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Clinical Outcomes Associated with Speech, Language and Swallowing Difficulties Post-Stroke – A Prospective Cohort Study

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Abstract

Background: Due to a lack of prospective research in South Africa's Speech-Language Therapy (SLT) private healthcare sector, this prospective cohort study investigated associations between speech, language, and swallowing conditions (i.e. dysarthria, apraxia of speech, aphasia, dysphagia), risk factors, and outcomes post-stroke (i.e. length of hospital stay, degree of physical disability according to the Modified Rankin Scale [mRS], functional level of oral intake according to the Functional Oral Intake Scale [FOIS], dehydration, weight loss, aspiration pneumonia, mortality). ***Methods:*** Adults with a new incident of stroke without pre-existing speech, language or swallowing difficulties (N=68) were recruited. Convenience sampling was used to select participants. A prospective design was used to determine the incidence of speech, language, and swallowing conditions post-stroke and association with outcomes from admission to discharge. ***Results:*** Co-occurring speech, language, and swallowing conditions frequently occurred post-stroke (88%). Participants who were referred to SLT greater than 24 hours post-admission (52.94%) stayed in hospital for a median of three days longer than those who were referred within 24 hours (p=.042). Dysphagia was significantly associated with moderate to severe physical disability. Dysphagia with aspiration was significantly associated with poor functional level of oral intake (i.e. altered consistency diets and enteral nutrition), at admission and at discharge (p<.01). Dysphagia had a higher likelihood of mortality (OR=2.86) (p=.319). At discharge, aspiration pneumonia was significantly associated with severe physical disability (p<.01, *r*=0.70). Risk factors; poor oral hygiene (p=1.00), low level of consciousness (p=1.00), dependent for oral intake (p=.040), and enteral nutrition (p=.257); were not associated with aspiration pneumonia. ***Conclusion:*** In South Africa's private sector, co-occurring speech, language, and swallowing conditions commonly occurred post-stroke, and dysphagia was strongly associated with physical disability and poor functional level of oral intake. Length of hospital stay was increased by delayed SLT referrals.

Keywords: stroke, acute care, prospective cohort, South Africa, private sector, speech therapy, dysphagia, outcomes.

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Glossary

Acute care – A level of healthcare where individuals are treated for various medical conditions (e.g. emergency care, severe illnesses, surgical procedures, specialised care) for a short-term period (Hirshon et al., 2013).

Aphasia – An acquired language disorder as a result of a brain lesion, presented receptively or expressively, in one or more modalities (i.e., verbal, written and gestural), across all language domains (i.e., semantics, morphology, syntax) (Sinanović, Mrkonjić, Zukić, Vidović & Imamović, 2011).

Apraxia of speech – A motor speech disorder that is caused by a disruption in translation of linguistic-phonemic representations into motor plans that guide speech articulators how to move, coordinate and integrate action. It is clinically presented by an impairment in articulation and prosody (Haley, Cunningham, Eaton & Jacks, 2018).

Aspiration – Food, liquid, oral or gastric secretions that enter the airway below the level of the true vocal folds, as a result of dysphagia, or ineffective cough (Cohen et al., 2016).

Aspiration pneumonia – An infection caused by a large volume of oropharyngeal or gastric bacteria within the lungs as a result of aspiration (Mandell & Niederman, 2019).

Silent aspiration – Aspiration that is not clinically presented by outward signs of difficulty swallowing, and is often related to sensory loss or desensitization (Cohen et al., 2016).

Bolus – A small mass of food or liquid that is chewed or manipulated in the oral cavity, lubricated with saliva, and formed into a soft cohesive mass for the process of swallowing and digestion (Omari, Dejaeger, Tack, Van Beckevoort, & Rommel, 2013).

Central Nervous System (CNS) – A neurological system comprised of the brain and spinal cord, that controls and coordinates functioning and activity of the body (Ransohoff & Engelhardt, 2012).

Coronavirus Disease (COVID-19) – An infectious disease caused by a newly discovered coronavirus which results in mild to severe respiratory illness (WHO, 2020).

Dysarthria – A motor speech disorder that is characterised by slow, weak, imprecise and uncoordinated movements of speech musculature, resulting in impairment of respiration, phonation, articulation, resonance and prosody (Park, Theodoros, Finch & Cardell, 2016).

Dysphagia – Difficulty with eating and swallowing food and liquids, including behavioural, sensory and preliminary motor acts in preparation for the swallow (Smithard, 2016).

Endovascular thrombectomy – A surgical procedure that is performed to remove clots or blockage from arteries or veins, which restores blood flow (Campbell, Donnan, Mitchell & Davis, 2016).

Enteral nutrition – Feeding tubes which are inserted into the stomach or jejunum for short-term or long-term nutrition and hydration (Baiu & Spain, 2019).

Fibreoptic Endoscopic Evaluation of Swallowing (FEES) – A procedure that involves insertion of a thin flexible tube through the nose into the pharyngeal cavity to assess the safety of swallow, particularly the pharyngeal phase of swallowing (Nacci, Ursino, LaVela, Matteucci, Mallardi & Futtori, 2008).

Frazier Free Water Protocol (FFWP) – Individuals with dysphagia who are aspirating on thin liquids are allowed to swallow small volumes of water orally in between mealtimes, and after oral care (Gillman, Winkler & Taylor, 2017).

Intravenous thrombolysis – A medication used for restoration of an occluded artery, which if received early (within 0-6 hours post-stroke symptoms), can renew blood supply and reduce the amount of neurological damage post-stroke (Barreto, 2011).

Oral care - Maintaining oral hygiene by means of brushing and rinsing teeth, tongue, palate, gums and dentures (Murray & Scholten, 2018).

Nasogastric Tube (NGT) – A feeding tube that is inserted through the nose to the oropharynx, oesophagus, and stomach (Joundi et al., 2018).

Nil Per Os (NPO) – An individual does not receive any food or liquid orally (Dudaryk, Epstein, & Varon, 2018).

Non-Communicable disease – A medical condition or disease that is not transmissible or infectious amongst people (Kim & Oh, 2013).

Percutaneous Endoscopic Gastrostomy (PEG) – A feeding tube that is directly inserted into the stomach (Farrag, Shastri, Beilenhoff, Aksan, & Stein, 2019).

Postures - Head and neck movements to assist with dysphagia symptoms (e.g., chin tuck, head rotation, head tilt) (Johnson, Herring & Daniels 2014).

Puree diet – Food consistency that is smooth or blended with no lumps or solid pieces of food (IDDSI, 2019).

Regular diet – Any consistency of food or liquid with no texture modifications (IDDSI, 2019).

Sensory stimulation - Sensory stimuli which are used to improve oral sensory awareness (e.g., cold bolus, VitalStim) (Johnson et al., 2014).

Soft diet – Food that is softly cooked and easily mashed with the back of fork (IDDSI, 2019).

Stroke – A neurological incident that occurs as a result of acute focal injury of the CNS due to vascular etiology (e.g. cerebral infarction, intracerebral haemorrhage) (Barachinni et al., 2020).

Videofluroscopy – An x-ray examination where oropharyngeal swallowing anatomy and physiology are observed and evaluated as the individual eats or drinks a radiopaque substance such as barium sulphate mixed with food or liquid (RCSLT, 2013).

VitalStim – A type of Neuromuscular Electrical Stimulation (NMES) that comprises of electrical stimulation to head and neck muscles in combination with swallow exercises (Li et al., 2018).

Chapter 1: Introduction

Stroke is a prevalent non-communicable disease worldwide, and a leading cause of morbidity and mortality (Global Burden of Disease [GBD], 2019; Kaftan & Luft, 2018; Lindsay et al., 2019). In Low- and Middle-Income Countries (LMIC), such as South Africa, stroke morbidity and mortality rates has increased (Institute for Health Metrics and Evaluation [IHME], 2017; Mayosi et al., 2009; Qian & Chopp, 2020). A high prevalence of stroke incidence within South Africa places demand on the healthcare system (Maphumulo & Bhengu, 2019), especially acute care hospitals (Herpich & Rincon, 2020). In South Africa, stroke is managed medically in public and private healthcare (Maphumulo & Bhengu, 2019). These two healthcare systems differ in accessibility, resources, service delivery, and outcomes (De Villiers, 2021; Young, 2016).

Stroke can cause disability, including physical impairment and speech, language, and swallowing difficulties (Flowers et al., 2017; Langhorne, Bernhardt & Kwakkel, 2011; Perin et al., 2020), which should be managed immediately post-admission by a multi-disciplinary rehabilitation team (e.g. Speech-Language Therapist [SLT] and Physiotherapist), within the acute setting (Pierpoint & Pillay, 2020; Viljoen, Dalmeyer & De Villiers, 2014; Xirasagar et al., 2019).

Speech, language and swallowing conditions (i.e. dysarthria, apraxia of speech, aphasia, dysphagia) commonly occur post-stroke (De Cock et al., 2020; Flowers et al., 2017); and are associated with consequences such as decreased physical independence, poor functional level of oral intake, dehydration, weight loss, mortality, and aspiration pneumonia (Balie et al., 2019; Crary et al., 2013; Feng et al., 2019; McCurtin, Healy, Kelly, Murphy, Ryan, & Walsh, 2018; Schwarz, Coccetti, Murdoch & Cardell; Souza et al., 2020).

Dysphagia with aspiration is necessary but not sufficient to result in aspiration pneumonia (Martino et al. 2005). Aspiration pneumonia post-stroke is more likely to occur if certain risk factors are present (i.e. poor oral hygiene, low level of consciousness (LOC), dependent for oral intake, enteral nutrition) (Aoki et al., 2016; Kenzaka et al., 2017; Lyons et al., 2018;

Langmore et al., 1998; Mandell & Niederman, 2019; Martino et al., 2005; Schwarz, Coccetti, Murdoch & Cardell, 2018).

The timeliness of SLT services in acute care can impact length of hospital stay (LOS) (Viljoen et al., 2014). Delayed SLT referrals (i.e. >24 hours) and speech, language, and swallow screening post-stroke are associated with delayed SLT intervention (Balie et al., 2019; Viljoen et al., 2014), and consequences (i.e. aspiration pneumonia) (Bray et al., 2017; Han et al., 2018); which is associated with an increased LOS (Bernhardt, Godecke, Johnson & Langhorne, 2017; Viljoen et al., 2014).

Early SLT assessment and intervention can assist with management of speech, language and swallowing conditions and prevention of adverse outcomes (e.g., aspiration pneumonia) (Bernhardt et al., 2017). A high frequency of communication and swallowing intervention over short-term periods in acute care can assist with quicker recovery of speech, language, and swallowing functioning (Bryer et al., 2011; Harvey, Carragher, Dickey, Pierce & Rose, 2021; Martino, Martin & Black, 2012). Additionally, the nature of intervention used to treat dysphagia, aphasia, apraxia of speech, and dysarthria can improve neuroplasticity for speech, language, and swallowing functioning, which is associated with favourable outcomes, such as reduced risk of aspiration pneumonia, (Bath, Lee & Everton, 2019; Hilari, Efstratiadou, Holland & Papathanisiou, 2016).

Research on speech, language, and swallowing conditions post-stroke in the acute setting is largely based on international research, and South Africa's public sector (Balie et al., 2019; Bryer et al., 2011; Cawood & Visagie, 2016; De Villiers et al., 2011; Seedat & Penn, 2016; Viljoen et al., 2014). There is limited information and a lack of prospective cohort studies on speech, language, and swallowing conditions post-stroke in South Africa's private sector, which makes it difficult to make comparisons on stroke outcomes between the two sectors. There is a need to conduct research in the private sector to understand the quality of SLT services provided to manage speech, language, and swallowing conditions, and association with risk factors and outcomes post-stroke.

The present prospective cohort study will contribute to South African data on stroke in the private sector. Research can determine whether SLT stroke services in private healthcare need to be improved such as by developing efficient referral and screening protocols in the acute setting, which can increase favourable stroke outcomes (Chimatiro & Rhoda, 2019; Mashaphu & Chiliza, 2016; Pierpoint & Pillay, 2020).

The research questions of this prospective cohort study are: Which speech, language, and swallowing conditions (i.e. dysarthria, apraxia of speech, aphasia, dysphagia) are associated with outcomes (i.e. increased LOS, degree of disability according to the Modified Rankin Scale (mRS), functional level of oral intake according to the Functional Oral Intake Scale (FOIS)], dehydration, weight loss, mortality) in the private sector? And which risk factors (i.e., poor oral hygiene, dependent for oral intake, low LOC and enteral nutrition) are associated with aspiration pneumonia post-stroke?

In Chapter 1, the context of the study has been introduced and the research questions have been identified. In Chapter 2, the literature on speech, language, and swallowing conditions post-stroke and association with consequences, risk factors, nature of SLT services, and outcomes will be reviewed. In Chapter 3, the aims and objectives and methodology will be presented. In Chapter 4, the results of the study will be described. In Chapter 5, the implications of the study's results will be discussed.

Chapter 2: Literature Review

Stroke

Stroke is a prevalent non-communicable disease worldwide, and a significant cause of morbidity and mortality (GBD, 2019; Katan & Luft, 2018; Lindsay et al., 2019). In South Africa, stroke was the third leading cause of death (5.71% of total deaths) in 2019 (IHME, 2019). Stroke burden in terms of Disability Adjusted Life Years (DALYs) are reportedly increasing world-wide (Roth et al., 2020). In High-Income Countries (HIC), there has been a substantial decrease in stroke burden over the past 30 years due to improvements in prevention, acute management, and neurorehabilitation (Feigin et al., 2017; Katan & Luft, 2018). In comparison, stroke burden has increased in LMIC, such as South Africa, due to association with ageing and increased prevalence of treatable stroke risk factors (Feigin et al., 2017; Johnson, Onuma, Owolabi & Sachdev, 2016; Kaftan & Luft, 2018; Qian & Chopp, 2020). In 2019, stroke was the third leading cause of death in South Africa (IHME, 2019). The quadruple burden of disease in South Africa has increased stroke incidence, morbidity, and mortality rates. Untreated diseases such as the Human Immunodeficiency Virus (HIV), which has a high prevalence in South Africa, can cause strokes through opportunistic infections that can exacerbate the risk of disability and death (Bryer et al., 2011; IHME, 2019; Kaftan & Luft, 2018; Mayosi et al., 2009). Stroke is a prevalent non-communicable disease world-wide and a leading cause of morbidity and mortality in South Africa.

Stroke Management in South Africa

In South Africa, stroke is managed medically in public and private healthcare (Maphumulo & Bhengu, 2019). Individuals who have had a stroke can access healthcare at primary, secondary or tertiary level hospitals, where acute care is provided by a rehabilitation team, including Speech-Language Therapists (SLTs) (Boulanger et al., 2018; Herpich & Rincon, 2020; Mandizvidza, London, Bryer, 2021; Pierpoint & Pillay, 2020). South Africa's healthcare system has been compromised by colonialism, apartheid, corruption, and racial and socioeconomic disparities; which has led to differences in funding, expenditure, resources, and service delivery between public and private sectors (De Villiers, 2021; Young, 2016).

Public healthcare is provided by the Department of Health, using national healthcare protocols; whereas the private sector is provided by means of “for profit” hospital corporations and self-employed healthcare practitioners (Maseko & Harris, 2018; Young, 2016). Public hospitals serve the majority (84%) of South Africa’s population (Department of Health, 2011; Maseko & Harris, 2018); whereas private hospitals serve the minority (16%) of the population who can afford medical aid insurance, which is expensive (Erasmus & Kean, 2018; Pillay, Tiwari, Kathard & Chikte, 2020; Young, 2016).

In the public sector, individuals who have had a stroke may experience challenges in accessing healthcare such as long waiting times due to a high patient demand, which has an impact on pre-admission stroke management (e.g. Intravenous Thrombolysis [IVT] or Endovascular Thrombectomy) (Barreto, 2011; Campbell et al., 2016; Department of Health, 2011; Manyisa & Van Aswegen, 2017). There is a shortage of human resources in public healthcare (Maphumlo & Bhengu, 2019). In January 2018, there were 10.6% of SLTs who practiced in the Western Cape public sector compared to the majority of SLTs (89.4%) who practiced in the private sector; which may have been due to a lack of SLT posts in public healthcare (Pierpoint & Pillay, 2020). Less SLTs in the public sector servicing a large population may suggest challenges with timeliness and frequency of speech therapy services. Due to lack of funding, secondary and tertiary public hospitals can experience a lack of resources and inadequate technology services (e.g. Videoflouroscopy [VFSS]; Fibreoptic Endoscopic Evaluation of Swallowing [FEES]) (Owolabi et al., 2018). Delays in accessing stroke services and resources can lead to unfavourable outcomes in the public sector, such as preventable complications (e.g. aspiration pneumonia), high risk for mortality, and increased LOS (Balie, Botha, Hendricks, Kirstein & Malathela, 2019; De Villiers, Badri, Ferreira & Bryer, 2011; Ranchod et al., 2017; Taylor & Ntusi, 2019).

South African private healthcare is considered high-quality, as it was ranked 6th overall in developed and developing nations, which is on par with developed countries such as Switzerland and Sweden (Burger & Christian, 2020). In the private sector, the patient demand is lower, and there is a large availability of well-functioning technology and human

resources (Young, 2016; Ruiters & Van Niekerk, 2014; Pierpoint & Pillay, 2020). A high availability of resources and speech therapy services in the Western Cape Private sector may suggest efficient service delivery, high-quality care, and favourable stroke outcomes (Pierpoint & Pillay, 2020). The high standard of South African private healthcare suggests that SLT stroke services would also be ranked higher than in the public sector, but there is limited published information based on the following combination of search terms: *"South Africa", "speech therapy services", "stroke", "private healthcare", "quality of care",* using databases; Cochrane library (0), Primo (1), Pubmed (0), Google Scholar (1). The lack of research on SLT services in private healthcare makes it difficult to make comparisons and conclusions on stroke outcomes between the two sectors.

South Africa's Healthcare System and the National Health Insurance Scheme

It is necessary to research and understand the quality of SLT stroke services (i.e. referral, screening, intervention) and associated outcomes in South Africa's private healthcare sector in comparison to the public sector, in order to implement the National Health Insurance (NHI) proposal scheme (De Villiers, 2021, Dye et al., 2013). The NHI is an attempt to manage health inequity and achieve universal quality health coverage for all South Africa citizens by transforming the relationship between public and private healthcare sectors (Matthew & Mash, 2019; NHI, 2019; Van Niekerk et al., 2020; Passchier, 2017; Pillay, Tiwani, Kathard & Chikte, 2020). Bridging the two healthcare sectors entails research, developing guidelines for best South African SLT practice, and implementing standardised assessment and intervention protocols, which will facilitate equitable and quality SLT services for individuals with stroke (Burger & Christian, 2020).

