; Mennem et al. 2012). The Article Reading test was able to detect that patients with VFL read less accurately as evidenced by this group having more word omissions or substitutions than those without VFL. Although there was a difference between the ARTS of patients in the VFL and the Non-VFL group, this did not reach a statistical significance. Reading speed as measured by the time to complete the Article Reading test also showed some differences between the VFL and the Non-VFL group. The VFL group’s ARTT was longer than the Non-VFL group. Although a difference existed in the median time to complete the test between the groups, the difference did not reach statistical significance.

There are several factors that could have contributed to the overall outcome on reading performance of both groups in this study. First, the presence of cognitive impairment in the participants in either groups may have affected the overall reading performance and speed. The MMSE cut-off score used as an inclusion criterion (≥19/30) to recruit participants may have allowed the recruitment of participants with mild, or higher cognitive impairment, particularly memory and executive dysfunction (Stolwyk et al. 2014). Some have argued, however, that cognition only has an effect on reading comprehension and not on reading speed and accuracy which most test of reading performance were meant to measure (Rubin 2013). Nevertheless, the presence or absence of cognitive skills like attention and information processing could have affected the scores. Second, communication problems due to dysarthria or dysphasia may have been present also in some of the participants in this study that could have potentially affected reading accuracy and speed of the participants in either group.
Patients with dysphasia and dysarthria may pronounce words incorrectly as they read the article aloud making them likely to make omissions or substitutions which adds to the errors recorded in the test. Patients with cognitive and communication difficulties after a stroke are often observed when working in this field and is therefore an inevitable aspect of stroke cohort studies (Langhorne et al. 2011; Stolwyk et al. 2014). Other non-modifiable factors that were not accounted for in this study such as education level, reading habits and pre-stroke literacy of the participants which may have also impacted on the findings of this study (Rubin 2013).

The study by McDonald et al. (2006) compared the reading performance of 18 patients with right sided VFL to ten unimpaired control participants. The study found that the participants with VFL employed an eye strategy to compensate for the impairment caused by VFL early in their recovery (McDonald et al. 2006). Since the participants’ reading ability and reading speed in this study were recorded within the first four weeks of their stroke, it is possible that they had already acquired compensatory reading skills. It is also possible that some of the patients in the VFL group may have naturally recovered some of their visual field. Previous studies have reported that 16-20% of patients with VFL after stroke will recover some of their field loss in the first month after suffering a stroke (Tiel and Kolmel 1991; Rowe et al. 2013). The potential recovery of visual field, or compensation or both may have affected the results of the reading score and reading speed of patients with VFL making the difference between the VFL group and the Non-VFL group undetectable statistically (Kerkhoff 2000).

Another likely explanation for the lack of statistical significance in the reading performance between the groups in the current study is that there were not enough participants in either group to show statistical difference. The study was not powered to detect a statistical difference in reading scores across the groups. To this end, a larger cohort of adults with and without VFL post-stroke should be recruited to explore this finding further. It was initially anticipated that a greater number of participants with VFL would be recruited but the time constrains of the study prevented to facilitate this.
4.2 Assessment of Motor and Process Skills

The AMPS ADL motor and process ability scores of the total sample indicated that the participants demonstrated reduced ADL performance when interpreted according to the AMPS competence cut-off. Specifically, the participants exhibited increased effort and reduced inefficiency when performing ADL. The ADL motor and process of the total sample also suggested that the participants were likely to require assistance when discharged to the community when it was interpreted in relation to the AMPS independence cut-off.

A study by Verbraak et al. (2012) used the AMPS to assess ADL performance of patients with mild or non-disabling stroke that has been discharged from the hospital three days after their admission to an acute hospital (Verbraak et al. 2012). Verbraak et al. (2012) reported a higher ADL motor and ADL process ability scores for their participants (ADL motor 2.4 and process of 1.5) compared to the current study (ADL motor of 1.6 logits and ADL process 0.80 logits). The participants in the study by Verbraak et al (2012) can/could live independently in the community. The contrast in the findings of this study and that of Verbraak et al. (2012) can be attributed to the differences in the sample recruited and the time of stroke (4 weeks versus 3 days). Nevertheless, the current study and the study by Verbaak et al (2012) confirmed the assumption that although some patients with a mild stroke may appear to be physically capable, they were not able to perform familiar and pertinent daily activities as they could before their stroke. Thus, the AMPS was successful in detecting the subtle differences in the participants’ ADL performance after sustaining a stroke. These subtle differences would not have been detected had the current study used an ADL assessment tool that exhibits floor and ceiling effects (Fisher and Jones 2011; Verbraak et al. 2012; Choo et al. 2018).

4.2.1. ADL performance of patients with stroke with VFL

The study has shown that the VFL group had an ADL motor ability score of 1.70 suggesting mild to questionable effort and an ADL process ability score of .80 suggesting mild to questionable inefficiency. The scores also suggested that these individuals were likely to require assistance to live in the community.
This study is the first to indicate that patients with VFL after stroke show reduced ADL motor and process abilities as measured by the AMPS. This result demonstrated that VFL after a stroke affects both motor (ie. moving self and objects during tasks performance) and process skills (ie. selects, interacts, use tools, sequences and modifies performance) when performing ADL tasks. The persistence of these problems will present challenges for people returning to live alone in the community.

4.2.2. Comparing ADL performance of patients with and without VFL

The current study also explored if there were differences in the ADL motor and process ability scores across groups with and without VFL. The median ADL motor and ADL process skills scores of both the VFL group and the Non-VFL group were below the competence cut-off for motor and process skills and below the independence cut-offs. These scores suggest that the patients in both groups showed increased physical effort and reduced efficiency when performing ADL, increasing their likelihood that they will require assistance to live in the community.