Stroke Research in South Africa's Private Healthcare Sector

The majority of research on speech, language and swallowing conditions post-stroke are based on international research and South Africa's public sector (Balie et al., 2019; Bryer et al., 2011; Cawood & Visagie, 2016; De Villiers, Badri, Ferreira, & Bryer, 2011; Seedat & Penn, 2016; Viljoen, Dalmeyer & De Villiers, 2014). Limited research has been conducted in the private sector due to: Time constraints, lack of affiliation to an academic institution where

research is often conducted, and limited access to supervision and mentoring from senior healthcare workers involved in academia (Mashaphu & Chiliza, 2016). Despite a small patient population in South African private hospitals, there is an increasing need for clinicians to participate in research particularly in prospective cohort studies, to develop efficient protocols, strengthen clinical practice, improve quality of care, and provide a comprehensive understanding of the health sector (Chimatiro & Rhoda, 2019; Mashaphu & Chiliza, 2016). There is limited prospective cohort studies on speech, language and swallowing conditions post-stroke in South Africa's private sector, based on the following combination of search terms: *"prospective study", "speech", "language", "swallowing", "deglutition", "stroke", "South Africa", "private health care",* using databases: Cochrane library (0), Primo (0), Pubmed (0), and Google Scholar (2). South African acute care private hospitals have been working toward developing and improving existing stroke units, using multi-disciplinary teams and implementing evidence-based research (Chimatiro & Rhoda, 2019). Managing stroke disability and subsequent consequences effectively at South African private hospitals is dependent on new, valid, and reliable stroke data and research, which can be achieved through a prospective cohort study (De Rango, 2016; Sedgwick, 2013a). The availability of human and material resources in the private sector can facilitate early implementation of evidence-based research into stroke units and protocols (Bryer et al., 2011; Mashaphu & Chiliza, 2016; Pillay, Tiwari, Kathard & Chikte, 2020). Researching and understanding the associations between speech, language and swallowing conditions post-stroke, consequences, risk factors, nature of services, and outcomes in the private sector is necessary to facilitate improved stroke management at acute care hospitals.

Stroke Disability

Stroke can result in long-term disability (i.e. impairment, activity limitations and participation restrictions), which can negatively impact an individual's life and increase the risk of dependency (Perin et al., 2020; WHO, 2001). The type of stroke (e.g. ischaemic, haemorrhagic, transient ischaemic attack [TIA], classification [as per the Oxfordshire Community Stroke Project (OCSP)], site of lesions [e.g. right or left hemisphere, middle

cerebral artery, basal ganglia, brainstem], and severity of stroke according to the National Institute of Health Stroke Scale [NIHSS]) are associated with different types of impairments (i.e. physical, cognitive, speech, language, and swallowing difficulties) (Flowers et al., 2017; Irvine et al., 2016; Perin et al., 2020; Navorro-Orozco & Sanchez-Manso, 2020; Yang et al., 2016). Stroke impairment can have a long-term negative impact on function, activity, and participation; which can lead to depression, difficulty re-integrating back into social life, and reduce one's quality and enjoyment of life (Blomgren et al., 2019; McHutchison et al., 2019).

Incidence of Speech, Language, and Swallowing Conditions Post-Stroke

Speech, language, and swallowing conditions (i.e. dysarthria, apraxia of speech, aphasia, dysphagia) commonly occurs post-stroke (Balie et al., 2019; De Cock et al., 2020; Flowers et al., 2017; Stipancic, Borders, Brates & Thibeault, 2019). A South African retrospective study in the public sector found individuals post-stroke, who were referred to an SLT, and who presented with speech, language, and swallowing conditions had an incidence of 395.7 (per 1000) (Balie et al., 2019). In isolation, dysarthria had the highest incidence post-stroke (91.4), followed by dysphagia (25.5), aphasia (23.4), and apraxia of speech (10.6) (Balie et al., 2019). In comparison, an international prospective study (Stipancic, Borders, Brates & Thibeault, 2019), and a retrospective study (Flowers, Silver, Fang, Rochon & Martino, 2013) found dysphagia had the highest incidence post-stroke respectively (23.41; 38.51), followed by dysarthria (17.35; 35.48) and aphasia (9.23; 25.37).

Co-occurring speech, language, and swallowing conditions frequently occur post-stroke and is associated with adverse outcomes, such as an increased LOS (Balie et al., 2019; Flowers et al., 2013; Stipancic et al., 2019). Balie et al. (2019) found co-occurring speech and swallowing conditions (i.e. dysphagia and dysarthria) had the highest incidence (91.5 per 1000) post-stroke. Similarly, co-occurring dysphagia and dysarthria had the highest incidence in a retrospective (23.34) (Flowers et al. 2013) and prospective study (11.27) (Stipancic et al. 2019). There is a lack of data from recent prospective cohort studies on the incidence of speech, language, and swallowing conditions post-stroke (De Cock et al., 2020), especially in South Africa's private sector. The incidence of speech, language, and

swallowing conditions post-stroke in different populations (e.g. public versus private sectors) are important to determine in order to understand how frequently each condition occurs, associated predictor factors (e.g. stroke severity), and associations with consequences post-stroke (Flowers et al., 2017; Thrift et al., 2017).

Consequences associated with Speech, Language, and Swallowing Conditions post-Stroke

Speech, language, and swallowing conditions are associated with different consequences post-stroke in the acute setting (Arnold et al., 2016; Balie et al., 2019; Cohen et al., 2016; Crary et al., 2013; Feng et al., 2019; Schwarz, Coccetti, Murdoch & Cardell, 2018; Viljoen et al., 2014). Stroke can result in poor physical and functional ability, which has an impact on activity and participation in daily events, such as eating independently, and can increase the risk of further complications such as dehydration (Aoki, Iguchi, & Watabe, 2020; Waza et al., 2019). In South Africa's public sector, the majority of individuals with stroke who presented with speech, language and swallowing difficulties had moderate, moderately severe or severe physical disability at discharge (61%), according to the Modified Rankin Scale (mRS) (Balie et al., 2019). An association between aphasia and moderate physical disability was reported in previous studies (Ali, Lyden & Brady, 2013; Kim, Min, Lee & Kang, 2016; Wang et al., 2018). Two international prospective studies found an association between individuals with post-stroke dysphagia who received enteral nutrition (Functional Oral Intake Scale [FOIS] 1-3), and moderate to severe physical disability (mRS>3-6) (Al-Khaled et al., 2016; Souza et al., 2020). Additional prospective studies have found an association between moderate to severe physical disability and aspiration pneumonia post-stroke (Brueining & Al-Khaled, 2015; Schwarz et al., 2018). The association between degree of disability and speech, language, and swallowing conditions post-stroke is important to understand to guide SLT management and reduce complications, such as nursing training on how to feed individuals to reduce aspiration and dehydration risk (Brueining & Al-Khaled, 2015), and facilitating suitable communication methods (e.g. Augmentative and Alternative

Communication [AAC]), for individuals who have limited speech and physical abilities (Ameer & Ali, 2017).

Dysphagia post-stroke is associated with poor functional level of oral intake, dehydration, malnutrition, and weight loss (Arnold et al., 2016; Crary et al., 2013; Jeong, Leem, Moon & Kim, 2018; Schwarz et al., 2018; Wu, Miles & Braakhuis, 2021). Individuals who have dysphagia post-stroke can have oral phase difficulties such as difficulty with chewing (Schimmel, Ono, Lam & Müller, 2017), reduced buccal and labial tone (Umay et al., 2019), bolus propulsion (Vilardell et al., 2017); and pharyngeal phase difficulties such as premature spillage and oral residue (Hägglund, Hägg, Levring Jäghagen, Larsson & Wester, 2020), which can lead to aspiration (Smithard, 2016). Oral and pharyngeal phase difficulties post-stroke influence a patient's functional level of oral intake (i.e oral versus non-oral) as per FOIS (Crary, Mann & Groher, 2005), and are associated with altered food and liquid consistencies as per the International Dysphagia Diet Standardisation Initiative (IDDSI) (O'Keefe, 2018; IDDSI, 2019; Sungsinchai, Niamnuy, Wattanapan, Charoenchaitrakool, & Devahastin, 2019). Altering the consistency of food and liquids facilitates safe swallowing, but can increase the risk of reduced palatability and non-compliance, which is associated with dehydration, malnutrition, and weight loss (Baijens et al., 2017; Crary et al., 2013; Feng et al., 2019; McCurtin et al., 2018). Thickened liquids are an example of an altered consistency, and is recommended for individuals who are aspirating on thin liquids; however, there is significant patient dissatisfaction, and the risk of developing aspiration pneumonia is higher compared to aspiration of thin liquids (McCurtin et al., 2018; Steele, Ennis & Dobler, 2021). Further research on associations between dysphagia post-stroke and functional level of oral intake, dehydration, malnutrition, and weight loss are necessary to understand how to manage dysphagia without impacting an individual's nutritional intake and quality of life (Crary et al., 2013; Jeong et al., 2018).

Dysphagia-related complications such as malnutrition, weight loss (Gomes, Emery, & Weekes, 2016), dehydration (Bahouth, Gottesman, & Szanton, 2018), and aspiration pneumonia (Schwarz et al., 2018) post-stroke have been associated with an increased risk

for mortality (Arnold et al., 2016; De Villiers et al., 2011; Feng et al., 2019), for up to one-year post-stroke (Teh et al., 2018). Aphasia post-stroke has also been associated with increased risk for mortality (Lazar & Boheme, 2017; Lima et al., 2020). A retrospective study found individuals with aphasia post-stroke had higher mortality rates than those without aphasia (24.1% versus 10.7%, p=.004), which was associated with severe stroke severity (Lima et al., 2020). It is necessary to determine which speech, language and swallowing condition or combination of conditions post-stroke are associated with a higher risk for mortality, and how to manage these conditions efficiently in the acute setting, to reduce the risk of mortality (Bray et al., 2017; Feng et al., 2019).

Dysphagia post-stroke can lead to aspiration and silent aspiration (Aoki et al., 2016; Arnold et al., 2016; Cohen et al., 2016; Whitehead & Baalbergen, 2019). In South Africa's public sector, the incidence of aspiration in the stroke population (N=470) was 79 per 1000, and the incidence of aspiration in those with dysphagia (n=92) was 402 per 1000 (Balie et al., 2019). Aspiration is life-threatening, as any food, liquid, or oral secretions that cannot be cleared can obstruct the airway (Mandell & Niederman, 2019). Dysphagia with aspiration is a high-risk factor for aspiration pneumonia (Aoki et al., 2016; Feng et al., 2019; Mandell & Niederman, 2019); however, not everyone who aspirates develops aspiration pneumonia (Brogan, Langdon, Brookes, Budgeon & Blacker, 2014; Langmore et al., 1998; Langmore, Skarupski, Park & Fries, 2002; Mandell & Niederman, 2019; Martino et al., 2005). There are additional risk factors besides aspiration that influences the development of aspiration pneumonia (Martino et al., 2005). The incidence of aspiration pneumonia can provide information on how frequently this complication occurs post-stroke, and can assist in identifying the associated risk factors (Aoki et al., 2016; Mandell & Niederman, 2019; Schwarz et al., 2018).

Risk Factors

There are several risk factors for each consequence associated with speech, language, and swallowing conditions post-stroke. Physical and functional disability are increased by severe stroke severity (according to the NIHSS >14-42) (De Villiers et al., 2011; Lv, Sun, Li,

Zhang, He, & Zhou, 2021); older age (>65 years), cognitive impairment, aphasia (Lazar & Boehme, 2017), depression (Lv et al., 2021), and dehydration (Cortés-Vicente, et al., 2020). Risk factors for dehydration post-stroke includes older age (>65 years) and females (Cortés-Vicente, et al., 2020). Malnutrition is increased by poor caregiver or nursing care, diabetes mellitus, hypertension, low LOC, poor mobility, and poor oral hygiene (Sabbouh & Torbey, 2018). Risk factors for weight loss include older age (>70 years), eating and swallowing difficulties, low prealbumin value, physical dependence, and haemorrhagic stroke (Jönsson, Lindgren, Norrving, & Lindgren, 2008). Mortality post-stroke is increased by older age (>65 years), males, increased stroke severity, diabetes mellitus, haemorrhagic stroke (Mogensen, Olsen, Andersen, & Gerds, 2013), low LOC (Li et al., 2016), and Total Anterior Circulation Infarct (TACI) classification as per OCSP criteria (Lauretani et al., 2010). Risk factors for aspiration pneumonia post-stroke include (Table 1): Co-occurring dysphagia, aphasia, dysarthria (Anderson et al., 2015; Balie et al., 2019; Sellars et al., 2007); poor mobility and compromised immune system (Teramoto, 2009); increased stroke severity (Aoki et al., 2016; Finlayson et al., 2011; Hannawi, Hannawi, Rao & Suarez, 2013); severe physical disability (mRS>4) (Al-Khaled et al., 2016; Dziewas et al., 2004; Hannawi et al., 2013; Hibberd, Fraser, Chapman, McQueen & Wilson et al., 2013; Langmore et al., 1998; Sellars et al., 2007); poor oral hygiene (Lyons et al., 2018; Murray & Scholten, 2018); dependent for oral intake (Huang et al., 2006; Langmore et al., 1998); low LOC (Anderson et al., 2015; Brogan et al., 2014); and enteral nutrition (Arnold et al., 2016; Brogan et al., 2014; Dziewas et al., 2004; Langdon, Lee & Birns, 2009; Schwarz et al., 2018).

Table 1: ***Risk Factors for Aspiration Pneumonia Post-Stroke***

Researchers & Year	Research Design	Sample Size & Participant Information	Risk factors
Aoki et al., 2016	Prospective cohort, single-centre study	*N*=305 Acute stroke; acute care hospital	Severe [a]NIHSS score and lack of multidisciplinary stroke team management (SLT, Dietician,

			Physiotherapist, Occupational Therapist)
Anderson et al., 2015	Retrospective medical record review	*N*=2020 Acute stroke; acute community hospital	Severe neurological communication and cognitive fallout, age >65 years, low LOC, aphasia, apraxia of speech, dysarthria
Arnold et al., 2016	Prospective cohort study	*N*=570 Acute stroke; tertiary stroke centre	Enteral nutrition
Brogan et al., 2014	Retrospective medical record review	*N*=536 Acute stroke; six acute care tertiary hospitals	Ischaemic stroke, low Glasgow Coma Scale score, nil per mouth/Nasogastric Tube (NGT) feeding, poor mobility
Dziewas et al., 2004	Prospective cohort study	*N*=100 Acute stroke; stroke unit	Low LOC, NGT feeding, poor functional outcome as described by mRS>4, facial palsy
Finlayson et al., 2011	Multicentre retrospective cohort study	*N*=8251 participants with ischaemic stroke; regional stroke centres	Stroke severity, non-lacunar ischaemic stroke, older age, males, Chronic Obstructive Pulmonary Disease (COPD), coronary artery disease, preadmission dependency
Feng et al., 2019	Prospective cohort study	*N*=1220 Acute stroke; acute care	Cerebral haemorrhagic stroke
Hannawi et al., 2013	Scoping review	*N*=54 papers. Intensive care units	Stroke severity, left anterior cerebral artery stroke, brainstem infarction, poor physical ability (mRS>4), co-occurring infections
Huang, Zhang, Yao, Xia, & Fan, 2006	Prospective cohort study	N=96 Participants with post-stroke dysphagia; tertiary hospital	Dependent for oral intake
Langdon, Lee and Birns, 2009	Prospective cohort study	N=330 ischaemic stroke; three large tertiary hospitals	Enteral nutrition

Lyons et al., 2018	Narrative review	Acute stroke; acute care hospitals, rehabilitation, and nursing home settings	Poor oral hygiene
Murray & Scholten, 2018	Prospective cohort study	N=100; inpatient rehabilitation facilities	Poor oral hygiene
Schwarz et al. 2018	Retrospective cohort study	N=110; ischaemic stroke; secondary hospital	NGT feeding
Sellars et al., 2007	Prospective cohort study	N=412 Acute stroke; acute care tertiary hospital	Cognitive impairment, age >65 years, severe physical disability (mRS>4), dysarthria, aphasia, abnormal water swallow test

Note. [a]NIHSS: National Institutes of Health Stroke scale

The most pertinent risk factors for aspiration pneumonia post-stroke that will be investigated in the present study are: Poor oral hygiene, dependent for oral intake, low LOC, and enteral nutrition.

Poor Oral Hygiene

Poor oral hygiene is associated with an increased risk for aspiration pneumonia post-stroke (Mandell & Niederman, 2019; Lyons et al., 2018; Murray & Scholten, 2018; Seedat & Penn, 2016). Stroke can result in changes and complications within the oral cavity such as oral discomfort, pain, and oral infections (Schimmel, Ono, Lam & Müller, 2017), dehydration and xerostomia due to: Daily oxygen therapy, mouth-breathing, medication side-effects, and reduced food and liquid intake caused by dysphagia which promotes oral bacteria (Bahouth, Hills & Gottesman, 2015). Individuals post-stroke may experience physical and cognitive impairment, which can lead to being dependent on nursing staff for functional activities such as oral care, and can increase the risk of inefficient or neglected oral hygiene (Kwok, McIntyre, Janzen, Mays & Teasell, 2015; Murray & Scholten, 2018). Individuals who have

post-stroke dysphagia who receive enteral nutrition are also at risk of poor oral hygiene due to bacterial colonisation from feeding tubes and infrequent oral care, which promotes plaque build-up and periodontal diseases (Langdon, Lee & Birns, 2009; Langmore et al., 2002). In South Africa's public sector, Balie et al., (2019) did not find an association between poor oral hygiene and aspiration pneumonia post-stroke, which may have been due to a small number of participants (n=3; 37.5%). Both Seedat and Penn (2016) and Murray and Scholten (2018) found an oral care protocol comprised of 3 x daily regular oral care (i.e. brushing teeth or dentures) and Frazier Free Water Protocol (FFWP) resulted in absence of aspiration pneumonia. Individuals who received inconsistent oral care developed aspiration pneumonia (Seedat & Penn, 2016). More evidence-based research is required on whether improving oral hygiene reduces aspiration pneumonia post-stroke (Lyons et al., 2018).

Dependent for Oral Intake

Stroke impairs physical functioning leading to hemiplegia which restricts movement of the body and limbs (Li, Francisco & Zhou, 2018; WHO, 2001), and has an impact on the ability to self-feed (Kwok et al., 2015; Pedra, Pontes, Mourão, Braga, & Vicente, 2020). Being dependent for oral feeding has been associated with a high risk for aspiration pneumonia generally (Langmore et al., 2002; Manabe et al., 2015; Mandell & Niederman, 2019; Rhyou & Yang, 2018), and in stroke populations (Huang, Zhang, Yaom Xia & Fan, 2006; Langmore et al., 1998). Factors contributing to the risk of aspiration include untrained caregivers and rushed feeding pace (Huang et al., 2006; Langmore et al., 1998; Langmore et al., 2002; Wright et al., 2008). Huang et al. (2006) investigated the effect of nursing training on feeding individuals with post-stroke dysphagia. Results showed that the incidence of aspiration pneumonia was higher (33.3%) in the group who were fed orally by a family member with limited feeding guidance, compared to a low incidence (6.3%) for the group who were fed by nurses who were trained to use swallowing strategies. Implementing safe feeding strategies (e.g., slow feeding rate, bolus volume modifications, chin tuck, repeat swallows) for individuals with post-stroke dysphagia who are dependent for oral intake can reduce the risk of aspiration and aspiration pneumonia, and improve nutritional intake (Huang et al., 2006;

Pitthayapong, Thiangtam, Powwattana, Leelacharas, & Waters, 2017; Schindler et al., 2008; Wright et al., 2008). There is a lack of recent South African studies on the association between being dependent for oral intake and aspiration pneumonia in the stroke population, indicating the need for further research.