The study was not able to show any significant differences in the ADL performance between the groups as measured by the AMPS. However, the close proximity of the median ADL motor and process ability scores of the VFL group to the competence cut-off suggest that the participants in the VFL group were performing ADL tasks with reduced effort and increased efficiency than those in the Non-VFL group. This may be evidence that the impact of VFL after a stroke on one’s ability to perform ADL is mild. The finding that there is no difference in the ADL skills as measured by the AMPS across the groups correlates with our earlier finding: there is no difference in the ADL across groups as measured by the MBI. A similar observation was reported by Warren (2009) who concluded that patients with VFL as their main symptom after stroke can resume an independent life as evidenced by their ability to live at home. Unlike the participants in this current study, Warren’s (2009) study was based from findings of participants with stroke where VFL was their only deficit (Warren 2009). While it is possible that the participants in the VFL group in the current study also have VFL as their primary deficit after stroke, we cannot rule out the possibility that they also have other stroke related symptoms.
Our finding that there was no significant difference in performance between those with VFL and without VFL was also in agreement with the findings from a study by Kasneci et al. (2014) where the researchers compared the performances of patients with VFL with age and sex-matched healthy-sighted controls on a specific ADL task in a supermarket (Kasneci et al. 2014). The authors found no significant differences in the performance in the supermarket between the groups. However, since Kasneci et al. (2014) recruited participants with VFL during a longer time frame (six-month period onset of stroke), it is very likely that the participants in their study had already learned compensatory strategies which contributed to their findings. Some studies have reported compensatory strategies that patients with VFL employ long after the onset of their VFL resulting in an improvement in performance of some tasks over time (McDonald et al. 2006; Machner et al. 2009).

The unequal numbers of participants in both groups in the current study could have also affected the overall AMPS scores. As previously mentioned, efforts to recruit increased number of participants in the study, particularly of the participants with VFL were hampered by the time constraints. The cohort of recruited represents the participants from consecutive admissions to the three services in a set time period. Our incidence of VFL observed was smaller compared to earlier epidemiological studies that reported high prevalence rate of VFL in acute stroke units (49%) ((Zhang et al. 2006; Suchoff et al. 2008; Rowe et al. 2009b). However, it has to be noted that some patients with VFL admitted to the three services were not recruited to the study due to the severity of their stroke and the co-existence of other visual impairments. It is common for patients with stroke to have more than one visual impairment and it is not uncommon for VFL and visual inattention to co-exist (Rowe et al. 2009a). Excluding patients with VFL and concurrent visual inattention and those with severe disability also contributed to the small number of participants with VFL in the study.
4.2.3. Comparing ADL performances according to topography and laterality of VFL

4.2.3.1. Comparing ADL performances of patient with complete and incomplete VFL

We compared the performances of patient with VFL based on the topography: whether the VFL was complete or incomplete. There was a notable difference between the ADL performances of patients with complete compared to incomplete VFL. Specifically, the patients with complete VFL scored lower on both the ADL motor and process ability scores than patients with incomplete VFL. This finding supports the assumption proposed by previous researchers that the topography of VFL has a negative effect on function (Gall et al. 2010; Kasneci et al. 2014; Hikmat Subhi et al. 2017).

One such study by Gall et al. (2009) compared the NEI VFQ 25 scores of patients with complete and incomplete VFL and reported that patients with incomplete VFL garnered 10 points higher for the subscales of vision (near vision, distance vision and colour vision activities) than those with complete VFL suggesting that larger VFL is associated with worse self-evaluated visual functioning (Gall et al. 2010). Another study by Kasneci et al. (2014) that investigated the supermarket search tasks of 10 patients with VFL found a moderate correlation between VFL size and the time per number of correctly collected items (Kasneci et al. 2014). The authors concluded that the remaining intact visual field is associated with better performance. A more recent study by Subhi et al. (2017) explored the relationship between the visual field areas and functional difficulties and revealed that a VFL of 0-60 degrees was associated with worse self-reported overall function (Hikmat Subhi et al. 2017). Our findings are partially consistent with the results from these studies despite the variety of difference outcome measures used across the studies to measure function.

Our finding that patients with complete VFL display motor difficulties are in agreement with prior studies that reported that difficulties with motor function are related to the size of VFL. One such study by Mennem et al. (2012) found that patients with VFL rated eye-hand coordination and mobility as difficult using a self-rated functional questionnaire (Mennem et al. 2012). Another study by Subhi et al. (2017) reported similar findings that patients with VFL reported “mobility-related” activities as problematic (Hikmat Subhi et al. 2017). One plausible explanation for this common finding is that peripheral vision is necessary to update the representation of the spatial
environment needed for walking and to avoid potential hazards during task performance (Turano et al. 2004; Hikmat Subhi et al. 2017).

Our finding that individual with complete VFL have lower ADL process skills confirms the findings by Warren (2009) who described the challenges experienced by patients with VFL. These included skills like searching/locating objects, navigating around a room, noticing and responding to actions or objects appropriately (Warren 2009). These actions are similar to some of ADL process skills items in the AMPS (search/locates, navigates, notice/responds and adjusts). The inability to retrieve information from the environment, to comprehend, to respond appropriately and in a timely fashion due to VFL may explain the impairment of ADL process skills after VFL (Warren 2009).

Overall, our finding confirms the previously held assumption that the size of VFL has a negative impact on ADL performance, and this finding has direct implication for immediate assessment and planning of an early stroke occupational therapy intervention. Occupational therapist or other health care professions who work with patient with VFL after a stroke should be vigilant and cautious when working with patients with complete VFL without a comprehensive ADL assessment, such as the AMPS. As our findings show that patients with complete VFL demonstrated deficits in ADL motor and process abilities, this group of patients should be prioritised for assessment and rehabilitation either to ameliorate and/or compensate for these deficits (Fischer 2009).