Low Level of Consciousness

Low level of consciousness (LOC) may occur post-stroke due to association with advanced age, pre-existing comorbidities (e.g. atrial fibrillation), increased stroke severity, and massive cerebral infarct (Li et al., 2016). A prospective cohort study found most individuals with stroke had a low LOC (53%) at admission according to the Glasgow Coma Scale (GCS) (Li et al., 2016). Low LOC is a risk factor for aspiration pneumonia post-stroke (Anderson et al., 2015; Brogan et al., 2014; Dziewas et al., 2004; Eltringham et al., 2019; Kenzaka et al., 2017). A multi-centre study found low LOC was one of three indicators to discontinue oral intake for those who have swallowing difficulty due to poor coughing reflex and difficulty coordinating breathing and swallowing, which increases the risk for aspiration and aspiration pneumonia (Kenzaka et al., 2017; Mandell & Niederman, 2019). A prospective study found 44 (79%) individuals' post-stroke who received Nasogastric Tube (NGT) feeding developed aspiration pneumonia, of whom 19 (43%) had a low LOC (Dziewas et al., 2004). Results from these studies indicated that low LOC may increase the risk for aspiration pneumonia for individuals with stroke who are fed via oral and non-oral methods. Information on the association between low LOC and aspiration pneumonia post-stroke is necessary to guide dysphagia management and reduce the risk of aspiration pneumonia (Mandell & Niederman, 2019).

Enteral Nutrition

Enteral nutrition (e.g. NGTs, Percutaneous Endoscopic Gastroscopy [PEG]) is recommended for individuals with severe dysphagia who have a high risk of aspiration, low LOC, malnutrition, or unable to meet their nutritional requirements on an oral diet (Langmore et al., 1998; Viljoen et al., 2014). Studies have found an association between enteral nutrition and aspiration pneumonia post-stroke (Aoyagi et al., 2021; Balie et al., 2019;

Brogan et al., 2014; Dziewas et al., 2004; Langdon, Lee & Birns, 2009; Schwarz et al., 2018). Factors such as incorrect positioning when receiving enteral nutrition (i.e. supine or low fowlers position) and limited mobilisation can contribute to Gastro-Oesophageal Reflux (GOR), which increases the risk of aspiration pneumonia (Langdon, Lee & Birns, 2009; Mandell & Niederman, 2019). A retrospective and prospective study reported that the risk of aspiration pneumonia is greater for individuals who are fed via NGTs and who have severe physical disability or poor functional outcomes (mRS>4) post-stroke (Dziewas et al., 2004; Schwarz et al., 2018). Although enteral nutrition has an important role in maintaining nutrition and hydration for individuals with compromised swallowing and low LOC, tube-feeding may not reduce the risk of aspiration and aspiration pneumonia (Langdon et al., 2009; Schwarz et al., 2018). The relationship between enteral nutrition and aspiration pneumonia post-stroke is equivocal and requires further investigation (Arnold et al., 2016).

Aspiration pneumonia post-stroke often occurs in the acute setting due to inadequate dysphagia intervention and poor multi-disciplinary management (Palli et al., 2017). The four risk factors (i.e. poor oral hygiene, dependent for oral intake, low LOC, enteral nutrition) are an early warning for development of aspiration pneumonia and can be managed by the multi-disciplinary team (e.g. Medical Doctors, nurses, Physiotherapists, and SLTs), in the acute setting (Aoki et al., 2016; Li, Kang, Ren, Lai, & Tai, 2017; Palli et al., 2017; Whitehead & Baalbergen, 2019). Management of these risk factors include routine oral care, discontinuation of oral intake due to low LOC, nursing training on feeding guidelines for those who are dependent for oral feeding, and appropriate positioning when receiving enteral nutrition (Kenzaka et al., 2017; Mandell & Niederman, 2019; Murray & Scholten, 2018; Schindler, Ginocchio & Ruoppolo 2008; Wright, Cotter & Hickson, 2008). The existing research on associations between risk factors and aspiration pneumonia post-stroke is based on international research and South Africa's public sector. The association between poor oral hygiene, dependent for oral intake, low LOC, enteral nutrition and development of aspiration pneumonia were investigated in the present study, as there is limited information on these associations in South Africa's private healthcare sector, based on the following

combination of search terms: "*South Africa", "private hospitals", "risk factors", "aspiration pneumonia post-stroke", "poor oral hygiene", "dependent on being fed orally", "low level of consciousness", "enteral nutrition",* using databases; Cochrane Library (1), Primo (0), Pubmed (0), Google Scholar (0). Research on these four risk factors and aspiration pneumonia will provide an understanding of whether these associations occur in the private sector; how SLTs are currently managing these risk factors; and if there is a need to improve SLT services and intervention to prevent the risk of aspiration pneumonia post-stroke (Palli et al., 2017; Pierpoint & Pillay, 2020).

Nature of Speech, Language and Swallowing Services Post-Stroke

Speech, Language, and Swallowing Referrals and Length of Stay

Individuals with stroke who have speech, language, and swallowing difficulties require early SLT referrals to manage risk factors (e.g., dependent for oral intake) for associated consequences such as aspiration pneumonia (Bray et al., 2017; Smithard, 2016); and reduce LOS in the acute setting (Viljoen et al., 2014). In South Africa's public sector, individuals who had a stroke were referred within or greater than 72 hours post-admission (Balie et al., 2019; Seedat & Penn, 2016; Viljoen et al., 2014); and referrals to SLT were predominantly made by Dietitians, which was assumed to suggest lack of knowledge of SLT role by other healthcare professionals (e.g. Medical Doctors, nurses) (Seedat & Penn, 2016). Information on timeliness of SLT referrals post-stroke in South Africa's private sector is unknown. Late SLT referrals (i.e. >72 hours) are not within the recommended international stroke guidelines (i.e. within 24 hours) (World Stroke Organisation, 2021). Delayed SLT referrals are associated with a delay in speech, language, and swallowing screening and intervention, which are associated with preventable complications (Balie et al., 2019; Bray et al., 2017; Han et al., 2018). Development of preventable complications in the acute setting is associated with poor patient outcomes, including a longer LOS, and increased healthcare costs (Feng et al., 2019; Schwarz et al., 2018; Viljoen et al., 2014). The association between delayed SLT referrals and increased LOS needs to be investigated in the private sector to

determine the timeliness of referrals, and whether there is a need to improve the SLT referral system post-stroke (Viljoen et al., 2014).

Speech, Language, and Swallowing Screening

Speech, language, and swallowing screening post-stroke are necessary for guiding assessment and intervention (Fairfield & Smithard, 2020; Mitchell et al., 2021). Dysphagia screening is often prioritised over aphasia screening, which is likely due to association with high-risk consequences and outcomes such as aspiration pneumonia, dehydration, and mortality (Joundi et al., 2017; Palli et al., 2017). Delayed swallowing screening increases the risk for dysphagia-related consequences, which are associated with feeding individuals orally without formal evaluation by an SLT (Arnold et al., 2016; Cohen et al., 2016). Early swallowing screening post-stroke (i.e. within 24 hours) can improve the timeliness of dysphagia assessment and intervention, reduce the risk of dysphagia-related consequences, and decrease LOS and subsequent hospital costs (Bernhardt, Godecke, Johnson & Langhorne, 2017; Bray et al., 2017; Eltringham et al., 2018; Han et al., 2018; Stroke Foundation, 2019; Viljoen et al., 2014). The timeliness of aphasia, dysarthria, and apraxia of speech screening post-stroke is equally as important as dysphagia screening. Delayed communication intervention can affect speech and language recovery rate post-stroke, which has an impact on social participation, functional outcomes, and quality of life, and is also associated with an increased LOS (Lazar & Boehme, 2017; Mc Menamin, Tierney & Macfarlane, 2015; Mitchell et al., 2021). Information on the efficiency and type of SLT screening measures currently used at South African hospitals can guide development and improvement of standardised post-stroke screening protocols; which is necessary for early speech, language, and swallowing intervention (Palli et al., 2017).

Speech, Language, and Swallowing Assessment

Individuals with stroke who have been screened and who have speech, language, and swallowing difficulties require comprehensive assessment, using valid and reliable standardised tools (e.g. The Western Aphasia Battery [WAB]) (Stroke Foundation, 2019; Valilla-Rohter, Kasparian, Kaminski, Schliep & Koyman, 2018). Speech, language, and

swallowing assessment is necessary to identify and understand specific speech, language, and swallowing difficulties that individuals are experiencing, which will guide SLT intervention goals (Fairfield & Smithard, 2020). There is wide variation in the way individuals' post-stroke are assessed by SLTs. The type of assessment used depends on the patient's functional abilities and medical status (Brodsky, Mayfield & Gross, 2019). In South Africa's public sector, Clinical Swallow Evaluations (CSE) were commonly used to assess dysphagia post-stroke compared to objective assessments (i.e. Videofluroscopy [VFSS], Fibreoptic Endoscopic Evaluation of Swallowing [FEES]) (Balie et al., 2019). Objective measures may not have been used as frequently as individuals' degree of disability or unstable medical status post-stroke can affect transportation and positioning for VFSS (Brodsky et al., 2019). Clinical Swallow Evaluations (CSE) are often used to evaluate swallowing functioning and aspiration risk as they are easy and quick to administer (Immovilli et al., 2021); however, they are not sufficient as VFSS and FEES at accurately identifying swallow function and impairment contributing to aspiration and silent aspiration (Farneti, Turroni & Genovese, 2018; Fattori et al., 2016; Mancopes et al., 2014; Seo, Ku, & Park, 2021; Virvidaki, Nasios, Kosmidou, Giannopoulos, & Milionis, 2018; Warnecke, Dziewas & Langmore, 2021). Cough Reflex Testing (CRT) can also be used to detect silent aspiration (Field, Wenke, Sabet, Lawrie & Cardell, 2018). Outcome measure scales, such as FOIS are useful for evaluating clinical change of functional eating abilities post-stroke from admission to discharge, which is useful for tracking progress (Crary, Mann & Groher, 2005). It is important to know the type of assessment tools that SLTs are using to evaluate speech, language and swallowing abilities post-stroke in acute care, in order to review and develop standardised assessment protocols for best clinical practice (Fairfield & Smithard, 2020; Wang et al., 2019).

Nature of Speech, Language, and Swallowing Intervention

It is necessary to investigate the nature of speech, language, and swallowing intervention post-stroke, to determine the type and efficacy of therapy, and impact on outcomes (Bath, Lee & Everton, 2019). Various speech, language, and swallowing intervention techniques are used to rehabilitate individuals' post-stroke who have aphasia, apraxia of speech,

dysarthria, and dysphagia. Aphasia therapy approaches such as Melodic Intonation Therapy (MIT), Constraint-Induced Therapy (CIT), Action Observation Treatment (AOT), and Semantic Feature Analysis (SFA) are associated with neuroplasticity recovery following stroke (Hilari, Efstratiadou, Holland & Papathanisiou, 2016; Watila & Balarabe, 2015). Apraxia of speech intervention such as the articulatory-kinematic technique and musical approaches, such as MIT, are associated with improved articulation accuracy and less phoneme errors (Mauszycki & Wambaugh, 2011; Slavin & Fabus, 2018; Van Sickle, 2016 Wambaugh, 2021). Dysarthria behavioural techniques which have shown improvement in functional communication include: Rate modification, biofeedback, emphasis on salient syllables, increasing volume, and consonant exaggeration (Mackenzie, Muir, Allen & Jensen, 2014; Park, Theodoros, Finch & Cardell, 2016; Spencer & Brown, 2018). Inspiratory and expiratory Respiratory Muscle Strength (RMS) training has shown positive outcomes with improving respiratory muscle strength post-stroke which is necessary for phonation (Liaw et al., 2020). Augmentative and Alternative Communication (AAC) has benefits for individuals' post-stroke who are non-verbal or have limited speech, and can improve their quality of life (Basilakos, 2018). Speech and language difficulties post-stroke can lead to difficulty participating in social situations and maintaining relationships; therefore, counselling and supported communication for the patient and their families are beneficial (Flowers et al., 2017; Mc Menamin et al., 2015).

Dysphagia intervention, such as compensatory strategies (e.g. positioning, postures) can compensate for swallowing deficits in the interim by reducing dysphagia symptoms and managing a safe swallow, and adequate nutrition and hydration intake (ASHA, 2021; Brogan et al., 2014; Johnson et al., 2014; Solazzo et al., 2012). Swallow manoeuvres, such as Mendelsohn and Supraglottic Swallow, are exercises that can improve the physiology of swallowing, which is beneficial for long-term swallowing recovery and functioning (Inamoto et al., 2018; Smithard, 2016). Previous studies have found that individuals with dysphagia received behavioural modifications and compensatory strategies more frequently than swallowing manoeuvres, which was associated with time constraints in the clinical setting

(Balie et al., 2019; Sura, Madhavan, Carnaby, & Crary, 2012). Bath et al. (2019) systematic review reported that dysphagia intervention was associated with decreased LOS and aspiration pneumonia, but did not have an effect on mortality post-stroke. Information on the nature of speech, language and swallowing intervention in South Africa's private sector is unknown. Research can determine which evidence-based speech, language, and swallowing therapy techniques are being provided by SLTs in the private sector, and how the type of intervention influences stroke outcomes (e.g. reduced incidence of aspiration pneumonia).

Number of Speech, Language, and Swallowing Intervention Sessions

The number of speech, language, and swallowing intervention sessions in acute care settings are dependent on various factors, such as patient's motivation, medical aid insurance, and availability of SLTs (Hersh, 2016; Martins et al., 2013). Co-occurring speech, language, and swallowing conditions can impact the number of intervention sessions, as the complexity of difficulties require a wider range of intervention and higher number of therapy sessions (Harvey et al., 2021). In South Africa's public sector, individuals with stroke received an average of two speech therapy intervention sessions, which was reportedly due to prioritisation of medical and nursing care (Balie et al., 2019). Few speech therapy sessions in the acute setting are not ideal for early speech, language, and swallowing recovery post-stroke (Bernhard et al., 2017). A longer length of early intervention in acute care (e.g., 12 sessions averaging 30 minutes each) is beneficial for stroke recovery and improvement of swallowing ability (Bryer et al., 2011; Martino et al., 2012). A higher frequency of speech therapy intervention in a short-term period is also associated with positive stroke outcomes, such as quicker speech and language recovery (Harvey, Carragher, Dickey, Pierce, & Rose, 2021). A secondary analysis from two randomised single-blind controlled trials found individuals' post-stroke speech and language progress improved by 6.3% for every 10-minute increase in aphasia therapy per day in acute care settings (Godecke, Rai, Ciccone, Armstrong, Granger, & Hankey, (2013).

Research has shown that dysphagia intervention is often prioritised over speech and language intervention, which is due to the high-risk complications associated with dysphagia in the acute setting (Crary et al., 2013; Feng et al., 2019; Hersh, 2016; Mandell & Niederman, 2019; Mitchell et al., 2021; Schwarz et al., 2018; Viljoen et al., 2014). In the public sector, individuals' post-stroke received significantly more dysphagia intervention sessions (mean: 3.41), compared to those with aphasia (mean: 1.68), apraxia of speech (mean: 1.35), and dysarthria (mean: 0.48); despite dysarthria having the highest incidence post-stroke (Balie et al., 2019). The number of speech therapy intervention sessions post-stroke is unknown in South Africa's private healthcare. It is important to determine the frequency of speech, language, and swallowing intervention that is being provided in the private sector, and if there are any associations with favourable stroke outcomes, such as quicker recovery rate and decreased LOS.

Referral for Continued SLT Services as an Outpatient

Individuals who have received speech, language, and swallowing intervention post-stroke in acute care can be referred for continued SLT outpatient services upon discharge, for further intervention with the goal of returning to premorbid functioning (Cawood & Visagie, 2016; Janzen et al., 2019; Whitehead & Baalbergen, 2019). In South Africa's public sector, a significant percentage of individuals with co-occurring speech, language, and swallowing conditions (85.7%) were referred for outpatient SLT services. Individuals with dysphagia in isolation were less often referred (Balie et al., 2019). In addition, the majority of individuals who were referred for outpatient SLT services had moderate to severe disability (mRS>3) at discharge (61%) (Balie et al., 2019). These results indicated that individuals' post-stroke who have a high complexity of speech, language, swallowing impairment and physical disability at discharge may require a long intervention period to improve function, activity and participation; hence, there is an increased likelihood for outpatient therapy (Thorpe, Garret, Smith, Reneker & Phillips, 2018; WHO, 2001). Outpatient referrals can indicate which speech, language and swallowing condition or co-occurring conditions are more likely to require further intervention post-acute care (Whitehead & Baalbergen, 2019).

Conclusion

Research on speech, language, and swallowing conditions and association with outcomes post-stroke in the acute setting is largely based on international research, and South Africa's public sector (Balie et al., 2019; Bryer et al., 2011; Cawood & Visagie, 2016; De Villiers et al., 2011; Seedat & Penn, 2016; Viljoen et al., 2014). A retrospective study on outcomes associated with speech, language, and swallowing conditions, was conducted in the public sector (Balie et al., 2019). There is a need to conduct a study of similar nature in a prospective manner, to determine outcomes post-stroke and how they are actively managed from admission to discharge. Due to a lack of existing studies, there is also a need to conduct research in the private sector to understand the quality of SLT services provided to manage speech, language, and swallowing conditions, and association with risk factors and outcomes post-stroke. Conducting research in the private sector will assist with making comparisons on stroke outcomes between the two sectors. The present study thus aims to conduct a prospective cohort study in South Africa's private sector, to determine which speech, language, and swallowing conditions are associated with outcomes post-stroke (i.e. degree of physical disability, functional level of oral intake, dehydration, weight loss, aspiration pneumonia, mortality); which risk factors (i.e. poor oral hygiene, dependent for oral intake, low LOC, enteral nutrition) are associated with aspiration pneumonia; and how the timelines and nature of SLT services in the private sector influences stroke outcomes (e.g. LOS). Results from the present study can facilitate development of improved SLT stroke services (e.g., referral and screening protocols) in the acute setting, which is needed to achieve universal quality stroke management and increase favourable outcomes (Chimatiro & Rhoda, 2019; De Villiers, 2021; Palli et al., 2017; Pierpoint & Pillay, 2020).

Chapter 3: Methodology

Aims and Objectives

Aim 1: To describe speech, language and swallowing conditions post-stroke and their associations with clinical outcomes.

Objectives:

1. Determine the incidence of dysphagia, dysarthria, aphasia, and apraxia of speech post-stroke.
2. Describe the nature of SLT services (i.e. time from admission to SLT referral, number of intervention sessions, number of outpatient referrals) provided post-stroke.
3. Determine associations with clinical outcomes (i.e. length of stay [LOS], degree of physical disability [Modified Rankin Scale (mRS 0-6], functional level of oral intake [Functional Oral Intake Scale (FOIS 1-7], dehydration, weight loss, and mortality).
4. Determine the types of speech therapy intervention used to manage these conditions.

Aim 2: To determine associations between dysphagia, aspiration, aspiration pneumonia and clinical outcomes.

Objectives:

1. Determine the number of participants with dysphagia who aspirated.
2. Determine the number of participants with dysphagia who aspirated and developed aspiration pneumonia.
3. Determine the association between risks factors (i.e. poor oral hygiene, dependent for oral intake, low level of consciousness [LOC], poor oral hygiene, enteral nutrition) and aspiration pneumonia.
4. Compare the clinical outcomes for participants with dysphagia (i) with and without aspiration, and (ii) with and without aspiration pneumonia. Outcomes include: LOS, degree of physical disability (mRS 0-6), functional level of oral intake (FOIS 1-7), dehydration, weight loss, and mortality.

Research Design

A prospective multisite study design was used to observe a cohort of participants, who had speech, language, and swallowing conditions post-stroke. The study design entailed observing a cohort over time (i.e. from admission to discharge) to determine the incidence of speech, language, and swallowing conditions post-stroke; and the temporal sequence between risk factors and association with subsequent outcomes (De Rango, 2016; Hoffman, 2015; Parfrey & Barrett, 2015; Wang & Kattan, 2020). An advantage to using a prospective design was the ability to observe participants while they were in hospital from admission to discharge; and to determine information on the types of intervention provided and associated clinical changes post-stroke, which was recorded prospectively in hospital folders by participants' treating therapists. Accessing prospective information improved the validity and reliability of results (Gregory & Radovinsky, 2012; Kruse & Mehr, 2008; Sedgwick, 2013a). The risk of confounding variables (e.g. stroke and COVID-19 were associated with similar outcomes) was a disadvantage to using a prospective design, and was managed by exclusion (e.g. excluding individuals who had co-occurring stroke and COVID-19) (De Rango, 2016; Nørgaard, Ehrenstein, Vandenbroucke, 2017; Wang & Kattan, 2020).

Study Sites

Permission was sought from nine acute care private hospitals in the Cape Metropolitan area for the study to be conducted at these sites. These hospitals were selected due to easy accessibility, as the researcher and research personnel provided SLT services to individuals at these sites. Five hospitals, representing four private hospital network groups in Cape Town, agreed to participate in the study. Two hospitals did not respond to the study invitation, one hospital declined participation due to a lack of stroke admissions; and one hospital withdrew from the study due to prioritisation of COVID-19 management.

Participants

Inclusion and Exclusion Criteria

The study included all adults (i.e., 18 years +) who were admitted for a new incident of acute stroke, and who presented with speech, language, and swallowing difficulties. The study excluded individuals with pre-existing speech, language, and swallowing difficulties. Data collection began in February 2020 before the COVID-19 pandemic started in Western Cape, South Africa. Adjustments had to be made to the exclusion criteria when the pandemic started in March 2020. Reasons for adjustments include emerging evidence has shown an association between COVID-19 and onset of neurological sequalae, including stroke (Avula et al., 2020; Frajkovi, Tedla, Tedlova, Suchankova & Geneid, 2020; Hess, Eldahshan & Rutkowski, 2020). In addition, stroke can lead to dysphagia, and COVID-19 can cause acute respiratory distress resulting in breathing-swallowing incoordination and dysphagia; and are associated with similar outcomes, such as aspiration pneumonia and mortality (Frajkova et al., 2020; Kovács, Szabó, & Folyovich, 2021; Mohan & Mohapatra, 2020). Therefore, individuals with stroke who were infected with COVID-19 during their hospitalisation or had an incidence of stroke post-COVID-19 infection were excluded from this study to avoid ambiguous interpretation of results.

Recruitment

Recruitment firstly involved obtaining permission from hospital Chief Executive Officers (CEOs) to conduct the study at the hospital sites. The researcher then met with the SLTs who worked at the hospital sites, as a group, to explain the study purpose, inclusion and exclusion criteria, and requested their assistance in identifying potential participants for inclusion in the study. The SLTs were required to assure that potential participants had no premorbid speech, language, and swallowing difficulties; by asking the patient or their family members, as well as reviewing their hospital folder for any record of previous difficulties. SLTs requested permission from potential participants to share their names and contact details with the researcher if they were interested in participation. The researcher met with potential participants to inform them about the study (Appendix A), to answer questions of

clarification, and obtained consent via signing a hard copy form (Appendix B). Two potential participants could not be enrolled into the study due to the severity of their strokes, intubation, and reduced level of consciousness, leading to the death of one patient.

Sample Size

A power analysis calculation yielding N=85 was required for the study, as verified under the advice of a biostatistician. The study began and the advent of COVID-19 pandemic had an impact on lower number of stroke admissions (Erdur et al., 2021; Nogueira et al., 2021; Rinkel et al., 2020), and thus less SLT referrals. Two participants had to be excluded from the study due to acquiring COVID-19 during their hospitalisation. The total number of participants in this study was N=68.

Sampling Method

Convenience sampling was used to select participants. Convenience sampling is a type of non-probability sampling, that is often implemented in observation studies (De Rango, 2016; Parfey & Barret, 2015; Tyrer & Heyman, 2016), as it facilitates easy access to sampling participants (Etikan, Musa & Alkassim, 2016). Participants were selected at the respective hospital sites if they met the inclusion criteria of the study. All eligible candidates who consented to participate in the study were included. A disadvantage to convenience sampling is limited generalisability of results – The participants from this study were not selected at random; therefore, the results may not be representative of the stroke population in the private sector (Parfey & Barret, 2015; Sedgwick, 2013b).

Participant Description

The median age of participants was 70.5 years (IQR 60-79). Most participants spoke English and Afrikaans, and were retired (Table 2).

Table 2*: Participant Demographics*

Participant Demographics (N=68)							
Age	N	Minimum	Maximum	Mean	SD	Median	95%CI
	68	24	98	68.41	14.27	70.5	60-79
						n	%
Language(s)							
		English & Afrikaans				35	51.5
		English				23	33.80
		English & isiXhosa				7	9.86
		Afrikaans				2	2.90
		English, Afrikaans, isiXhosa				1	1.47
Sex							
		Female				36	52.94
		Male				32	47.06
Employment Status							
		Retired				40	57.35
		Employed				22	32.35
		Unemployed				6	8.80

At admission, a small number of participants received thrombolysis. At discharge, the majority of participants were alive and were transferred to their community or to a rehabilitation care facility (Table 3).

Table 3*: Admission and Discharge Information*

Admission and Discharge Information (N=68)		n	%
Admission			
	Level of Consciousness ([a]GCS >12/15)	56	82.35
	Level of Consciousness (GCS < 12/15)	12	17.64
	Thrombolysis	13	19.11
	Dehydration	3	4.41
Discharge			
	Level of Consciousness (*GCS >12/15)	54	79.41
	Level of Consciousness (GCS <12/15)	14	20.58
Discharge Destination			
	Community	29	42.65
	Rehabilitation Care Facility	29	42.65
	Deceased	10	85.29

Note.

[a]GCS (13-15 = mild; 9-12 = moderate; 3-8 = severe; <3 = vegetative state).

The majority of participants had a medical history of hypertension, and most participants had other co-morbidities pre-stroke (Table 4).

Table 4*: Comorbidities Pre-Stroke*

Comorbidities Pre-Stroke (N=68)	n	%
Lifestyle Factors		
Smoking	2	2.94
Respiratory Infections		
Chronic Obstructive Pulmonary Disease (COPD)	2	2.94
Cardiac		
Ischaemic Heart Disease	5	7.35
Congestive Heart Failure	4	5.88
Valvular Heart Disease	3	4.41
Atrial Fibrillation	2	2.94
Cardiovascular Disease	2	2.94
Chronic		
Hypertension	55	80.88
Diabetes Mellitus	26	38.23
Hypercholesterolaemia	11	16.17
Cancer	8	11.76
Dementia	5	7.35
Depression	4	5.88
HIV/AIDS	4	5.88
Epilepsy	3	4.41
Kidney Disease	1	1.47
Other	37	54.41

Ischaemic stroke was the most prevalent type of stroke in this study. The infarct site as per the Oxfordshire Community Stroke Project Classification (OCSP) criteria, on MRI or CT scans, were not specified for the majority of participants who had an ischaemic stroke (n=42, 82.35%). The majority of participants had a right hemisphere stroke (Table 5).

Table 5*: Type and Nature of Stroke*

Type and Nature of Stroke according to MRI or CT Brain Scans (N=68)	n	%
Previous Stroke	17	25
Type of Acute Stroke		
Ischaemic	51	75
Intracerebral Haemorrhagic	6	8.82
Unspecified	4	5.88
Infarct with Haemorrhagic Conversion	3	4.41
Haematoma	3	4.41
Transient Ischaemic Attack (TIA)	1	1.47
Site of Stroke Lesion		
Right Hemisphere	43	63.23
Middle Cerebral Artery	31	45.58
Left Hemisphere	29	42.64
Parietal	20	29.41
Other	18	26.47
Frontal	17	25
Basal ganglia	11	16.17
Temporal	10	14.70
Occipital	8	11.76
Brainstem	4	5.88
Infarct Site of Acute Ischaemic Stroke as per OCSP Criteria[a]		
Posterior circulation infarct (POCI)	5	9.80
Partial anterior circulation infarct (PACI)	2	3.92
Lacunar Infarct (LACI)	1	1.96
Total anterior circulation infarct (TACI)	1	1.96
Stroke Morbidity		
Hemiparesis	52	76.47
Hemiplegia	47	69.11
Hemineglect	10	14.70
Agnosia	1	1.47

Note. [a]Two participants had two co-occurring infarct sites of ischaemic stroke as per OCSP criteria

A high proportion of participants received daily oxygen therapy, as part of stroke management. There were a few participants who were dependent on mechanical ventilation and tracheostomy (Table 6).

Table 6*: Acute Medical Management*

Acute Medical Management (N=68)		n	%
Antibiotics		9	13.23
Daily oxygen therapy		29	42.65
Disruption of Glottis Closure			
	Mechanical Ventilation	8	11.76
	Endotracheal Intubation	7	10.29
	Sputum suctioning	6	8.82
	Tracheostomy	4	5.88
	Cuff inflated when receiving feeds	2	2.94
	Speaking valve	1	1.47

Data Collection

Research Personnel

The research personnel were the researcher and three SLTs registered with the Health Professions Council of South Africa (HPCSA), who worked at the different private hospitals. The researcher trained all SLTs to administer and score the Modified Rankin Scale (mRS) and the Functional Oral Intake Scale (FOIS), which were used during data collection. One of the three SLTs was also trained to abstract data using the study's coding manual, which was necessary for reliability checks.

Materials and Tools

Consent Forms. Consent forms were written in English and translated post-ethics approval using four first language speakers of Afrikaans and isiXhosa, who were also fluent in English. Two speakers translated the consent forms into Afrikaans and isiXhosa, which was translated back into English by two different speakers, who were blind to the original (Castro & Leite, 2017; WHODAS 2.0 Translation Package). Discrepancies in language translations were discussed and edited.

Data Abstraction Tool (Balie et al., 2019). An electronic data abstraction tool (Appendix C) was created using Microsoft Excel and was based on the tool used by Balie et al., 2019. A data abstraction tool guides the data collection process (Gearing, Mian, Barber & Ickowicz, 2006), and makes provision for the variables of interest to be abstracted from participants' medical records and recorded (Gregory & Radovinsky, 2021). An electronic data abstraction tool is cost-effective, allows for easy access to stored data, decreases risk of error in data entry; and facilitates reliable data analysis (Vassar & Holtzmann, 2013).

The data abstraction tool made provision for the following data sets to be abstracted:

1. Demographic details (e.g. age, languages) (Arnold et al., 2016).
2. Admission information: Date of stroke, date of admission, degree of disability according to the mRS scale (0-6) (Banks & Marotta, 2007), functional level of oral intake at admission according to the FOIS scale (1-7) (Crary et al., 2005), level of consciousness according to Glascow Coma Scale (GCS) (Weir, Bradford, & Lees, 2003), number of days from diagnosis to admission, and residence (Viljoen et al., 2014).
3. Discharge information: Date of discharge, LOS (in days), discharge destination (Vassar & Holzmann, 2013), level of consciousness according to GCS (Weir, Bradford, & Lees, 2003), degree of disability according to mRS (0-6) (Banks & Marotta, 2007), and functional level of oral intake according to FOIS (1-7) (Crary et al., 2005).

4. Stroke details: Type of stroke (Flowers et al., 2017; Viljoen et al., 2014), infarct classification as per OCSP criteria (Amarenco, Bogousslavsky, Caplan, Donnan & Hennerici, 2009) site of lesion (Viljoen et al.,2014), stroke severity according to the NIHSS (Kasner, 2006; Yeh et al., 2011).
5. Pre-existing comorbidities: Lifestyle factors (e.g. smoking) (ESO, 2008); respiratory tract infections (LRTI, COPD, TB) (Brogan et al., 2014; DiBardino & Wunderink, 2015; Eisenstadt, 2010; Matsuo, Ishikawa, Tachi, Yoshida, & Teramoto, 2014); cardiac disease (e.g. atrial fibrillation) (Mandell & Niederman, 2019; Miyata et al., 2017); chronic (e.g. diabetes mellitus, hypertension [Bray et al., 2016]); consequences of stroke (e.g. hemi-neglect) (Viljoen et al., 2014); and other co-morbidities (e.g. previous surgeries, mental illnesses).
6. Dentition: Oral hygiene status, decayed teeth, dentures (Cohen et al., 2016; Smithard, 2016).
7. Medication: Administration of antibiotics (DiBardino & Wunderink, 2015; Mandell & Niederman, 2019); daily oxygen therapy (Dong et al., 2021).
8. Mechanical disruption of glottis closure: Tracheostomy (cuff inflated or deflated, speaking valve) (Matthews & Coyle, 2010); endotracheal intubation, mechanical ventilation, upper endoscopy, and sputum suctioning (Wästfelt et al., 2018; Yeh et al., 2011).
9. Speech, language, and swallowing diagnosis: Aphasia, dysarthria, apraxia of speech, and dysphagia (Flowers et al., 2017).
10. Dysphagia: Mode of dysphagia assessment (e.g. CSE, VFSS) (Immovilli et al. 2021), dysphagia findings (clinical signs for risk of aspiration and silent aspiration) (Cohen et al., 2016), and oral diet consistency (e.g. puree, soft, regular) (Cichero et al. 2017).
11. Dysphagia-related outcomes: Pneumonia type (e.g. hospital-acquired pneumonia, aspiration pneumonia, community acquired pneumonia), method of identification (Radiologist's interpretation of chest x-rays, and medical diagnosis made by participants' Physicians), dehydration, and weight loss (Armstrong & Mosher, 2011;

Crary et al., 2013; DiBardino & Wunderink, 2015; Eisenstadt, 2010; Feng et al., 2019; Gomes et al., 2016; Manabe et al., 2015; Mandell & Niederman, 2019).

12. Nature of SLT services: Time of stroke diagnosis to SLT referral (hours), number of SLT intervention sessions, and referral to outpatient therapy (Bray et al., 2017; Hersh, 2016; Viljoen et al., 2014).
13. Nature of SLT intervention: Type of therapy provided for dysphagia (e.g. compensatory strategies, swallow exercises) (Arnold et al., 2016; Smithard et al., 2016), aphasia (Watila & Balarabe, 2015), apraxia of speech (Basilakos, 2018), and dysarthria (Park et al., 2016).

Coding Manual

A coding manual (Appendix D) was created to guide data abstraction, for the researcher and second data abstractor (Gearing et al., 2006). The coding manual contained a key to describe the codes (e.g., A, 0, 1) used which represented specific variables, and explained how to enter data to ensure that data was abstracted objectively and uniformly; and to achieve a consistent method of data abstraction across participants (Gearing et al., 2006; Gregory & Radovinsky, 2012). The coding manual was revised for discrepancies in abstracting data (e.g., using the correct code, 0 or 1, to indicate present or absent outcomes), and edited after the pilot study to improve consistent data abstraction (Gearing et al., 2006). Missing data was addressed in the coding manual with a respective code (e.g. variable highlighted in red) to indicate that the data was missing, and required follow-up by reviewing participants' hospital folders and SLT consultation notes (Gearing et al., 2006). The outcome measure scales (mRS, FOIS) were described in the coding manual by defining the scores and their correlating descriptions (Banks & Marotta, 2007; Crary et al., 2005).

Outcome Measure Scales

Functional Oral Intake Scale (FOIS). The FOIS (Appendix E) is a tool used to describe individuals' functional level of oral intake of food and liquid or degree of swallowing disability (Crary et al., 2005). The FOIS is a 7-point ordinal scale, with levels 1-3 describing varying degrees of non-oral intake, and levels 4-7 describing varying degrees of oral intake. A value of 6-7 (i.e. total oral intake of multiple consistencies with specific food limitations [FOIS=6] or no restrictions [FOIS=7]) are considered favourable outcomes post-stroke (Crary et al., 2005). The FOIS reportedly has high inter-rater reliability with perfect agreement on 85% of ratings (Kappa statistics ranged from .86 to .91). Criterion validity was high at onset of stroke and one-month post-stroke (Crary et al., 2005). The FOIS has high concurrent validity as there is significant association with a similar scale, the Food Intake Level Scale (FILS) (Kunieda, Ohno, Fujishima, Hojo, & Morita, 2013). The FOIS is a valid and reliable tool used to determine clinical change in oral intake for individuals' post-stroke (Crary et al., 2005).

Modified Rankin Scale (mRS). The mRS (Appendix F) is a common outcome measure tool used to determine the degree of physical disability for individuals' post-stroke (Banks & Marotta, 2007; Harrison, McArthur & Quinn, 2013). The mRS is a 6-point scale from 0 = no symptoms at all, to 6 = death. A value of 0-1 (i.e. no symptoms [mRS=0]; no significant disability despite symptoms, able to carry out all usual duties and activities [mRS=1]) are considered favourable outcomes for individuals' post-stroke (Banks & Marotta, 2007). Reportedly, the mRS has moderate inter-rater reliability (kappa 0.56) and strong test-retest reliability (kappa=0.81 to 0.95) (Banks & Marotta, 2007). A limitation of the mRS is interobserver variability which impacts reliability (Harrison, McArthur & Quinn, 2013). Concurrent validity between the mRS and other disability scales is well-defined (Banks & Marotta, 2007). The mRS relates to the Functional Ambulation Category (MFA) test, which similarly assesses level of functional ability and also has adequate intra- and inter reliability and high validity (Kim et al., 2016; Park & An, 2016). The mRS is a valuable tool for evaluating the degree of disability post-stroke (Banks & Marotta, 2007).