4.2.3.2 Comparing ADL performances of patients with right and left VFL

We compared the ADL performances of patient with VFL according to laterality of VFL (left versus right VFL). We found that there was no significant difference in the ADL performance of patients with left and right VFL. This finding is in accordance with the previous study by Mennen et al. (2012) that explored performance limitation of people with VFL and found that whether the patient has a right or left VFL did not affect the level of performance difficulty (Mennem et al. 2012). Although there were differences in the outcome measures used, the study by Mennem et al. (2012) used a subjective ADL measure and the current study used an objective measure of ADL.
(AMPS), both studies showed that the side of VFL did not significantly affect ADL performance.

However, the current study was able to show clinically relevant differences in the ADL process ability scores between patients with right and left VFL, with the left VFL scoring lower on ADL process scale. The ADL process scores of patients with left sided VFL (0.40 logits) compared to those with right sided VFL (1.10 logits) suggested that this subgroup demonstrated reduced efficiency during ADL performance increasing their likelihood to need assistance to live in the community. One plausible explanation for the differences in the ADL performance based on the laterality of VFL can be offered based on how normal vision operates. People with normal vision execute a left to right pattern when scanning and exploring the environment (Pambakian et al. 2000). In the left sided VFL, the starting point of visual search is non-existent. Therefore, a left-sided VFL will significantly impair one’s ability to scan an environment more than the right-sided VFL when performing ADL.

4.2.4. Comparing the ADL performances of patients with and without VFL on follow-up

Our findings did not show any significant differences, either from a statistical or clinical perspective, in the ADL motor and ADL process ability scores between the VFL and the comparison group on follow-up. In fact, the ADL motor and ADL process scores of both groups were relatively the same: both groups are showing performance that are effortless and efficient ADL performance. The scores of both groups in relation to the independence cut-off suggested that both groups can or could live independently in the community. Again, this finding was in direct contrast to reports from the study by Patel et al. (2000), who reported that patients with VFL after a stroke were more likely to require assistance when discharged to the community (Patel et al. 2000). The difference can be attributed to the differences in the inclusion criteria employed and the tools used to measure ADL between the study by Patel et al. (2000) and the current study. The study by Patel et al. (2000) combined VFL with motor and sensory impairment after stroke potentially recruiting patients who have severe disability while the current study used the MRS ≤ 3 restricting recruitment of participants with a mild to moderate disability to the study. The study by Patel et al. (2000) used the MBI, while the current
study used the AMPS. The difference in the criterion of the tools in predicting discharge home used in these studies may have also resulted in the difference in the outcome.

Our finding suggest that there has been an improvements of ADL performance ≥ 7 weeks in either group. The ADL difficulties that existed in the participants during the acute stage did not persist during follow-up. This could suggest that it is more effective to assess ADL skills in the early stage of stroke where no compensatory, spontaneous or through therapy, has developed yet. Assessment of ADL skills at 2 months follow-up may be not as efficacious.

4.2.5. Improvements in the ADL performances of patients with and without VFL

The study was able to investigate if participants in the VFL group improved over time, mirroring the trajectory of improvement of ADL performance of the participants in the Non-VFL group. However, these findings cannot confirm whether the improvement of ADL performance was the result of spontaneous improvement or if it was the result of rehabilitation. All the participants received rehabilitation assessment and/or intervention, as per usual care, through their admissions to the services that the participants were recruited from. It is possible that the participants recruited to the study received intervention to improve ADL as per usual care potentially contributing to the improvement of their ADL performance during follow-up. As the study did not control for this factor, we cannot attribute the improvement of ADL skills solely to the intervention that the participants received. Earlier studies have reported spontaneous improvement of ADL after a stroke particularly in the first three 10 weeks after a stroke (Jorgensen et al. 1995; Kwakkel et al. 2006). One prospective study by Duncan et al. (1994) reported that spontaneous improvement of ADL as measured by the Barthel Index level off between four to twelve weeks (Duncan and Min Lai 1997). Therefore, it was very likely that the participants had spontaneous improvement of their ADL skills from the time of their stroke to follow-up assessment. Previous studies have also reported that natural recovery of VFL can occur in the first three months after the onset of stroke (Cassidy et al. 2001; Zhang et al. 2006; Ali et al. 2013). It is also likely that the patients with VFL had some spontaneous recovery from the time of initial assessment to the time of follow-up (≥ 7 weeks). As we were unable to measure the VFL using perimetry at follow-up, we cannot confirm if spontaneous recovery of VFL
occurred among the participants with VFL. There are other confounding factors that could have contributed to the improvement in their ADL performance such as age, gender and type of stroke. However, the research by Rexroth et al (2005) and Bernsprang et al. (1995) reported that the laterality of stroke and gender did not exhibit clinically detectable differences in ADL performance as measured by the AMPS (Bernspang and Fisher 1995; Rexroth et al. 2005). Therefore, we are confident that the factor gender and laterality of stroke had little influence on the outcome of the AMPS in this current study.

Our findings showed that having VFL after a stroke did not impede measurable improvement of ADL performance and the likelihood of being discharged home independently. This finding that patients with VFL after stroke improved ADL performance after a period of time are also at odds with the finding of the study by Patel et al. (2000) that found that patients with VFL after a stroke reduced the likelihood of being discharged home without assistance when coupled with motor impairments. (Patel et al. 2000). As previously mentioned, the differences in the tools used to predict ability to be discharged independently had affected the reported rates in the studies.

Our findings showed that there was a statistically significant improvement in the ADL motor and process ability scores from initial assessment to follow-up for the whole sample, the VFL group and the Non-VFL group. When median ADL motor and process ability measures were explored in relation to the independence cut off, it was clear that the total sample and both groups can or could live independently. This finding is at odds with that of Verbraak et al. (2012) who reported that there was a relevant decrease in the ADL motor and process ability scores of the total sample of 45 patients with mild stroke after six months (Verbraak et al. 2012). The difference of the severity of the stroke as defined by the two studies, the difference in time which follow up was conducted (≥7 weeks versus 6 months) and participant numbers may account for the differences in the reported improvement in AMPS scores.

The findings of this study that showed that there was a clinically relevant improvement in the ADL motor ability scores but not the ADL process scores of the VFL group between initial assessment and follow-up are also at odds with findings of the study by Verbraak et al (2012). In the previous study, the authors reported a clinically relevant improvement in ADL process and not ADL motor ability score (Verbraak et al. 2012).
The difference in the findings can be attributed to the time when follow-up was carried out and the difference of AMPS scores at one month in both studies.

This study demonstrated the value of the AMPS in assessing the ADL limitations of patients with stroke with VFL in the acute and subacute stage of stroke. The AMPS was able to detect the subtle but important differences in ADL performance that would otherwise have been undetected had a less sensitive assessment tool of ADL skills was used such as the MBI. The outcome of the study will contribute to a better understanding of the ADL limitation of patients with VFL after a stroke. There are no other identified studies that investigated the ADL performances of patients with VFL after stroke that used an observation-based assessment.

4.3. Strengths and limitations of the study

This is the first study to use a standardised objective tool to assess the ADL limitation of patients with VFL after stroke. The AMPS has been reported to have good internal consistency, reliability and validity (Fisher and Jones 2011). The AMPS software adjusts the final ADL ability scores to simultaneously account for skill item difficulty, severity of the rater and challenge of the task so that the resulting ADL ability measures are not biased by the individual rater who observed the performance or by the tasks the person performed. The AMPS does not exhibit floor and ceiling effects, thus making it sensitive to even the small and moderate improvements in ADL. These are the benefits of using the AMPS in assessing ADL performance. It is the most sensitive outcome measure that is available. The outcome of this study that used the AMPS will be more meaningful to occupational therapist who work with patients with VFL after a stroke than by using subjective measures of ADL. Therefore, the study supports the use of the AMPS in the evaluation of ADL skills with patients following a stroke.

However, the use of the AMPS in this study can also limit its applicability as the measure is not readily available in all stroke units or rehabilitation centres. As discussed in Chapter 2, an occupational therapist have to attend a verified training course and undergo stringent calibration training to qualify as an AMPS rater.

Another strength of this study was the low rate of attrition. Efforts were made from the beginning to facilitate maximum rates of follow-up. Some of these efforts included
availability of home visits for follow-up assessments and scheduling follow up appointment to coincide with patient hospital visits or stroke out-patient appointments. These efforts, we believe, have reduced the rates of attrition in this study.

Robust and transparent methods were used to recruit participants to the study. The gatekeepers to the study were the senior occupational therapists in Neurology and ESD working in this hospital and they were not known to most of the participants in the study. The researcher, on the other hand, was known to most of the potential participants as he was a staff occupational therapist working in the same acute hospital where the participants were admitted and treated for their stroke presentation. This could be construed to bias the investigator’s ability to objectively score the participants during administration of measures used in the study. The primary researcher was the only occupational therapist who administered the primary outcome measure, the AMPS. This could have resulted in potential detection bias when scoring the participants’ performances. These risks were managed by submitting all AMPS raw data to the Center of Innovative OT Solutions (CIOTS) in Fort Collins, Colorado for analysis. All data stored in the OTAP software was encrypted and password-protected to ensure that only the authorised occupational therapist could access his or her client data. No sensitive information related to the patient was stored in the software.

The results of the current study should be interpreted with some caution. Although we were able to generate new findings that contribute to existing knowledge on the performance of patients with VFL, there were some potential limitations to the study. First, the findings were based on a relatively small number of patients. We recruited a smaller than expected number of patients with VFL due to time restrictions during recruitment. This has resulted to the Non-VFL group disproportionately larger than the VFL group. A more balanced number of VFL participants against the Non-VFL group could have yielded different results. Unfortunately, we were not able to recruit more participants in the VFL group due to time restriction and the consecutive sampling nature of recruitment. The study also was only able to recruit three patients with complete VFL making the subgroup with incomplete VFL larger than the complete VFL (13 versus 3). Different proportions of people in the VFL and comparison group have affected the distribution of data and the subsequent statistical analysis. These factors could potentially reduce the generalisability of the results and also limits our ability to draw robust conclusions.
Some items of the inclusion criteria may have affected the general overall outcome of the study results. First, since we only recruited patients with stroke with a mild-moderate disability as defined by an mRS score of $\leq 3$, we have excluded patients that would have had a severe disability making the generalisability of the study restricted only to patients with mild to moderate disability after a stroke. The mRS cut-off may have also introduced high variability of function of the patients recruited to the study contributing to the less than significant differences in ADL performance in the sample when looking at AMPS scores. Second, the cut-off for the MMSE score for this study (19/30) may have allowed the recruitment of patients with some cognitive impairments. As previously discussed, the MMSE is not sensitive to mild cognitive changes or changes in higher level cognitive function (Stolwyk et al. 2014). The cut-off measure was adopted as it was considered sufficient to be able to ascertain if participants could follow simple commands, a requirement that was essential in gaining consent, and in the administration of the baseline and primary outcome measure used in the study. Third, we recruited participants in the first four weeks since the onset of their stroke. As previous studies have reported, some improvements in visual field can occur in the first four weeks after a stroke (Zhang et al. 2006; Ali et al. 2013). Therefore, it was possible that some recovery of the VFL had occurred during the time of the recruitment or the time at which the baseline and outcome measures were conducted on the VFL group. This could have led to the lack of statistically significant differences in the ADL performance between the VFL and Non-VFL group.