Validity

The validity of a study is a measure of whether the study's research is true and whether the methods used are evaluating what it intends to evaluate (Zohrabi, 2013). Ensuring validity is necessary as accurate interpretation of the study's results and conclusions will form an important guide for future research (Vassar & Holtzmann, 2013). Internal validity is the degree to which the study's results truly represent associations between speech, language, and swallowing conditions and outcomes post-stroke (Terre Blanche et al., 2006). Internal validity was achieved by controlling for confounding variables by means of excluding participants with pre-existing speech, language and swallowing difficulties as a result of previous stroke or degenerative conditions; and excluding participants who had COVID-19 (Terre Blanche et al., 2006). Information from participants' hospital folders were collected in accordance with the aims and objectives of the study, and data was rechecked, which ensured that the relevant content was abstracted (Gregory & Radovinsky, 2012). Content validity is the extent to which the data abstraction tool represented speech, language, and swallowing conditions and associated outcomes post-stroke (Terre Blanche, 2006; Zamanzadeh et al., 2015). Content validity was addressed by referring to the data abstraction tool used by Balie et al. (2019) retrospective study, who researched a similar content.

Reliability

Reliability is the extent to which the research instruments (i.e. data abstraction tool, outcome measure scales scores) consistently had the same results when used in the same situation or with repeated trials (Heale & Twycross, 2015). Variability may occur during data collection and abstraction, which increases the risk of observer bias, and inconsistent scoring on outcome measure scales (Zohrabi, 2013). The researcher trained the research personnel on how to administer the two outcome measure scales (mRS, FOIS). Descriptions for each severity rating of the scales were discussed with the research personnel to gain consensus and to avoid inconsistent scoring. The researcher first learned how to abstract data by referring to Balie et al. (2019) study who used similar data collection methods. The researcher then trained the second data abstractor on how to capture data onto the

abstraction tool, using the coding responses described in the coding manual (Gregory & Radovinsky, 2012). Intra-rater reliability was achieved by the researcher and second data abstractor re-checking their own data entries, blind to the original data set, to ensure that all relevant information was captured consistently (Hallgren, 2012). At the start of data collection, the researcher and second data abstractor trained collaboratively with a statistician on how to administer inter-rater reliability checks. After the first ten participants' data were abstracted, the researcher and second data abstractor abstracted data for those ten participants, blind to the original data set (Scheel et al., 2018). The percentage of agreement was calculated using Cohen's Kappa coefficient, to assess inter-rater reliability (Hallgren, 2012). There was perfect agreement (1.00) for mRS score on admission, admission and discharge FOIS scores, comorbidities, SLT diagnoses, pneumonia type, and admission diet. There was near perfect agreement (0.81-0.99) for discharge mRS score, type of stroke, OCSP criteria, site of lesion, stroke morbidity, oral hygiene status, dysphagia interventions, discharge diet, aphasia intervention, and apraxia of speech intervention (Kanganathan, Pramesh & Aggarwal, 2017). Inconsistent data entries were identified and managed by reviewing participants' hospital folders and SLT consultation notes, and making corrections to the data entries.

Research Procedures

The University of Cape Town (UCT), Faculty of Health Sciences (FHS), Human Research Ethics Committee (HREC) required the supervisor to have oversight of the study as the Primary Investigator, but the development and submission of the proposal for review and ethical research conduct was the student's responsibility. Ethics approval was obtained in November 2019 from the UCT FHS HREC, HREC reference 730/2019 (Appendix G), prior to commencement of the study. Permission to conduct the study was obtained from the CEOs of five acute care private hospitals in Cape Town (Appendix H). Participants were recruited, consented, and enrolled into the study. The study was conducted according to Helsinki 2013 guidelines (World Medical Association, 2013). The SLTs at the hospital sites provided the participants with standard of care and recorded details of intervention in medical folders. The

researcher did not share the aims of the study with the research personnel during data collection, to avoid potential modification of standard of care. At admission and discharge, the FOIS was administered to determine participants' functional level of oral intake or degree of swallowing disability and the mRS was administered to determine participants' degree of physical disability. The treating SLT consulted with the participant's Physiotherapist about the mRS score. Afrikaans and isiXhosa speaking participants were managed by their treating SLT providing therapy in these respective languages. Nursing staff and participants' family members also assisted the treating SLT with Afrikaans and isiXhosa translations. The researcher and second data abstractor accessed and reviewed the treating SLTs' patient files, containing participant information, on Dropbox, on a weekly basis. Data collection was conducted from February 2020 – November 2020. Participant data was de-identified using a coding system and was abstracted onto the password-protected data abstraction tool by the researcher and second data abstractor (Gregory & Radovinsky, 2012).

Adjustments to Research Procedures during COVID-19 Pandemic (March-November 2020)

Since November 2019, COVID-19 caused by the novel SARS-CoV-2 spread worldwide. The COVID-19 pandemic affected the study's research procedures. As a result, adjustments to the research procedures were made as requested and approved by the HREC. A witness (e.g., a healthcare professional working at the hospital site) was required to sign the participant's consent form and provide their full name and contact details. In the case of proxy consent; informed consent was obtained electronically (i.e., consent forms were emailed, signed, scanned, and returned via email to the researcher), as due to the COVID-19 pandemic, visitors (i.e., legally authorised next-of-kin) were not allowed into the hospitals. All SLTs involved in data collection continued to provide SLT services to participants during the pandemic as they used the required Personal Protective Equipment (PPE), and followed all infection control procedures requested by the respective private hospitals, as part of standard of care during COVID-19.

Pilot Study

A pilot study was conducted on three participants post-stroke prior to the main study to test the feasibility of the study, to test recruitment and consent rate, to pilot the outcome measure scales, to identify errors in the protocol; and to assess the need for further training of the SLTs collecting and abstracting the data (Gearing et al., 2006; Hassan, Schattner & Mazza, 2006). The results from the pilot participants were not added to the dataset of the main study. Errors in data collection and abstraction were identified and changes were made to the study protocol (Terre Blanche et al., 2006): An error in coding data on the abstraction tool was identified (i.e. data was not recorded using a coding system – e.g. 0, 1), and corrected; detailed descriptions for rating scales (mRS, FOIS, GCS) were added to the coding manual; and the method of calculating the number of SLT intervention sessions was clearly specified. The pilot study showed that most variables of interest were easily accessed from participants' hospital folders; however, some information were missing such as NIHSS scores, admission and discharge weight, and infarct as per OCSP criteria in participants' hospital folders or on CT or MRI scans. When a participant was discharged, sometimes the treating SLT was not informed and the participant's hospital folder was already archived; therefore, it was difficult to obtain missing information at discharge (e.g. discharge weight). If missing information could not be obtained from hospital folders, other means were considered (e.g. consulting Dietitians about participants' admission and discharge weight). Missing information on NIHSS scores, weight, and infarct as per OSCP criteria continued to impact data collection in the main study.

Data Analyses

Data Management

Data was cleaned by rechecking data entries, and missing data was managed by reviewing participant's hospital folders and SLT consultation notes to obtain the relevant data. If missing data could not be obtained, these variables were excluded from statistical analyses for the specific case (Kang, 2013; Kwak & Kim, 2017). Data from the abstraction tool was analysed.

Statistical Analyses

The statistical package that was used to analyse the data was IBM SPSS Statistics 26. The alpha level was set at Bonferroni Correction $p < 0.01$ (Napierala, 2012; VanderWeele & Mathur, 2019). Various statistical measures were used to analyse the data. The number of participants with dysphagia, aphasia, dysarthria, apraxia of speech, aspiration, and aspiration pneumonia were calculated. A series of Mann-Whitney *U* tests were used to determine associations between speech, language and swallowing conditions (i.e. dysphagia, aphasia, dysarthria, apraxia of speech) and timeliness of SLT referral, number of intervention sessions, and clinical outcomes (i.e. LOS, degree of disability [mRS values], functional level of oral intake [FOIS values]). Mann-Whitney *U* tests were also used to determine associations between aspiration, aspiration pneumonia and clinical outcomes (i.e. LOS, degree of disability [mRS values], functional level of oral intake [FOIS values]) (MacFarland & Yates, 2016; Streiner & Norman, 2011; Tredoux & Durrheim, 2002). Pearsons's chi-square tests of independence (Cramer's *V*) or Fischer's Exact test were used to determine the proportion of participants with dehydration and mortality; to determine the association between the four risk factors (i.e. low LOC, poor oral hygiene, enteral nutrition, and dependent for oral intake) and aspiration pneumonia; and to determine the associations between aspiration, aspiration pneumonia and clinical outcomes (i.e. mortality, dehydration, weight loss) (Streiner & Norman, 2011; Tredoux & Durrheim, 2002). (Tredoux & Durrheim, 2002). An Odds Ratio (OR) was calculated to determine the likelihood of mortality for dysphagia, aphasia, dysarthria, and apraxia of speech (Tredoux & Durrheim, 2002).

Ethical Considerations

Autonomy

Autonomy refers to respecting the rights of individuals to voluntarily decide whether or not to participate in the study, and giving them the freedom to withdraw from the study at any point (Terre Blanche et al., 2006; World Medical Association, 2001). Research personnel involved in this study were acknowledged and managed as data collectors and abstractors by voluntary participation, and were allowed to withdraw from their role in the study at any

point. If patients agreed to participate in the study, they were asked to sign the consent form (Higgins et al., 2016). In the situation where the patient was being managed by the researcher, another SLT met with the patient to enrol them into the study, to avoid any potential power imbalance caused by a dependent relationship (World Medical Association, 2013). With reference to the Declaration of Helsinki, provision was made for informing and obtaining consent from individuals who had difficulty with receptive language related to aphasia or cognitive impairment by using a pictographic consent form (appendix I) for easier understanding. If individuals' language, cognitive, or physical impairments were severe (i.e. disorientated, limited verbal and literacy ability) and restricting their ability to make an informed decision; proxy consent was obtained, for 23 participants, from a legally authorised next of kin, in person or electronically (World Medical Association, 2013). The researcher was responsible for collecting signed consent forms. Consent forms were scanned, and will be uploaded to an electronic storage system as recommended by the UCT data management policy, and will be accessible through single sign-on credentials.

Confidentiality

Confidentiality refers to limiting access to the study's data which has participant information (Ethicist, 2015). Participant data that was uploaded onto Dropbox was secured by an authentication process using an email address and password. The study's dataset had no identifying information. A coding system was used where each participant was assigned a respective code for de-identification (e.g. A1) (Giordano, O'Reilly, Taylor & Dogra, 2007). A separate password-protected electronic document (Appendix J) was created with the participants' names and their respective codes to ensure that reliability checks could be conducted (Kaiser, 2009). A document which had the identifying participant details and associated code was stored on a desk-based computer, which is password protected, and will be uploaded to an electronic storage system recommended by UCT, for future accessibility.

Beneficence

Beneficence refers to maximising the benefits that the research study will offer to participants (Terre Blanche et al., 2006). There were no direct benefits to participating in the study; however, the study's results will facilitate improved management of future individuals' who present with speech, language and swallowing difficulties post-stroke. All four research personnel were given an incentive (vouchers) for assisting the researcher with the study's data collection and abstraction procedures.

Non-Maleficence

Non-maleficence refers to the duty of the researcher to prevent direct or indirect harm to participants (Jelsma & Clow, 2005). There was no harm to participants participating in the study as data collection involved recording data from hospital folders (Newington & Metcalfe, 2014).

Justice

Justice refers to the researcher treating research participants with fairness throughout the research study (Terre Blanche et al., 2008). There was no participant coercion in enrolling participants into the study.

Conclusion

A prospective multi-site study was conducted on a cohort of 68 adults who had an incident of acute stroke, at five private hospitals in the Cape Metropolitan area. Convenience sampling was used. The research personnel were four registered SLTs who worked at the hospital sites. SLTs at the hospital sites provided participants with standard of care and recorded details of intervention in medical folders, from admission to discharge. Due to the COVID-19 pandemic, adjustments to the research procedures were implemented. The mRS and FOIS were outcome measure tools administered during data collection. An electronic data abstraction tool was used for abstracting data. Various statistical measures were used, by a statistics program, to analyse the data. Ethical considerations were maintained.

Chapter 4: Results

The results were described in accordance with the aims and objectives of this study.

Speech, Language, and Swallowing Conditions

Of the 68 participants who were referred to SLT post-stroke; 53 (78%) participants presented with dysphagia, 50 (73.53%) presented with aphasia, 50 (73.53%) presented with dysarthria, and 11 (16.17%) presented with apraxia of speech. The majority of participants (88%) had co-occurring diagnoses. Aphasia, dysarthria, and dysphagia were the most commonly co-occurring diagnoses (38.23%) (Table 7).

Table 7: *Speech, Language and Swallowing Conditions*

Speech, Language and Swallowing Conditions N=68		
Conditions in Isolation	n	%
Dysarthria	3	4.41
Aphasia	3	4.41
Dysphagia	2	2.94
Apraxia	0	0.00
Co-occurring Conditions	n	%
Aphasia, Dysarthria, Dysphagia	26	38.23
Dysarthria, Dysphagia	10	14.70
Aphasia, Dysphagia	7	10.30
Aphasia, Dysarthria	6	8.82
Aphasia, Apraxia	3	4.41
Apraxia, Dysarthria, Dysphagia	3	4.41
Aphasia, Apraxia, Dysphagia	3	4.41
Aphasia, Dysarthria, Apraxia, Dysphagia	2	2.94

The Association between Speech, Language and Swallowing Conditions, and Length of Stay

The median LOS across all four conditions (i.e., dysphagia, aphasia, dysarthria, apraxia of speech) was 15 days (IQR 9-20). Participants with dysphagia stayed in hospital for a median of six days longer than those without dysphagia, but this difference was not statistically significant (p=.022). Similarly, participants with aphasia had a median of 4.5 days longer hospital stay than those without aphasia, but this difference was not statistically

significant (p=.023). There were no statistically significant differences in LOS across the four SLT conditions (Table 8).

Table 8: ***Association between Speech, Language and Swallowing Conditions, and Length of Stay***

	Dysphagia				
	Dysphagia (n = 53)	No Dysphagia (n = 15)			
N=68	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Length of Stay (LOS)	15 (11-21)	9 (7-14.75)	222	.022	0.40
	Aphasia				
	Aphasia (n = 50)	No Aphasia (n = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	15.5 (10.25-23.5)	11 (8-15)	267.5	.023	0.37
	Apraxia of Speech				
	Apraxia (n =11)	No Apraxia (n = 57)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	16 (13.5-22)	14 (9-20)	255.5	.378	0.17
	Dysarthria				
	Dysarthria (n = 50)	No Dysarthria (n = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	15 (9-20)	14.5 (7.75-19)	393.5	.506	0.11

Note. $p < 0.01$ at Bonferroni adjusted alpha level

The Association between Speech, Language and Swallowing Conditions and Degree of Physical Disability

At admission, there was a significantly greater number of participants with dysphagia (p<.01) who had moderate to severe physical disability compared to those without dysphagia, with a strong effect size (r=0.68). At discharge, there was a significantly greater number of participants with dysphagia (p<.01) who had moderate to severe physical disability compared to those without dysphagia, with a moderate effect size (r=0.49). At admission and discharge, dysphagia was significantly associated with moderate to severe physical disability (mRS 3-5). There were no statistically significant differences in admission and discharge disability for participants with aphasia, apraxia of speech, and dysarthria (Table 9). Although not significant, most participants with co-occurring speech, language and

swallowing conditions had moderate to severe physical disability (mRS 3-5) at discharge (refer to Table K1 in Appendix K).

Table 9: ***Association between Speech, Language and Swallowing Conditions and Degree of Physical Disability (mRS)***

	Dysphagia				
	Dysphagia (*n* = 53)	No Dysphagia (*n* = 15)			
N=68	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Admission mRS	4 (4-5)	2 (1-4)	127.5	< .001**	0.68
Discharge mRS	4 (3-5)	1 (1-4)	201.5	.003**	0.49
	Aphasia				
	Aphasia (*n* = 11)	No Aphasia (*n* = 57)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	4 (3.25-5)	4 (3.25-5)	454.5	.953	0.01
	4 (2-5)	4 (2.25-4)	446	.960	0.01
	Dysarthria				
	Dysarthria (*n* = 50)	No Dysarthria (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	4 (3-5)	4 (4-5)	490	.562	0.09
	4 (2-4)	4 (4-5)	554.5	.138	0.23
	Apraxia of Speech				
	Apraxia (*n* = 11)	No Apraxia (*n* = 57)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	4 (3.5-5)	4 (3-5)	297	.779	0.05
	4 (3.5-4.5)	4 (2-5)	298	.797	0.05

Note. ***p* < 0.01 at Bonferroni adjusted alpha level

The Association between Speech, Language and Swallowing Conditions, and Functional level of Oral Intake

At admission, dysphagia was significantly associated with altered consistency diets (FOIS 4-6) and enteral nutrition (FOIS 1-3) ($p<.01$), with a very strong effect size ($r=0.94$). At discharge, participants with dysphagia were significantly associated with altered consistency diets and enteral nutrition ($p<.01$), with a strong effect size ($r=0.60$). At admission and discharge, dysphagia was significantly associated with poor functional level of oral intake (i.e. altered consistency diets and enteral nutrition). There were no statistically significant differences in functional oral intake for participants with aphasia, dysarthria, and apraxia of speech (Table 10). Although not significant, most participants with co-occurring speech,

language and swallowing conditions had FOIS<7 scores at discharge, indicating a lower level of oral intake and enteral nutrition (refer to Table K2 in Appendix K).

Table 10: ***Association between Speech, Language and Swallowing Conditions and Functional Level of Oral Intake (FOIS)***

	Dysphagia				
	Dysphagia (*n* = 53)	No Dysphagia (*n* = 15)			
N=68	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Admission FOIS	5 (1-6)	7 (7-7)	772.5	< .001**	0.94
Discharge FOIS	6 (1-7)	7 (7-7)	637	< .001**	0.60
	Aphasia				
	Aphasia (*n* = 50)	No Aphasia (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	5 (2.25-6)	5 (3.5-6)	455	.949	0.01
	6 (3-7)	6 (5.25-7)	454.5	.953	0.01
	Dysarthria				
	Dysarthria (*n* = 50)	No Dysarthria (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	5 (5-6)	5 (1-7)	454.5	.954	0.01
	6 (5-7)	6 (2-7)	431	.785	0.04
	Apraxia of Speech				
	Apraxia (*n* = 11)	No Apraxia (*n* = 57)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	5 (4-6.5)	5 (2-6)	316.5	.966	0.01
	6 (6-7)	6 (3-7)	308	.930	0.02

Note. ***p* < 0.01 at Bonferroni adjusted alpha level.