Another potential limitation is the diverse range of co-morbidities that the participants may have presented with. We were not able to control for the medical co-morbidities of the participants during recruitment. Co-morbidities are common in patients with stroke and it was beyond the scope of the current study to adjust for known confounding factors in the data analysis (Banks and Marotta 2007). These comorbidities could have influenced the ADL performance of some of the participants even prior to their admission to the hospital due to a stroke. Premorbid breathing difficulties due to respiratory problems, for example, can have a negative impact on the ADL motor ability score (Fisher and Jones 2011) Furthermore, co-variates including age, gender, cause of stroke (TOAST classification), or the location of the stroke were not adjusted for during the data analysis phase. The variability in age, gender, type of stroke in the sample recruited to the study could have affected the overall outcome of the study.
However, the study by Rexroth et al. (2005) reported that the effects of gender and laterality of stroke on ADL performance were small and were considered not clinically relevant (Rexroth et al. 2005). The authors concluded that patients with a right or left hemisphere stroke actually have similar abilities to perform ADLs regardless of their body functions or impairments. Thus, the possibility exists that, had the sample been matched for gender and the side of stroke, the difference would have been unremarkable.

The primary investigator was not blinded to group allocation and was the only person who conducted the AMPS on initial evaluation and follow-up. The ADL tasks selected by the participants may have also contributed to detection bias. Previous research has concluded that patients with VFL have more errors in performing tasks that require a larger visual search (Warren 2009). The effect of VFL on ADL performance is directly related to the visual burden of the requirements of a task (Papageorgiou et al. 2007). Thus, patients with VFL will evoke more errors in tasks that require a lot of visual searching. Some patients may have, unwittingly or not, chosen tasks that required less visual search than others therefore contributing to a potential performance bias. However, since AMPS software adjusts the final ADL ability scores according to the skill item difficulty, severity of the rater and challenge of the task, the resulting ADL ability scores were not biased by the primary investigator’s rating or by the tasks the participants chose.

Although the MBI scores have been reported to be reliable and valid, it may not have been the most sensitive assessment tool for assessing personal ADL. The test was not able to capture the subtle differences between the levels of independence in the groups due to its floor and ceiling effects. A more sensitive assessment tool, like the Functional Independence Measure and Functional Adaptation measure (FIM+FAM), could have yielded different results due to its higher sensitivity compared to the MBI (Choo et al. 2018). Unfortunately, the FIM+FAM was not routinely used in the services where the participants were recruited from to assess personal ADL skills and therefore was not used for the study.

The majority of the participants in this study completed their AMPS initial evaluation and follow-up in the hospital. Few patients carried out the assessments in their familiar
home environment especially during follow-up. The difference in the setting where the AMPS was administered may have resulted in differences in ADL performance.

Several assessments have been developed specifically to measure reading performance of patients with visual problems (Rubin 2013). While most of these tests were not designed specifically to assess reading performance of patients with VFL, studies have used these tests with patients with VFL following a stroke (S. Schuett et al. 2009; Blaylock et al. 2016; Rubino et al. 2016). The BIT and all its subtests, including the Article Reading subtest have been reported to have good validity and reliability in testing the presence of inattention. However, like most reading tests, the article reading test has not been used specifically to measure the reading performance of patients with VFL. Also, the article reading test was not originally timed as part of scoring reading performance (Rubin 2013). We recorded time separately to measure reading speed in keeping with other reading assessment tools. The Article Reading test, a behavioural subtest of the BIT, was adopted for pragmatic reasons. This test was available in the department and it is a test that is very familiar for occupational therapist working in the setting. Therefore, the use of the Article reading test in the study can be considered a limitation. The use of a reading assessment tool that have been used for patients with VFL specifically could have yielded different results. One reading test, the Visual Skills for Reading Test (VSRT), has been reported to have a good reliability, validity and internal consistency to assess the reading skills of patients with VFL (Blaylock et al. 2016). However, this test was not able in the department during the time of the study. The use of such test would have been more sensitive to differences in the reading performance between the VFL group and the comparison group which the current study was not able to demonstrate.

Although most of the participants in this study reported having an educational minimum achievement of having secondary school education, we were not able to ascertain if the participants had difficulties with reading prior to their admission and/or recruitment to the study. Potential reduced reading skills may have contributed to the variability of reading performance of the participants in the study.
4.4. Implications for Clinical Practice

The study aimed to assess the quality of ADL performance of patients with VFL after a stroke using an observation-based measure. The results of the study found that patients with VFL after a stroke have reduced efficiency and increased physical effort during ADL performance. Our findings further advanced the value of using assessment tools such as the AMPS as part of the overall assessment of patients with VFL because it was able to detect the subtle changes in ADL performance that other assessment were not able to offer. Also, the AMPS was able to predict the ability of the person after a stroke to live independently thus contributing to the overall care plan of patients with VFL. The use of such assessment tool should complement the use of other assessment tools used in the assessment of function after sustaining a VFL. Standardised and non-standardised subjective tools lack specificity in their outcome and cannot offer recommendation like that of the AMPS. The use of subjective measures alone in the assessment of ADL performance of patients with VFL after a stroke may not be able to recommend further intervention that can lead to inappropriate discharge plans and increase the potential for re-admissions due to inadequate levels of support and/or isolation.

The findings also suggest that patients with VFL will require intervention due to reduced efficiency and increased physical effort during ADL performance. This clarifies the need for OT intervention to ameliorate and/or compensate the negative effects of VFL to improve ADL performance. OT Interventions that targets these problems of patients with VFL after a stroke could include compensatory (Nelles et al. 2001), restitutive (Hayes et al. 2012) and substitutive (A. Pollock et al. 2011; Modden et al. 2012)

The results of this study showed that stroke patients with and without VFL have comparable ADL performance but did not exhibit clinically relevant differences between groups in terms of their abilities to perform ADL. Based on this result, it is recommended that an occupational therapist should be cautious when dealing with patients with mild to moderate disability including those who have VFL despite these group of patients often being labelled as relatively independent (Warren 2009).

The finding of this study that patients with VFL after a stroke performed better than patients without VFL might suggest that the effect of VFL in ADL performance is
relative small when compared to impairment of other body functions. However, occupational therapists should prioritise to use objective measures such as the AMPS that can assess level of independence and can predict their ability to live independently in the community. This can, in turn, lead to a more appropriate referral for further intervention and appropriate discharge planning. This finding should provide occupational therapist to form as a basis for their clinical reasoning when referring patients with VFL for community services.

The study has shown some evidence that patients with complete VFL and those with left VFL were likely to show increased physical effort and reduced efficiency during ADL performance than those with an incomplete and right sided VFL. This gives us a better understanding of the potential value of the category of laterality and topography of ADL when predicting ADL performance of patients with VFL. Occupational therapists working with patients with VFL can incorporate the categories of VFL used in this study when prioritising patients for ADL based assessment and intervention.

4.5. Recommendations for future studies

This study was able to provide evidence that patients with VFL after stroke have reduced ADL as demonstrated by increased effort and reduced efficiency using the AMPS. The AMPS, however, is an expensive assessment tool which requires time to become trained in. Occupational therapists are required to attend a training workshop and to undergo calibration in order to be qualified AMPS rater. This assessment may not be readily available to all occupational therapists working in hospitals. Further assessment of VFL-related ADL limitations using a readily available and less expensive outcome measures such as the FIM+FAM may be preferable for some hospitals or rehabilitation centers. The results of the FIM+FAM, however, will not be as objective and as sensitive to change like the AMPS (Choo et al. 2018).

Future studies should recruit a larger sample to see if the findings of this study can be replicated. Broadening the inclusion criteria to include patients with moderate to severe disability could shed more light on the abilities of patient with VFL when compared to the rest of the stroke population, thereby improving the generalisability of the results and enable analysis across different levels of stroke severity. Future studies should also
include matched comparison of individuals with VFL and a normal population which could also determine the accurate ADL performance of patients with VFL.

There are other classifications of VFL in the literature that have been used in previous studies to ascertain which components of VFL affected functional performance the most (Trauzettel Klosinski and Reinhard 1998; McKean-Cowdin et al. 2007). No studies have been carried out associating these components (ie. congruency, macular sparing) with ADL performance. Using alternative VFL classification to the ones used in this study could be valuable to examine if these classifications are more sensitive to detecting variances in ADL performance. Further research should also control for other visual impairments, such as visual acuity or contrast sensitivity that could also be impaired after a stroke in conjunction with VFL (Trauzettel Klosinski and Reinhard 1998; S. Schuett et al. 2009) to determine if these other visual functions could have affected ADL performance.

This study demonstrated that patients with complete VFL and left VFL demonstrated problems with ADL process skills. The next step is to ascertain which specific item skill function under ADL motor and process skill is deficient after VFL. A larger sample of patients with VFL allows the possibility that the resulting data from the AMPS could analysed to determine what specific items in ADL motor and process skills are affected in patients with VFL.

The finding that those with a complete VFL and those with left sided VFL are likely to show impaired ADL performance than those with an incomplete VFL and those with right sided VFL warrants further research. A larger sample involving only patients with VFL could further affirm this finding.

No study has used an objective measure of ADL, like the AMPS, in assessing the efficacy of VFL treatment intervention (Lane et al. 2008; A. Pollock et al. 2011). The use of objective measure of ADL should be incorporated in future studies of intervention for VFL after a stroke. This will help occupational therapists to select the best treatment intervention for VFL that will have significant positive impact on ADL performance.

Lastly, the study did not use a subjective assessment of ADL skills in addition to the use of the AMPS as an objective measure of ADL. The result of such study can ascertain
if one type of ADL assessment tool (objective versus subjective) is superior than the other. This can help occupational therapist in selecting the most appropriate evaluation tool in situation where time is restricted.

4.6. Conclusion

The study showed that patients with stroke with and without VFL perform similarly with ADL tasks. The impact of VFL on ADL performance is relatively “mild” but does impact on people’s abilities to perform ADL and to their ability to be discharge to the community independently. Both groups showed questionable-to-mild increases in physical effort and mild reduced efficiency which increased their likelihood that they will require supervision or minimal assistance to live safely in the community.

There was some preliminary evidence that patients with complete VFL have reduced ADL performance compared to those with incomplete VFL and that they were likely to require assistance to live in the community based on their AMPS scores, while those with incomplete VFL were more likely to live in the community independently due to an effortless and efficient ADL performance. ADL performance of patients with VFL as measured by the AMPS did not differ whether the VFL is lateralised to the left or right side.

There were no significant differences between those with and those without VFL on follow-up but comparison of the initial and follow-up ADL performance of both groups showed improvement in performance. This suggests that VFL has no negative impact on the potential for improvement of ADL performance overtime.

This study has highlighted the need to use an objective measure of ADL such as the AMPS in the early stages to detect subtle differences in ADL performance after sustaining VFL due to a stroke. Results of such outcome can help occupational therapist to facilitate early intervention and promote safe and appropriate discharge plans for patients with VFL. Priority should be given when assessing ADL of patients with a complete VFL and those with a left sided VFL as they tended to perform worse than their counterparts.