The Association between Speech, Language and Swallowing Conditions and Dehydration

There were three participants (4.41%) who presented with dehydration on admission. All three participants presented with dysphagia and co-occurring speech and language conditions. Dehydration on admission was not significantly associated with any of the presenting speech, language and swallowing conditions (*p*=.00; *p*=.560; *p*=.169; *p*=.416) (Table 11). Two (66.66%) of these participants with dehydration on admission died prior to discharge. There were no participants who had dehydration on discharge.

Table 11: ***Association between Speech, Language and Swallowing Conditions and Dehydration***

	Dysphagia			
	Dysphagia (*n* = 53)	No Dysphagia (*n* = 15)	*p*	Cramer's *V*
Admission dehydration (n=3)			.00	0.11
Yes	3	0		
No	50	15		
	Dysarthria			
	Dysarthria (*n* = 50)	No Dysarthria (*n* = 18)	*p*	Cramer's *V*
			.560	0.13
	3	0		
	47	18		
	Aphasia			
	Aphasia (*n* = 50)	No Aphasia (*n* = 18)	*p*	Cramer's *V*
			.169	0.20
	1	2		
	49	16		
	Apraxia of Speech			
	Apraxia (*n* =11)	No Apraxia (*n* =57)	*p*	Cramer's *V*
			.416	0.10
	1	2		
	10	55		

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

The Association between Speech, Language and Swallowing Conditions and Mortality

There were ten (14.70%) participants who died during the study period. None of the speech, language and swallowing conditions in isolation were significantly associated with mortality (Table 12). Participants who died had two to four co-occurring speech, language and swallowing conditions, of whom nine (90%) had dysphagia. Most participants who died had co-occurring aphasia, dysarthria and dysphagia (30%), and co-occurring dysarthria and dysphagia (30%) (refer to Table K3 in Appendix K).

Table 12: ***Association between Speech, Language and Swallowing Conditions and Mortality***

	Dysphagia				
	Dysphagia (*n* = 53)	No Dysphagia (*n* = 15)	X^2	*p*	Cramer's *V*
Mortality			0.99	.319	0.12
Alive	44	14			
Died (n=10)	9	1			
	Dysarthria				
	Dysarthria	No Dysarthria	X^2	*p*	Cramer's *V*

(*n* = 50)	(*n* = 18)			
		0.25	.616	0.06
42	16			
8	2			
Aphasia				
Aphasia (*n* = 50)	No Aphasia (*n* = 18)	X^2	*p*	Cramer's *V*
		0.08	.784	0.03
43	15			
7	3			
Apraxia of Speech				
Apraxia (*n* = 11)	No Apraxia (*n* =57)	X^2	*p*	Cramer's *V*
		0.33	.566	0.07
10	48			
1	9			

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

Participants with dysphagia had a higher odds (2.86) of dying compared to those without dysphagia (Table 13).

Table 13: ***Speech, Language and Swallowing Conditions and Risk of Mortality (Odds Ratio)***

			X^2	*p*	*V*	*OR*
	Dysphagia					
Mortality			0.99	.319	0.12	2.86
Alive	44	14				
Died	9	1				
	Dysarthria					
			0.25	.616	0.06	1.52
	42	16				
	8	2				
	Aphasia					
			0.08	.784	0.03	0.81
	43	15				
	7	3				
	Apraxia of Speech					
			0.33	.566	0.07	0.53
	10	48				
	1	9				

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

Nature of Services

Timeliness of Admission to SLT Referral

All 68 (100%) participants were referred by their Physicians to SLT services. The median time from admission to SLT referral (hours) was 48 hours for the four speech, language and swallowing conditions. There were no statistically significant differences in time from admission to SLT referral across the four conditions (Table 14)

Table 14: *Timeliness of Admission to SLT Referral*

	Apraxia of Speech				
	Apraxia (*n* = 11)	No Apraxia (*n* = 57)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Timeliness of Admission to SLT Referral (hours)	48 (24-108)	48 (24-72)	421	.383	0.16
	Dysphagia				
	Dysphagia (*n* = 53)	No Dysphagia (*n* = 15)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	48 (24-72)	24 (24-48)	365	.624	0.08
	Aphasia				
	Aphasia (*n* = 50)	No Aphasia (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	48 (24-72)	24 (24-48)	421	.681	0.06
	Dysarthria				
	Dysarthria (*n* = 50)	No Dysarthria (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	48 (24-72)	24 (24-48)	262.5	.880	0.02

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

The Association between SLT Referral Time and Length of Stay

There were 32 (47.06%) participants who were referred to SLT within 24 hours (refer to Table K4 in Appendix K). Participants who were referred later than 24 hours stayed in hospital for a median of three days longer than those who were referred within 24 hours, but this difference was not statistically significant (p=.042) (Table 15).

Table 15: *Association between SLT Referral Time and Length of Stay*

	SLT Referral Time				
	Early (Within 24 hours) (*n* = 32) Median (IQR)	Late (>24 hours) (*n* = 36) Median (IQR)	*W*	*p*	Effect size
Length of hospital stay	12 (7 – 17.5)	15 (11.5 – 21.5)	398	.042	0.29

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

The Association between Speech, Language and Swallowing Conditions and Number of Intervention Sessions

Participants received an average of 11 intervention sessions in a median of 15 days. Participants with apraxia of speech had a median of four more intervention sessions compared to those without apraxia, whereas participants with aphasia had 3.5 more intervention sessions compared to those without aphasia. There were no statistically significant differences in the number of intervention sessions across the speech, language and swallowing conditions (Table 16).

Table 16: ***Association between Speech, Language and Swallowing Conditions and Number of Intervention Sessions***

	Apraxia of Speech				
	Apraxia (*n* = 11) Median (IQR)	No Apraxia (*n* = 57) Median (IQR)	*W*	*p*	Effect size
Total number intervention sessions	10 (8-18.5)	6 (4-11)	287	.033	0.41
	Aphasia				
	Aphasia (*n* = 50) Median (IQR)	No Aphasia (*n* = 18) Median (IQR)	*W*	*p*	Effect size
	8.5 (5-14)	5 (4-7)	287	.024	0.36
	Dysphagia				
	Dysphagia (*n* = 53) Median (IQR)	No Dysphagia (*n* = 15) Median (IQR)	*W*	*p*	Effect size
	7 (5-13)	6 (3-8.5)	291	.116	0.27
	Dysarthria				
	Dysarthria (*n* = 50) Median (IQR)	No Dysarthria (*n* = 18) Median (IQR)	*W*	*p*	Effect size
	7 (4.25-11)	7.5 (4-12)	185	.989	<0.01

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

Type of Dysphagia Assessment

All 68 (100%) participants had a swallowing screening or assessment using subjective or objective measures (Table 17). The majority of participants (89.70%) had CSE, compared to the other modes of dysphagia assessment. Objective measures (i.e., FEES, VFSS) were not used as frequently.

Table 17: *Type of Dysphagia Assessment*

Type of Dysphagia Assessment	N=68	100%
Bedside Clinical Swallow Evaluation (CSE)	61	89.70
Screening	8	11.76
Videofluoroscopic Swallow Study (VFSS)	4	5.88
Fibreoptic Endoscopic Evaluation of Swallowing (FEES)	1	1.47

Note. Type of dysphagia assessments were not mutually exclusive as some participants received more than one type of assessment.

Nature of Speech, Language and Swallowing Intervention

Nature of Dysphagia Intervention. Participants with dysphagia (78%) received different types of intervention including compensatory strategies, swallow exercises, and sensory stimulation (Table 18). All 53 participants with dysphagia received compensatory strategies (100%); most participants received swallow exercises (54.71%); and some participants received sensory stimulation (38.85%).

Table 18: *Nature of Dysphagia Intervention*

Nature of Dysphagia Intervention		n= 53	78%
Compensatory		53	100
	Positioning (e.g. upright)	52	98.11
	Oral care	44	83.02
	Postures (e.g. chin tuck)	17	32.07
	Modification to oral intake (e.g. small bolus volumes)	14	26.41
	Behavioural (e.g. repeat swallow, liquid wash)	9	16.98
	Consistency changes (e.g. thickened liquids)	9	16.98
	Frazier Free Water Protocol (FFWP)	3	5.66
Swallow Exercises		29	54.71
	Oral Motor Exercises (jaw, lips, cheeks, face)	25	47.17
	Effortful swallow	10	18.87

	Tongue strengthening exercises	6	11.32
	Shaker or Chin Tuck Against Resistance (CTAR)	5	9.43
	Mendelsohn	4	7.55
	Masako	4	7.55
	Gargle	3	5.66
	Supraglottic swallow and/or Super-supraglottic swallow	1	1.88
Sensory Stimulation		19	35.85
	Sensory stimuli (e.g. ice, thermal tactile stimulation)	19	35.85
	Vital-Stim	3	5.66

Note. Some of the participants received more than one type of intervention, hence the interventions are not mutually exclusive.

Following SLT assessment and recommendation, 37 (69.81%) participants had altered consistency diets at admission, 23 (43.39%) participants had altered consistency diets at discharge, and 15 (28.30%) participants returned to a regular diet or total oral intake at discharge. There was not a significantly greater number of participants who were on oral intake at discharge (n=53) relative to admission (n=52). There were 16 (30.18%) participants who were placed on enteral nutrition following admission, and 15 (28.30%) participants were receiving enteral nutrition at discharge. At discharge, 27 participants (50.94%) improved their functional level of oral intake; nine participants (16.98%) remained on the same altered consistency diet; and seven participants (13.20%) had a lower level of functional oral intake (i.e. altered consistency diet or enteral nutrition) (Table 19).

Table 19: ***Mode of Nutritional Intake at Admission and Discharge***

Altered Consistency Diets			
Admission		Discharge	
	n (%)		n (%)
Puree ([a]IDDSI 4)	14 (26.41)	NPO - 2 (NGT) died in hospital	2 (14.28)
		Puree (IDDSI 4)	1 (7.14)
		Soft (IDDSI 6)	7 (50)
		Regular (IDDSI 7)	4 (28.57)
Soft (IDDSI 6)	23 (43.39)	NPO - 1 (NGT) discharged to rehab - 2 (NGT) died in hospital	3 (13.04)
		Puree (IDDSI 4)	2 (8.70)
		Soft (IDDSI 6)	8 (34.78)
		Regular (IDDSI 7)	10 (43.48)
Regular (IDDSI 7)	15 (28.30)	Regular (IDDSI 7)	15 (28.30)
Enteral Nutrition			
NPO	16 (30.18)	NPO - 1 (NGT) went home - 3 (NGT) discharged to rehab - 4 (NGT) died in hospital - 1 (PEG) went home - 1 (PEG) died in hospital	10 (62.50)
		Puree (IDDSI 4)	4 (25)
		Soft (IDDSI 6)	1 (6.25)
		Regular (IDDSI 7)	1 (6.25)

Note.
[a] International Dysphagia Diet Standardisation Initiative (IDDSI)

Nature of Aphasia, Apraxia of Speech, and Dysarthria Intervention. Participants with aphasia (73.53%), dysarthria (73.53%) and apraxia of speech (16.17%), received various types of intervention (Table 20). The majority of participants who had aphasia received expressive language intervention (86%), and therapy for word-retrieval, including semantic feature analysis (76%). The majority of participants who had dysarthria received intervention for articulation of whom 54% had consonant exaggeration. Therapy for prosody, such as rate modification, was a prominent form of dysarthria management (46%). Eight participants who had apraxia of speech received therapy for automatic speech (72.72%), and articulatory kinematic therapy (72.72%).

Table 20: ***Nature of Aphasia, Dysarthria, and Apraxia of Speech Intervention***

Nature of Aphasia, Dysarthria, and Apraxia of Speech Intervention		n	%
Aphasia		n=50	73.53
	Expressive language intervention	43	86.00
	Therapy for word retrieval	38	76.00
	Receptive language intervention	14	28.00
	Augmentative and Alternative Communication (AAC)	4	8.00
Dysarthria		n=50	73.53
Respiration	Establishing optimal breath group	23	46.00
	Maximum vowel prolongation	10	20.00
	Increasing respiratory support exercises	6	12.00
Articulation	Consonant exaggeration	27	54.00
	Intelligibility drills	19	38.00
	Phonetic placement	11	22.00
Prosody	Rate modification (i.e. decrease speech rate)	23	46.00
Apraxia of Speech		n=11	16.17
	Techniques for severe apraxia (e.g. automatic speech tasks)	8	72.72
	Articulatory Kinematic Approach	8	72.72
	Melodic Intonation Therapy	4	36.36
	AAC	4	36.36
	Other	3	27.27

Note. Some of the participants received more than one type of intervention, hence the interventions are not mutually exclusive.

The Association between Speech, Language and Swallowing Conditions and Referral for Continued SLT Services as an Outpatient

There were no significant associations between SLT conditions in isolation and referral for continued SLT services as an outpatient (Table 21). There were 29 (42.65%) participants who were referred to outpatient therapy, of whom 27 (93.10%) had physical disability (mRS >1-5). There was a maximum of three outpatient referrals per participant and the majority of participants who were referred to outpatient therapy had co-occurring SLT conditions (89.65%) (refer to Table K5 and K6 in Appendix K).

Table 21: ***Association between Speech, Language and Swallowing Conditions and Referral for SLT Outpatient Therapy***

	Dysphagia				
	Dysphagia (*n* = 53)	No Dysphagia (*n* = 15)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Outpatient Referrals (n=29)	0 (0-1)	0 (0-0)	274.5	.039	0.31
	Apraxia of Speech				
	Apraxia (*n* = 11)	No Apraxia (*n* = 57)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	1 (0-1)	0 (0-1)	457.5	.258	0.19
	Dysarthria				
	Dysarthria (*n* = 50)	No Dysarthria (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	0 (0-1)	0 (0-1)	253.5	.680	0.06
	Aphasia				
	Aphasia (*n* = 50)	No Aphasia (*n* = 18)			
	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
	0 (0-1)	0 (0-1)	457.5	.912	0.02

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

Dysphagia with Aspiration and Aspiration Pneumonia

There were 53 participants (78%) who had dysphagia, of whom 34 (64.15%) aspirated, and five (9.43%) developed aspiration pneumonia (Table 22).

Table 22: ***Dysphagia with Aspiration and Aspiration Pneumonia***

Dysphagia n=53 (78%)

	n (%)
Dysphagia with aspiration	34 (64.15)
Aspiration with aspiration pneumonia	5 (14.70)

The Association between Risk Factors and Aspiration Pneumonia

The association between four risk factors (i.e. low LOC, poor oral hygiene, enteral nutrition, and dependent for oral intake) and aspiration pneumonia was determined (Table 23). None of the risk factors were significantly associated with aspiration pneumonia. The majority of participants (94.11%) had good oral hygiene, which was assessed clinically by their treating SLT. All five participants who developed aspiration pneumonia were dependent for oral intake compared to those without aspiration pneumonia, however, this difference was not statistically significant (p=.040).

Table 23: ***Association between Risk Factors and Dysphagia with Aspiration Pneumonia***

	Dysphagia (n=53)				
	Aspiration Pneumonia	No Aspiration Pneumonia	X^2	*p*	Cramer's *V*
Risk Factors	(*n* = 5)	(*n* = 48)			
Dependent for Oral Intake			4.23	.040	0.28
Yes	5	25			
No	0	23			
Enteral Nutrition			1.28	.257	0.16
Yes	4	10			
No	1	38			
Oral Hygiene			-	1.00	0.09
Good	5	44			
Poor	0	4			
Admission LOC			-	1.00	0.01
Non-alert	4	10			
Alert	1	38			

Note. $p < 0.01$ at Bonferroni adjusted alpha level.

Clinical Indicators associated with Dysphagia with Aspiration

Associations between clinical indicators (i.e. LOS, weight loss, degree of disability [mRS scores], and functional level of oral intake [FOIS scores]), and dysphagia with aspiration were determined (Table 24). At admission, dysphagia with aspiration was significantly associated with altered consistency diets (p<.01) (n=21; 61.76%) or enteral nutrition (n=14; 41.17%), with a strong effect size (*r*=0.50). At discharge, dysphagia with aspiration was

significantly associated with altered consistency diets (p<.01) (n=15;44.11%) or enteral nutrition (n=12; 35.29%), with a moderate effect size (*r*=0.49). At admission and discharge, dysphagia with aspiration was significantly associated with poor functional level of oral intake (i.e. altered consistency diets or enteral nutrition). Participants with dysphagia who aspirated stayed for a median of three days longer in hospital compared to those who did not aspirate, but this difference was not statistically significant (p=.091).

Table 24: *Clinical Indicators associated with Dysphagia with Aspiration*

	Dysphagia (n=53)				
	With Aspiration (*n* = 34)	Without Aspiration (*n* = 19)			
Clinical Indicators	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Length of Stay	16 (12-24.75)	13 (8-19.5)	231.5	.091	0.28
Admission weight	77.5 (70-82.13)[a]	75 (69.5-88.5)[b]	72.5	.00	0.01
Admission mRS	5 (4-5)	4 (4-4.5)	253.5	.164	0.22
Discharge mRS	4 (4-5)	4 (3-4)	225	.062	0.30
Admission FOIS	5 (1-5)	6 (5-6)	485.5	**.002	0.50
Discharge FOIS	5 (1-6)	7 (6-7)	479.5	**.003	0.49

*Note.***p* < 0.01 at Bonferroni adjusted alpha level.

[a] Eighteen participants with aspiration did not have an admission weight.

[b] Eight participants without aspiration did not have an admission weight.

Clinical Indicators associated with Dysphagia with Aspiration Pneumonia

Associations between clinical indicators (i.e. LOS, weight loss, degree of disability [mRS scores], functional level of oral intake [FOIS scores]) and dysphagia with aspiration pneumonia were determined (Table 25). At discharge, dysphagia with aspiration pneumonia was significantly associated with severe physical disability (p<.01) (n=5; 100%), with a strong effect size (*r*=0.70). Participants who developed aspiration pneumonia stayed for a median of five days longer in hospital compared to those without aspiration pneumonia, but this difference was not statistically significant (p=.120). Although not significant (p=.019), the majority of participants who developed aspiration pneumonia had enteral nutrition at discharge (median FOIS=1) (n=4; 80%).

Table 25: *Clinical Indicators associated with Dysphagia with Aspiration Pneumonia*

	Dysphagia (n=53)				
	With Aspiration Pneumonia (*n* = 5)	Without Aspiration Pneumonia (*n* = 48)			
Clinical Indicators	Median (IQR)	Median (IQR)	*W*	*p*	Effect size
Length of Stay	20 (16-32)	15 (10-20.25)	68.5	.120	0.43
Admission weight	65 (56-73)[a]	80 (70-87.5)[b]	51	.197	0.48
Admission mRS	5 (5-5)	4 (4-5)	83	.227	0.31
Discharge mRS	5 (5-6)	4 (3-4.25)	35.5	**.008	0.70
Admission FOIS	1 (1-5)	5 (2-6)	174.5	.087	0.45
Discharge FOIS	1 (1-1)	6 (4.5-7)	195	.019	0.63

Note. ***p* < 0.01 at Bonferroni adjusted alpha level.