Researchers are encouraged to further investigate the findings of this study using a larger sample, particularly exploring the differences of ADL performance according to
the classification of VFL used in this study and to use an objectives measure of ADL like the AMPS when examining the effects of VFL interventions.
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Appendix 1. **CINAHL/MEDLINE Search strategy**

**Activities of Daily Living**

1. **TI:** stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
2. **AB:** stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
3. #1 OR #2
4. **TI:** hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
5. **AB:** hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
6. #4 OR #5
7. #3 AND #6
8. **TI:** activities of daily living OR adl* OR selfcare OR activit* OR occupat* OR function OR performance OR participat* OR eadl OR e-adl OR iadl OR i-adl OR dressing OR eating OR feeding OR personal hygiene OR grooming OR washing OR bathing OR toilet* OR mobility OR driving OR reading OR shopping OR telephone use OR meal preparation
9. **AB:** activities of daily living OR adl* OR selfcare OR activit* OR occupat* OR function OR performance OR participat* OR eadl OR e-adl OR iadl OR i-adl OR dressing OR eating OR feeding OR personal hygiene OR grooming OR washing OR bathing OR toilet* OR mobility OR driving OR reading OR shopping OR telephone use OR meal preparation
10. #8 OR #9
11. #7 AND #10
Driving

1. TI: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
2. AB: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
3. #1 OR #2

4. TI: hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
5. AB: hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
6. #4 OR #5
7. #3 AND #6
8. TI: driv*
9. AB: driv*
10. #8 OR #9
11. #7 AND #10

Reading

1. TI: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
2. AB: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
3. #1 OR #2
Mobility

1. TI: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
2. AB: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussion/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic
3. #1 OR #2
4. TI: hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
5. AB: hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
6. #4 OR #5
7. #3 AND #6
8. TI: mobil* OR ambulat* OR walk*
9. AB: mobil* OR ambulat* OR walk*
10. #8 OR #9
11. #7 AND #10
Appendix 2: PubMed search strategy

Activities of daily living

1. **TI/AB:** stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussi/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic)
2. **TI/AB:** hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
3. #1 AND #2
4. **TI/AB:** activities of daily living OR adl* OR selfcare OR activit* OR occupat* OR function OR performance OR participat* OR eadl or e-adl OR iadl OR i-adl OR dressing OR eating OR feeding OR personal hygiene OR grooming OR washing OR bathing OR toilet* OR mobility OR driving OR reading OR shopping OR telephone use OR meal preparation
5. #3 AND #4 (334 hits)
6. Filter activated # 5 Humans:
7. Filter activated #6 Adult (+ 19 years old)

Driving

1. **TI/AB:** stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussi/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic)
2. **TI/AB:** hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
3. #1 AND #2
4. **TI/AB:** driv*
5. #3 AND #4
6. Filter activated # 5 Humans:
7. Filter activated #6 Adult (+ 19 years old)
Reading

1. TI/AB: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussio/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic)
2. TI/AB: hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
3. #1 AND #2
4. TI/AB: read*
5. #3 AND #4
6. Filter activated #5 Humans:
7. Filter activated #6 Adult (+ 19 years old):

Mobility

1. TI/AB: stroke OR poststroke post-stroke OR cerebrovasc* OR brain vasc* OR cerebral vasc* OR CVA OR apoplex* OR SAH OR Subarachnoid* OR brain injur* OR exp brain concussio/ OR brain hemorrhage, traumatic OR brain OR brain injury, chronic)
2. TI/AB: hemianopsia OR hemianopia OR quadrantanopia OR visual field loss OR visual field defect OR partial blindness
3. #1 AND #2
4. TI/AB: ambula* OR walk* OR mobil* OR mobility
5. #3 AND #4
6. Filter activated #5 Humans:
7. Filter activated #6 Adult (+ 19 years old):
Appendix 3 Information Leaflet

Information Leaflet

The Purpose of this information leaflet is to describe a research project that I would like to conduct in TALLAGHT HOSPITAL and invite you to take part in

Title of the study:

Exploring the Activities of Daily Living Performance of Patients with Visual Field Loss Following a Stroke: A Prospective Cohort Study

Who is doing this research?

I am a Senior Occupational Therapist working in Tallaght Hospital and completing this research as part of a Masters in Research in the University of Limerick

What you will be asked to do as part of this research?

You have been identified as potential participant in this study. Visual Field Loss occurs in some patients who have suffered Stroke. This affects their ability to carry-out daily activities. I would like to find out if patients with Visual Field Loss show the same problems when they are performing daily tasks by directly observing them complete these tasks. You will be asked to perform two (2) tasks that you would normally do at home like preparing toast and a hot beverage, ironing a shirt, or vacuuming a small room. The assessment will take 45 minutes to complete.

What will happen with the information you give and what are the rules about confidentiality?

I will have written information about the tasks you do, I will make sure that your name is not on any of the paperwork that I complete or put into a computer programme.

Your information will be held confidentially in a locked filing cabinet in the hospital.

Your identity or any personal information will not be used with any publication and presentation of the results of this research as part of my Research Masters in the University of Limerick.

The benefits in taking part in this research:
By taking part in this research you will help us understand more about how visual field loss after a stroke affects daily living and therefore focus our treatment strategies to help you with your rehabilitation and safe discharge home.

**Are there risks involved in taking part?**

There are no risks to your health by taking part in this research. However if at any time during the assessments you become tired we can take a break.

**Voluntary Participation:**

You have volunteered to participate in this study. You may stop at any time. If you decide not to participate, or to withdraw from the research at any time you can. This will not affect your rights with any other treatments in the hospital.

Also, if required, I may withdraw your participation in the study at any time without your consent.

**Ethical approval for this research:**

This research has approval from the Hospital Research Ethics Committee.

**How to let me know if you want to take part:**

Once you have read the information and consent form you can decide if you would like to take part in this research. Please think about this for a week. During that week if you have any questions or would like to talk to me more about the research the nurse looking after you can arrange for me to come and talk to you.

On the first day of the assessment I will meet you and explain the research again, and if you are still interested in taking part I will ask you to sign the consent form.

Christian Garcia  
Senior Occupational Therapist  
TALLAGHT HOSPITAL  
Dublin 24  
Phone 414 3230
Appendix 4 Consent Form

Consent Form

Study Title: Exploring the Activities of Daily Living Performance of Patients with Visual Field Loss Following a Stroke: A Prospective Cohort Study.

This study and this consent form have been explained to me. The occupational therapist has answered all my questions to my satisfaction. I understand what will happen if I agree to be part of this study.

I have read, or had read to me, this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I have received a copy of this agreement and I understand that, if there is a sponsoring company, a signed copy will be sent to that sponsor.

Participants Name:

Participant’s Signature:

Date:

Date on which the participant was first furnished with this form:

Where the participant is capable of comprehending the nature, significance and scope of the consent required, but is physically incapable to sign written consent, signature of two witnesses present when consent was given by the participant.

Name of first witness:
Signature:
Name of second witness:
Signature:

Statement of investigator’s responsibility: I have explained the nature, purpose, procedures, benefits of, risks of, and alternatives to, this research study. I have offered to answer any questions and fully answered such questions. I believe the participant understands my explanation and has freely given informed consent.

Investigator’s Signature:

Date:
Appendix 5 Participant Demographic Form

### Participant Demographic Form

<table>
<thead>
<tr>
<th>Name:</th>
<th>Gender</th>
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<table>
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<th>Age:</th>
<th>□ Male □ Female</th>
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</table>

<table>
<thead>
<tr>
<th>Previous known Stroke/TIA</th>
<th>□ Yes □ No</th>
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</table>

<table>
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<th>Ethnicity</th>
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<th>Highest Educational Level</th>
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<table>
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<th>Self-reported health status</th>
<th>□ Excellent or Very Good □ Good or Fair □ Poor or Very Poor</th>
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<th>Social status</th>
<th>□ Lives Alone □ Lives with Family or Partner □ Residential Care □ Other</th>
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</thead>
</table>

<table>
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<tr>
<th>Employment Status</th>
<th>□ Retired □ Employed (Part or Full time) □ Unemployed □ Homemaker □ Other</th>
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<th>Use community services</th>
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<th>Rural/Urban</th>
<th>□ Rural □ Urban</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Medical Card Holder</th>
<th>□ Yes □ No</th>
</tr>
</thead>
</table>

Appendix 6 Sample Data File

Sample Raw Data
1, 10099001, 19, 1, 1, 1, 1000099, 1, 11, 1-36,3,4,3,3,4,3,4,3,4,3,4,3,4,2,2,3,4,4,3,4,2,2,2,2,2,2
1, 10099001, 2, 2, 1, 1, 1000099, 1, 14, 1-36,3,4,2,3,3,3,3,2,2,3,2,2,3,3,4,3,3,3,2,2,2,3,2,2,2,2,2
3, 30105027, 23, 1, 1, 4, 1000105, 1, 21, 1-36,3,3,4,3,3,4,4,4,4,3,4,2,4,3,3,4,3,3,4,3,4,3,3,4,2,1,3,3,2,2
3, 30105027, 27, 2, 1, 4, 1000105, 1, 10, 1-36,3,3,4,3,4,4,4,4,4,4,4,3,4,4,2,3,4,4,4,2,4,4,3,4,3,3,3,2,2,2
6, 63322097, 23, 1, 1, 9, 1000322, 1, 9, 1-36,3,4,4,3,4,4,4,4,4,4,3,4,3,4,3,4,3,4,3,4,3,4,3,4,3,2,2,2,2
6, 60322097, 23, 2, 1, 9, 1000322, 1, 1, 1-36,4,4,3,4,4,3,3,3,3,4,4,3,4,3,3,3,3,4,3,3,3,3,3,2,2,2,2,2,2,2,2

Note:
Each person has two rows of data, one for each AMPS task observed

<table>
<thead>
<tr>
<th>Column 1: World region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column 2: Person Number</td>
</tr>
<tr>
<td>Column 3: Task code</td>
</tr>
<tr>
<td>Column 4: Task Order</td>
</tr>
<tr>
<td>Column 5: Gender</td>
</tr>
<tr>
<td>Column 6: Global Age Group</td>
</tr>
<tr>
<td>Column 7: Rater Number</td>
</tr>
<tr>
<td>Column 8: Global Diagnosis</td>
</tr>
<tr>
<td>Column 9: County</td>
</tr>
<tr>
<td>Column 10: AMPS item scores</td>
</tr>
</tbody>
</table>

Sample Person Label:
10099001 = 35 2 M ADLT
30105027 = 48 2 M ADLT
60322097 = 30 2 F ADLT

Note
Column 1: Person Number
Column 2: Age group
Column 3: Number of tasks observed
Column 4: Gender
Column 5: Diagnosis Group
Appendix 7. Ethical Approval Letter from the Research Ethics Committee

THE ADELAIDE & MEATH HOSPITAL, DUBLIN
INCORPORATING THE NATIONAL CHILDREN'S HOSPITAL
TALLAGHT, DUBLIN 24, IRELAND
TELEPHONE +353 1 4142300

SJI/AMNCH Research Ethics Committee Secretary
Claire Hartin Ph: 4142199
email: claire.hartin@amnch.ie

Mr. Christian Garcia
Senior Occupational Therapist
Tallaght Hospital
Tallaght
Dublin 24

20th June 2017

Re: Exploring The Activities of Daily Living Performance of Patients with Visual Field Loss after a Stroke: A Prospective Cohort Study

REC Reference: 2017-06 Chairman’s Action (5)
(*Please quote reference on all correspondence)*

Dear Mr. Garcia

The REC is in receipt of your recent application to SJI/AMNCH Research Ethics Committee in which you queried ethical approval for the above named study.

The Chairman, Dr. Peter Lavin, on behalf of the Research Ethics Committee, has reviewed your application and granted ethical approval for this study.

Yours sincerely,

Claire Hartin
Secretary
SJI/AMNCH Research Ethics Committee

The SJI/AMNCH Joint Research and Ethics Committee operates in compliance with and is constituted in accordance with the European Communities (Clinical Trials on Medicinal Products for Human Use) Regulations 2004 & ICH-GCP guidelines.