[a] Three participants with aspiration pneumonia did not have an admission weight.

[b] Twenty-three participants without aspiration pneumonia did not have an admission weight.

The Association between Mortality and Dysphagia with Aspiration and Aspiration Pneumonia

The association between mortality and dysphagia with aspiration and aspiration pneumonia were determined (Table 26). Mortality was not significantly associated with aspiration nor with aspiration pneumonia.

Table 26: ***Association between Mortality and Dysphagia with Aspiration and Aspiration Pneumonia***

	Dysphagia (n=53)				
	With Aspiration (*n* = 34)	Without Aspiration (*n* = 19)	X^2	*p*	Cramer's *V*
Mortality			0.88	.349	0.13
Alive	29	16			
Died	5	3			

	Dysphagia (n=53)				
	With Aspiration Pneumonia (*n* = 5)	Without Aspiration Pneumonia (*n* = 48)	X^2	*p*	Cramer's *V*
			-	.268	0.20
	3	40			
	2	8			

Note. *p* < 0.01 at Bonferroni adjusted alpha level.

Conclusion

The majority of participants had co-occurring diagnoses post-stroke. Aphasia, dysarthria, and dysphagia were the most commonly co-occurring diagnoses. The median time from

admission to SLT referral (hours) was 48 hours for the four speech, language, and swallowing conditions. The median LOS across all four conditions was 15 days. Participants who were referred later than 24 hours stayed in hospital for a median of three days longer than those who were referred within 24 hours. Participants received an average of 11 intervention sessions in a median of 15 days. At admission and discharge, dysphagia with and without aspiration pneumonia was significantly associated with moderate to severe physical disability (mRS 3-5). At admission and discharge, dysphagia with aspiration was significantly associated with altered consistency diets or enteral nutrition. None of the four risk factors (i.e. poor oral hygiene, dependent for oral intake, low level of consciousness, enteral nutrition) were significantly associated with aspiration pneumonia post-stroke.

Chapter 5: Discussion

Speech, Language, and Swallowing Conditions

Dysphagia, aphasia, dysarthria, and apraxia of speech frequently occurred post-stroke. There were 88% of participants who had co-occurring speech, language and swallowing diagnoses, of which dysphagia, aphasia, and dysarthria were the most frequent combination of conditions. The present study's finding indicated that post-stroke, individuals were more likely to have co-occurring speech, language and swallowing conditions compared to conditions in isolation, which is supported by the literature (Balie et al., 2019; De Cock et al., 2020; Flowers et al., 2013; Stipancic et al., 2019). Individuals who present with co-occurring dysphagia, aphasia, and dysarthria post-stroke have increased complexity that requires a wider range of SLT intervention, and careful selection of intervention methods (Mitchell et al., 2021). Individuals who have expressive aphasia may have difficulty communicating symptoms of dysphagia which can lead to untreated aspiration, delayed intervention, increased risk of aspiration pneumonia, and increased LOS which can be prevented (Bryer et al., 2010; Lazar & Boehmer, 2017; Mitchell et al., 2021; Whitehead & Baalbergen, 2019). Individuals with co-occurring communication difficulties (e.g. dysarthria, receptive and expressive aphasia) may have difficulty communicating effectively with family and friends, which can lead to frustration and depression (Baker, Worrall, Rose & Bryan, 2021; Rose, Wallace & Leow, 2019; Souchon, Krüger, Eccles & Pillay, 2020). Individuals with receptive aphasia might have difficulty understanding and following instructions for management of other co-occurring conditions (e.g. dysarthria and dysphagia), which influences the selection of intervention techniques (Mattioli, 2019). Additionally, communication difficulties, such as dysarthria and aphasia, will impact educating and counselling individuals, and affect their ability to make decisions on treatment options (McCormick, Bose & Marinis, 2017; Stipancic et al., 2019). Individuals referred for SLT post-stroke in the private sector are likely to present with co-occurring dysphagia, aphasia, and dysarthria, that requires comprehensive intervention.

Timeliness of SLT Referral and Length of Stay

The association between timeliness of SLT referral and LOS was determined in the present study. The majority of participants were referred within 48 hours, which is not compliant with the World Stroke Organisation (2021), which recommends SLT referrals and swallow screening occur as early as possible (i.e. within 24 hours of stroke admission). In South Africa's public sector, the average time from admission to SLT referral was 72 hours (Balie et al., 2019), which was a longer delay in referral compared to the present study, and suggests that private hospitals may be more timely at referring individuals with stroke to SLT services. In the present study, participants who were referred to SLT after 24 hours stayed in hospital for an average of three days longer compared to those who were referred within 24 hours. While not significant, this finding suggests a trend toward delayed SLT referrals being associated with an increased LOS, which was a consistent finding in previous public sector studies (Balie et al., 2019; Han et al., 2018; Viljoen et al., 2014). Delayed SLT referrals are associated with delayed communication and swallowing screening and intervention, which are related with subsequent consequences such as unsafe oral feeding, aspiration pneumonia and dehydration, and influences when one is medically stable for discharge (Arnold et al., 2016; Bray et al., 2017; Cohen et al., 2016; Feng et al., 2019; Han et al., 2018; Mitchell et al., 2021; Schwarz et al., 2018; Viljoen et al., 2014). In order to reduce LOS in the acute setting, SLTs need to raise awareness of the consequences of delayed referrals; establish referral guidelines and pathways for healthcare professionals (i.e. Medical Doctors, nurses) who are first in contact with individuals with stroke following admission; and monitor the efficiency of speech and swallow screening programmes (e.g. Aphasia Rating Scale [ASRS], Gugging Swallowing Screen [GUSS]) (Andrews & Pillay, 2017; Bray et al., 2017; Glize et al., 2015; Joundi et al., 2017; Martino et al., 2012; Palli et al., 2017; Pierpoint & Pillay, 2020; Viljoen et al., 2014; Yeh et al., 2011).

Length of Stay

Participants stayed in hospital longer (median LOS: 15 days) in the present study, compared to the public sector (median LOS: 12.5 days) (Balie et al., 2019). Although there were no significant associations between SLT conditions and LOS, participants with

dysphagia and aphasia were associated with a longer LOS, which is in alignment with the literature (Bray et al., 2017; Lazar & Boehme, 2017; Mitchell et al., 2021; Schwarz et al., 2018). Participants with dysphagia who aspirated and developed aspiration pneumonia stayed in hospital longer compared to those who did not aspirate, which was similarly reported in previous studies (Balie et al., 2019; Finlayson et al., 2011; Schwarz et al., 2018). Dysphagia with aspiration and aspiration pneumonia may be associated with a longer LOS as a result of increased time in transitioning from enteral nutrition to total oral intake, poor medical status, and physical disability (Armstrong & Mosher, 2011; Maeda, Murotani, Kamoshita, Horikoshi, & Kuroda, 2021; Schwarz et al., 2018; Smithard, 2016). It is necessary to manage dysphagia in individuals' post-stroke by providing timely SLT intervention to minimise aspiration and to reduce the risk of aspiration pneumonia; which can improve patient outcomes and reduce healthcare costs which are associated with an increased LOS (Bray et al., 2017; Han et al., 2018; Viljoen et al., 2014).

Degree of Physical Disability Post-Stroke

Moderate to severe physical disability (mRS 3-6) post-stroke on admission and discharge was associated with dysphagia; and severe physical disability (mRS 5) was associated with aspiration pneumonia at discharge. These findings are supported by previous studies (Al-Khaled et al., 2016; Brueining & Al-Khlaed, 2015; Langmore et al., 1998; Schwarz et al., 2018; Souza et al., 2020). SLTs should be aware that moderate to severe disability is associated with dysphagia with aspiration pneumonia in individuals' post-stroke; and should incorporate this information into planning and delivering dysphagia management that reduces aspiration pneumonia risk and optimizes patient outcomes (Brueining & Al-Khaled, 2015; Schwarz et al., 2018). Dysphagia is managed best by a multi-disciplinary team for collaborative patient care (Kelly, Cronin, Hynes, Duxbury & Twomey, 2021; Pierpoint & Pillay, 2020). SLTs can advise the team (i.e. Physiotherapists and Occupational Therapists) to assist individuals' post-stroke who have physical disability by positioning them upright for mealtimes and practicing self-feeding, which will facilitate safe swallowing and reduce the risk of aspiration (Kwok et al., 2015; Pedra, Pontes, Mourão, Braga, & Vicente, 2020).

In the present study, speech and language conditions were associated with a lower degree of disability at admission and discharge (mRS 0-1), compared to dysphagia. In contrast, previous studies have found an association between aphasia, dysarthria, and physical disability post-stroke (Ali et al., 2013; Mitchell et al., 2021). Although not significant, a higher degree of physical disability post-stroke (mRS 3-5) at discharge was associated with co-occurring speech, language and swallowing conditions. Similarly, Balie et al. (2019) found moderate to severe physical disability was associated with co-occurring speech, language and swallowing conditions post-stroke. Future research should further investigate the association between moderate to severe physical disability post-stroke and co-occurring speech, language and swallowing conditions; and how this association impacts patient outcomes.

Functional Level of Oral Intake Post-Stroke

Dysphagia with aspiration was significantly associated with poor functional level of oral intake (i.e. altered consistency diets and enteral nutrition) at admission and discharge. Similarly, in the public sector, individuals who had dysphagia with aspiration received altered consistency diets and enteral nutrition (Balie et al., 2019). Individuals' post-stroke who have dysphagia with aspiration are at an increased risk for oral and pharyngeal phase difficulties; hence they are more likely to receive altered consistency diets to assist with safe eating and swallowing; and enteral nutrition to optimise nutrition and hydration (Cichero et al., 2017; Cohen et al., 2016; Lee et al., 2016; Schimmel et al., 2017; Smithard, 2016). At discharge, most participants (43.39%) continued to receive altered consistency diets; 15 (28.30%) participants who were receiving altered consistency diets at admission returned to a regular diet or total oral intake (FOIS 7); and seven participants (13.20%) regressed to a lower level of oral intake or enteral nutrition.

Mode of Dysphagia Assessment and Enteral Nutrition

Decisions for enteral nutrition placement for participants with dysphagia with aspiration risk were based on subjective clinical assessments (i.e. CSE), which is in accordance with South African Stroke Guidelines (Bryer et al., 2011). The majority of participants who were

placed on enteral nutrition had not been assessed via objective assessments (i.e. VFSS, FEES) (81.25%). This finding indicates that objective swallow assessments were not used frequently in the private sector. Objective assessments are useful as it yields information about the presence or absence of aspiration, including silent aspiration; identifies swallow function and impairment contributing to aspiration; and provides the opportunity to assess the efficacy of trial interventions (Fattori et al., 2016; Field et al., 2018; Mancopes et al., 2014; Seo, Ku, & Park, 2021; Warnecke, Dziewas & Langmore, 2021). Although private hospitals have regular access to well-functioning technology for objective assessments (i.e. VFSS, FEES) (Ranchod et al., 2017; Young, 2016); factors such as limited medical aid insurance cover may explain the infrequent utilisation of these assessments, which are often expensive (Benatar, 2013). Objective assessments are not applicable for all individuals with post-stroke dysphagia in acute care, especially individuals who have severe physical disability or who have a poor medical status, which can impact transportation to radiology and positioning for the assessment (Brodsky et al., 2019; Eltringham et al., 2018). Utilising objective assessments for all individuals with post-stroke dysphagia may also increase the risk of over-servicing (Young, 2016; Ruiters & Van Niekerk, 2014). The majority (91.66%) of participants who had a low LOC at admission were placed on enteral nutrition as standard of care, which is likely due to poor cough reflex and difficulty coordinating breathing and swallowing as reported in the literature (Kenzaka et al., 2017; Mandell & Niederman, 2019). The majority (80%) of participants who had aspiration pneumonia continued with enteral nutrition at discharge. Individuals with aspiration pneumonia post-stroke are likely to have long-term enteral nutrition due to severe dysphagia with aspiration and compromised medical status (Maeda et al., 2021; Schwarz et al., 2018). The majority (62.5%) of participants who were placed on enteral nutrition following admission were still receiving enteral nutrition at discharge. This result indicated that there was limited progress in mode of nutritional intake from admission to discharge. Long-term enteral nutrition may be associated with severe physical disability (mRS 3-5), co-occurring speech, language and swallowing

conditions, elderly and retired population, ischaemic stroke, and low LOC (Dziewas et al., 2004; Kenzaka et al., 2017; Schwarz et al., 2018; Viljoen et al., 2014). At discharge, caregivers and healthcare workers at step-down facilities need to be counselled that although enteral nutrition is important for maintaining nutrition and hydration, it does not prevent aspiration and aspiration pneumonia; therefore, precautionary measures are necessary such as positioning adjustments and regular oral care (Langdon et al., 2009; Mandell & Niederman, 2019).

Dehydration Post-Stroke

There were no significant associations between dehydration and speech, language and swallowing conditions post-stroke which may be associated with efficient management of acute complications at admission in private healthcare (Ruiz-Sandoval et al., 2018). Previous studies have found that dysphagia post-stroke can predispose individuals to dehydration due to fear of choking and poor oral intake due to reduced palatability of altered food or liquid consistencies (e.g. thickened liquids) (Baijens et al., 2017; Carnaby-Mann, Lenius, & Crary, 2007; Crary et al., 2013; McCurtin et al., 2018). In the present study, all three participants who had admission dehydration had co-occurring speech, language and swallowing conditions, and had moderate to severe physical disability (mRS 3-5). Two of these participants died during the study. Associations between dehydration, physical disability, and mortality have been reported in previous studies (Crary et al., 2013; Rowat, Graham & Dennis, 2012; Jeong et al., 2018). Although dehydration was not a significant complication post-stroke in the private sector, the multi-disciplinary team needs to be aware that a high complexity of co-occurring impairments (i.e. speech, language, swallowing and physical disability) may be associated with an increased risk of dehydration.

Aspiration and Aspiration Pneumonia Post-Stroke

The majority of participants who had dysphagia aspirated (64.15%), which was similarly found in the public sector (Balie et al., 2019). Previous international studies have similarly reported that individuals with post-stroke dysphagia have a high-risk for aspiration (Aoki et al., 2016; Arnold et al., 2016; Feng et al., 2019; Mandell & Niederman, 2019; Martino et al.,

2005). Most participants with dysphagia who aspirated did not develop aspiration pneumonia (85.29%). A low incidence of aspiration pneumonia compared to aspiration elucidates previous studies' findings that not everyone who aspirates develops aspiration pneumonia, and additional risk factors are associated with the development of aspiration pneumonia (Brogan et al., 2014; Langmore et al., 1998; Langmore, Skarupski, Park & Fries, 2002; Mandell & Niederman, 2019). None of the four risk factors; poor oral hygiene, dependent for oral intake, low LOC, and enteral nutrition; were significantly associated with aspiration pneumonia post-stroke, which may have been related to regular oral care and early SLT referrals and dysphagia intervention in the private sector. Previous studies have similarly reported that regular oral care, dysphagia management (e.g. positioning adjustments), and medical intervention (i.e. daily oxygen therapy, antibiotics) are associated with reduced incidence of aspiration pneumonia post-stroke (Mandell & Niederman, 2019; Murray & Scholten, 2018). Although not significant, all five participants who developed aspiration pneumonia in the present study, were dependent for oral intake. Research has shown that being dependent for oral intake is associated with aspiration pneumonia due to poorly trained caregivers and rushed feeding pace, resulting in aspiration (Huang et al., 2006; Langmore et al., 1998; Langmore et al., 2002; Wright, Cotter & Hickson, 2008), and is often observed in clinical settings. Nursing staff and caregivers require SLT training on how to safely feed those with post-stroke dysphagia (e.g. slow feeding pace, bolus volume modifications, upright positioning) to prevent aspiration and aspiration pneumonia (Huang et al., 2006; Pierpoint & Pillay, 2020; Schwarz et al., 2018; Wright, Cotter & Hickson, 2008).

Mortality Post-Stroke

Ten participants died during the study period of whom all had two to four co-occurring SLT diagnoses. Balie et al. (2019) found there was significantly more individuals without an SLT diagnosis post-stroke died, indicating that speech, language and swallowing conditions do not significantly predict mortality, and additional factors (e.g. comorbidities) may increase one's risk of mortality. In the present study, participants who had dysphagia were more likely to die compared to those without dysphagia, which was similarly reported in the public sector

(De Villiers et al., 2011). Dysphagia post-stroke is associated with mortality due to increased risk of related complications such as enteral nutrition, aspiration pneumonia, dehydration, weight loss, and malnutrition (Arnold et al., 2016; Feng et al., 2019; Schwarz et al. 2018; Viljoen et al., 2014). From the five participants who developed aspiration pneumonia, 40% died during the study period. There were no significant associations between mortality and aspiration pneumonia in the present study which may have occurred due to the low incidence of aspiration pneumonia. In comparison, previous studies with large study populations have reported associations between aspiration pneumonia and mortality post-stroke (Feng et al., 2019; Schwarz et al., 2018); and increased risk for mortality up to 1-year post-stroke (Teh et al., 2018). Early acute care SLT intervention is necessary to manage dysphagia post-stroke (Bray et al., 2017) and prevent complications, such as aspiration pneumonia, which are associated with increased risk for mortality (Feng et al., 2019; Mandell & Niederman, 2019).

Dysphagia Intervention

In the present study, all participants with dysphagia received compensatory strategies (100%); whereas, swallow exercises (54.71%) and sensory stimulation (35.85%) were less often implemented, which was similarly found in the public sector (Balie et al., 2019). Compensatory strategies (e.g. head postures, upright positioning, modifications to bolus volume) may have been implemented more frequently to compensate for swallowing deficits that were not yet sufficiently rehabilitated (ASHA, 2021); and were effective in preventing dysphagia symptoms, managing swallow safety and maintaining nutrition and hydration intake (Johnson et al., 2014; Lazarus, 2017). Swallow exercises were necessary for participants as these exercises reportedly improve neural plasticity and swallowing recovery long-term (Inamoto et al., 2018; Smithard, 2016). In the present study, sensory stimuli (e.g. ice, thermal tactile stimulation) was often used for sensory stimulation therapy. Previous studies have reported sensory stimuli has shown improvement in pharyngo-oesophageal swallowing biomechanics and is an effective dysphagia intervention (Gatto et al., 2021; Nakamura, & Fujishima, 2013; Teismann et al., 2009). Dysphagia intervention techniques

provided to participants in the present study were supported by evidence-based research (Cohen et al., 2016; Inamoto et al., 2018; Robbins et al., 2007; Smithard, 2016).

Speech and Language Intervention

All participants with aphasia, apraxia of speech, and dysarthria received speech and language assessment and intervention. The majority of participants with aphasia received expressive language intervention (86%) compared to receptive language intervention (28%). Most participants with dysarthria received articulation, respiration, and prosody intervention to improve speech intelligibility. Consonant exaggeration was frequently provided and is a technique that has shown clinical improvement in speech intelligibility in the Clear Speech dysarthria program by Park et al. (2016). Prosody management, specifically rate modification, was a common form of dysarthria intervention. Consonant exaggeration and rate modification were beneficial strategies compared to other dysarthria techniques as imprecise articulation, reduced speech intelligibility, and slow speaking rate, commonly occurs post-stroke, regardless of stroke location (Mackenzie, 2011). Participants with apraxia of speech often received techniques such as automatic speech tasks and articulatory kinematic techniques (i.e., Rosenbek's 8 step-Continuum Technique), which are evidence-based strategies for improving articulation accuracy (Mauszycki & Wambaugh, 2011; Van Sickle, 2016). Previous research has found articulatory-kinematic approach has more efficacy compared to other apraxia therapy techniques (Wambaugh, Nessler, Cameron & Mauszycki, 2012; Wambaugh, 2021). Several evidence-based speech, language and swallowing intervention techniques were used to manage aphasia, apraxia of speech, dysarthria, and dysphagia; however, participants' level of communication and swallowing progress and associated outcomes at discharge were not determined. Future research should assess the efficacy of communication and swallowing intervention techniques for individuals' post-stroke.

Number of SLT Intervention Sessions

There were no significant differences in the number of SLT intervention sessions across all four speech, language and swallowing conditions. Participants with co-occurring conditions had intervention sessions comprised of a combination of speech, language, and swallowing management, which may have contributed to an equal number of sessions. In comparison, the public sector found individuals' post-stroke received more dysphagia intervention sessions than aphasia, apraxia of speech, and dysarthria; despite dysarthria having the highest incidence (Balie et al., 2019). Prioritisation of dysphagia intervention is likely due to associated risk of complications (Feng et al., 2019; Hersh, 2016; Mandell & Niederman, 2019; Mitchell et al., 2021; Schwarz et al., 2018; Viljoen et al., 2014). Due to the fast-paced nature of acute care, the focus is typically on discharge planning and transfer to step-down facilities, hence SLTs prioritise dysphagia management, as there is limited time to manage speech and language conditions comprehensively (Hersh, 2016). Not prioritising speech and language management in acute care is an important issue to address as individuals' post-stroke who have communication impairment may miss out on early neurological recovery, which has an impact on social participation and quality of life ((Hersh, 2016; Mc Menamin, Tierney & Mac Farlane, 2015; Mitchell et al., 2021). SLTs need to advocate the importance of speech and language management in the acute setting and encourage the stroke multi-disciplinary team to incorporate communication management techniques in their intervention sessions (e.g. AAC), for holistic management (Hersh, 2016).

Participants received an average of 11 intervention sessions in a median of 15 days, in the present study; whereas, individuals' post-stroke in the public sector had an average of two intervention sessions in a median of 12.5 days (Balie et al., 2019). There were more SLT intervention sessions per median time (0.73) in the private sector, compared to the public sector (0.16). A low frequency of intervention in the public sector was reportedly due to prioritisation of medical and nursing care (Balie et al., 2019). A high frequency of intervention in the acute setting is beneficial as it is associated with favourable outcomes such as earlier stroke recovery (Martino et al., 2012), and improvement of swallowing ability (Bryer et al., 2011; Han et al., 2018). An increased number of intervention sessions in the private sector

could have occurred due to a lower patient demand and increased availability of SLTs (Pillay et al., 2020; Young, 2016). Additionally, as part of the Practice's standard of care, SLTs treated individuals' post-stroke on weekends (i.e., Saturday and Sunday) in addition to weekdays, which may have contributed to a high number of intervention sessions.

Outpatient Referrals

Participants received an approximately equal number of outpatient referrals across all speech, language and swallowing conditions. The majority of participants who were referred for continued SLT services as an outpatient had co-occurring speech, language and swallowing conditions (89.65%), and most of these participants had co-occurring dysphagia, aphasia, and dysarthria (57.69%). In addition, the majority of participants who were referred to outpatient therapy had a discharge mRS score of >1-6 (93.10%), signalling physical disability. These findings suggested that individuals' post-stroke with a complexity of co-occurring speech, language and swallowing difficulties and physical disability may be associated with being referred for outpatient therapy. Similarly, Balie et al. (2019) found a significant number of individuals' post-stroke with co-occurring speech, language and swallowing conditions and physical disability were referred for outpatient therapy, compared to conditions in isolation. Due to a high incidence of co-occurring conditions post-stroke, outpatient therapy was necessary to continue managing these conditions, and assist individuals with improving function, activity and participation (Whitehead & Baalbergen, 2019; WHO, 2001).

Strengths and Limitations

The study's strengths included a prospective cohort design which was advantageous as it allowed for the ability to control and access information from participants' hospital folders during data collection and analysis (Gregory & Radovinsky, 2012); the incidence of speech, language and swallowing conditions were determined; multiple outcomes were investigated; and the temporal sequence between risk factors and associated outcomes were determined (De Rango, 2016; Hoffman, 2015; Parfey & Barrett, 2015; Sedgwick, 2013a). The study was conducted in South Africa's private acute care sector compared to the majority of existing

stroke research in the public sector (Balie et al., 2019; Bryer et al., 2011; Cawood & Visagie, 2016; De Villiers et al., 2011; Seedat & Penn, 2016; Viljoen et al., 2014). The study was set at five private hospitals in the Western Cape representing four hospital network organisations, which increased external validity (Zohrabi, 2013). Confounding variables were controlled, such as excluding those who had co-occurring stroke and COVID-19 diagnoses, to avoid ambiguous results (Hess et al., 2020).

There were several limitations that were encountered during the study's data collection process which may have affected the validity of results. Convenience sampling was used which may have introduced bias and lack of generalisability, compared to randomised controlled trials (Lim & In, 2019). The study's sample size was small which affected the statistical power of several findings. During data collection, there were some variables which were not consistently recorded in participants' hospital folders; such as admission and discharge weight, stroke severity according to the NIHSS score, and stroke classification as per OCSP criteria; therefore, the association between these variables and outcomes could not accurately be determined.

Future Recommendations

Future recommendations include investigating associations between co-occurring speech, language and swallowing conditions post-stroke and outcomes (i.e. degree of disability, functional level of oral intake, dehydration, mortality, LOS); as co-occurring conditions frequently occurred post-stroke in the present study, and there were trends toward association with outcomes. Future research should further investigate the nature of SLT services and stroke outcomes in South African private and public healthcare, which can assist with future development of equitable stroke care.

Conclusion

This prospective cohort study investigated risk factors and outcomes associated with speech, language and swallowing conditions post-stroke in the private acute care sector in the Cape Metropolitan area, South Africa. Co-occurring speech, language and swallowing conditions frequently occurred post-stroke. Participants who were referred to speech therapy greater than 24 hours, and who had dysphagia with aspiration and aspiration pneumonia, had a longer LOS. Dysphagia and aspiration pneumonia were significantly associated with moderate to severe physical disability. Dysphagia with aspiration was significantly associated with poor functional level of oral intake (i.e. altered consistency diets and enteral nutrition). Participants with dysphagia had a higher likelihood of mortality, compared to speech and language conditions. None of the four risk factors; poor oral hygiene, low LOC, dependent for oral intake, enteral nutrition; were associated with aspiration pneumonia, but all participants who had aspiration pneumonia were dependent for oral intake. There were no significant differences in the number of speech, language and swallowing intervention sessions across all four conditions. Participants with co-occurring speech, language and swallowing conditions and physical disability were more likely to be referred for outpatient therapy. The study has shown that dysphagia post-stroke was strongly associated with unfavourable outcomes in the private sector, which has implications for the acute setting such as early SLT referrals (i.e. within 24 hours) and multi-disciplinary stroke management. Given the lack of existing research in private healthcare, this study has provided knowledge on speech, language and swallowing conditions post-stroke and association with risk factors, nature of SLT services, and outcomes in South Africa's private acute care sector.

References

Ali, M., Lyden, P., & Brady, M. (2013). Aphasia and dysarthria in acute stroke: Recovery and functional outcome. *International Journal of Stroke, 10*(3), 400-406. doi:10.1111/ijs.12067.

Al-Khaled, M., Matthis, C., Binder, A., Mudter, J., Schattschneider, J., Pulkowski, U., . . . Royl, G. (2016). Dysphagia in Patients with Acute Ischemic Stroke: Early Dysphagia Screening May Reduce Stroke-Related Pneumonia and Improve Stroke Outcomes. *Cerebrovascular Diseases, 42*, 81+. Retrieved from https://link-gale-com.ezproxy.uct.ac.za/apps/doc/A599052579/AONE?u=unict&sid=AONE&xid=429a51ba.

Amarenco, P., Bogousslavsky, J., Caplan, L. R., Donnan, G. A., & Hennerici, M. G. (2009). Classification of stroke subtypes. *Cerebrovascular Diseases, 27*(5), 493-501. doi:10.1159/000210432.

Ameer, K., & Ali, K. (2017). iPad use in stroke neuro-rehabilitation. *Geriatrics, 2*(1), 2.

Anderson, M.J., Smith, A.L; Borgert, A.J. & Hartman, D.E. (2015). Aspiration pneumonia after screening and diagnostic procedures for dysphagia following acute stroke. *Gunderson Medical Journal, 9*(1).

Andrews, M., & Pillay, M. (2017). Poor consistency in evaluating South African adults with neurogenic dysphagia. *South African Journal of Communication Disorders, 64*, 1-14. Retrieved from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2225-47652017000100001&nrm=iso.

Aoki, K., Iguchi, A., & Watabe, T. (2020). Evaluation of functional independence measure item scores for predicting home discharge after acute stroke rehabilitation. *Japanese Journal of Comprehensive Rehabilitation Science, 11*, 17-20.

Aoki, S., Hosomi, N., Hirayama, J., Nakamori, M., Yoshikawa, M., Nezu, T., . . . Matsumoto, M. (2016). The multidisciplinary swallowing team approach decreases pneumonia onset in acute stroke patients. *PloS One, 11*(5), e0154608. doi:10.1371/journal.pone.0154608.

Aoyagi, M., Furuya, J., Matsubara, C., Yoshimi, K., Nakane, A., Nakagawa, K., . . . Minakuchi, S. (2021). Association between Improvement of Oral Health, Swallowing Function, and Nutritional Intake Method in Acute Stroke Patients. *International Journal of Environmental Research and Public Health, 18*(21), 11379. Retrieved from https://mdpi-res.com/d_attachment/ijerph/ijerph-18-11379/article_deploy/ijerph-18-11379-v3.pdf.

Armstrong, J. R., & Mosher, B. D. (2011). Aspiration pneumonia after stroke: Intervention and prevention. *Neurohospitalist, 1*(2), 85-93. doi:10.1177/1941875210395775.

Arnold, M., Liesirova, K., Broeg-Morvay, A., Meisterernst, J., Schlager, M., Mono, M. L., . . . Sarikaya, H. (2016). Dysphagia in acute stroke: Incidence, burden and impact on clinical outcome. *PloS One, 11*(2), e0148424. doi:10.1371/journal.pone.0148424.

American Speech-Language-Hearing Association (ASHA) (2021). Adult Dysphagia. https://www.asha.org/practice-portal/clinical-topics/adult-dysphagia/.

Avula, A., Nalleballe, K., Narula, N., Sapozhnikov, S., Dandu, V., Toom, S., . . . Elsayegh, D. (2020). COVID-19 presenting as stroke. *Brain, Behavior, and Immunity, 87*, 115-119. doi:10.1016/j.bbi.2020.04.077.

Bahouth, M. N., Gottesman, R. F., & Szanton, S. L. (2018). Primary 'dehydration' and acute stroke: a systematic research review. *Journal of Neurology, 265*(10), 2167-2181.

Bahouth M., Hillis, A., & Gottesman, R. (2015). Abstract T MP86: A Prospective study of the effect of dehydration on stroke severity and short-term outcome. *Stroke, 46*(suppl_1), ATMP86-ATMP86. doi:10.1161/str.46.suppl_1.tmp86.

Baijens, L., Clavé, P., Cras, P., Ekberg, O., Forster, A., Kolb, G., . . . Walshe, M. (2017). European Society for Swallowing Disorders – European Union Geriatric Medicine Society white paper: Oropharyngeal dysphagia as a geriatric syndrome. *Clinical Interventions in Ageing*.

Baiu, I., & Spain, D. A. (2019). Enteral Nutrition. *JAMA, 321*(20), 2040-2040. doi:10.1001/jama.2019.4407.

Balie, M., Botha, T., Hendricks, M., Kirstein, C. & Malathela, K. (2019). Clinical outcomes associated with speech, language and swallowing difficulties post-stroke – A Retrospective review [Unpublished Honours Dissertation]. University of Cape Town.

Baker, C., Worrall, L., Rose, M., & Ryan, B. (2021). Stroke health professionals' management of depression after post-stroke aphasia: a qualitative study. *Disability and Rehabilitation, 43*(2), 217-228. doi:10.1080/09638288.2019.1621394.

Banks, J. L., & Marotta, C. A. (2007). Outcomes validity and reliability of the modified rankin scale: implications for stroke clinical trials: A literature review and synthesis. *Stroke, 38*(3), 1091-1096. doi:10.1161/01.STR.0000258355.23810.c6.

Baracchini, C., Pieroni, A., Viaro, F., Cianci, V., Cattelan, A. M., Tiberio, I., . . . Causin, F. (2020). Acute stroke management pathway during Coronavirus-19 pandemic. *Neurological Sciences*, 1-3.

Barreto, A. D. (2011). Intravenous thrombolytics for ischemic stroke. *Neurotherapeutics: The Journal of the American Society for Experimental Neurotherapeutics, 8*(3), 388-399. doi:10.1007/s13311-011-0049-x.

Basilakos, A. (2018). Contemporary approaches to the management of post-stroke apraxia of speech. In *Seminars in speech and language vol. 39*, no. 01, pp. 025-036. Thieme Medical Publishers.

Bath, P. M., Lee, H. S., & Everton, L. F. (2019). Swallowing therapy for dysphagia in acute and subacute stroke. *Cochrane Database of Systematic Reviews*(10). doi:10.1002/14651858.CD000323.pub3.

Benatar, S. (2013). The challenges of health disparities in South Africa. *SAMJ: South African Medical Journal, 103*, 154-155. Retrieved from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0256-95742013000300020&nrm=iso.

Bernhardt, J., Godecke, E., Johnson, L., & Langhorne, P. (2017). Early rehabilitation after stroke. *Current Opinion in Neurology*, *30*(1), 48-54.

Blomgren, C., Samuelsson, H., Blomstrand, C., Jern, C., Jood, K., & Claesson, L. (2019). Long-term performance of instrumental activities of daily living in young and middle-aged stroke survivors—Impact of cognitive dysfunction, emotional problems and fatigue. *PloS One, 14*(5), e0216822. doi:10.1371/journal.pone.0216822.

Boulanger, J. M., Lindsay, M. P., Gubitz, G., Smith, E. E., Stotts, G., Foley, N., . . . Butcher, K. (2018). Canadian stroke best practice recommendations for acute stroke management: prehospital, emergency department, and acute inpatient stroke care, 6th Edition, Update 2018. *International Journal of Stroke, 13*(9), 949-984. doi:10.1177/1747493018786616.

Bray, B. D., Smith, C. J., Cloud, G. C., Enderby, P., James, M., Paley, L., & Rudd, A. G. (2017). The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-associated pneumonia. *Journal of Neurology, Neurosurgery, and Psychiatry*, jnnp-2016.

Brodsky, M., Mayfield, E. and Gross, R. (2019). Clinical decision making in the ICU: Dysphagia screening, assessment, and treatment. *Seminars in Speech and Language*, *40*(03), 170-187.

Brogan, E., Langdon, C., Brookes, K., Budgeon, C., & Blacker, D. (2014). Respiratory infections in acute stroke: Nasogastric tubes and immobility are stronger predictors than dysphagia. *Dysphagia, 29*(3), 340-345. doi:10.1007/s00455-013-9514-5.

Bryer, A., Connor, M. D., Haug, P., Cheyip, B., Staub, H., Tipping, B., . . . Pinkney-Atkinson, V. (2011). South African guideline for management of ischaemic stroke and transient ischaemic attack 2010: A guideline from the South African Stroke Society (SASS) and the SASS Writing Committee. *SAMJ: South African Medical Journal, 100*, 750-778.

Burger, R., & Christian, C. (2020). Access to health care in post-apartheid South Africa: availability, affordability, acceptability. *Health Economics, Policy and Law, 15*(1), 43-55. doi:10.1017/S1744133118000300.

Campbell, B. C. V., Donnan, G. A., Mitchell, P. J., & Davis, S. M. (2016). Endovascular thrombectomy for stroke: current best practice and future goals. *Stroke and Vascular Neurology, 1*(1), 16. doi:10.1136/svn-2015-000004.

Carnaby-Mann, G., Lenius, K., & Crary, M. A. (2007). Update on assessment and management of dysphagia post stroke. *Northeast Florida Medicine, 58*(2), 31-34.

Castro, S. S., & Leite, C. F. (2017). Translation and cross-cultural adaptation of the World Health Organization Disability Assessment Schedule-WHODAS 2.0. *Fisioterapia e Pesquisa, 24*, 385-391.

Cawood, J., & Visagie, S. (2016). Stroke management and functional outcomes of stroke survivors in an urban Western Cape Province setting. *South African Journal of Occupational Therapy, 46*(3). doi:10.17159/2310-3833/2016/v46n3a5.

Chimatiro, G. L., & Rhoda, A. J. (2019). Scoping review of acute stroke care management and rehabilitation in low and middle-income countries. *BMC Health Services Research, 19*(1), 789. doi:10.1186/s12913-019-4654-4.

Cichero, J. A. Y., Lam, P., Steele, C. M., Hanson, B., Chen, J., Dantas, R. O., . . . Stanschus, S. (2017). Development of International Terminology and Definitions for Texture-Modified Foods and Thickened Fluids Used in Dysphagia Management: The IDDSI Framework. *Dysphagia, 32*(2), 293-314. doi:10.1007/s00455-016-9758-y.

Cohen, D. L., Roffe, C., Beavan, J., Blackett, B., Fairfield, C. A., Hamdy, S., . . . Randall, M. (2016). Post-stroke dysphagia: A review and design considerations for future trials. *International Journal of Stroke, 11*(4), 399-411.

Cortés-Vicente, E., Guisado-Alonso, D., Delgado-Mederos, R., Camps-Renom, P., Prats-Sánchez, L., Martínez-Domeño, A., & Martí-Fàbregas, J. (2020). Corrigendum: Frequency, risk factors, and prognosis of dehydration in acute stroke. *Frontiers in Neurology, 11*, 717. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7380263/pdf/fneur-11-00717.pdf.

Crary, M. A., Mann, G. D., & Groher, M. E. (2005). Initial psychometric assessment of a functional oral intake scale for dysphagia in stroke patients. *Archives of Physical Medicine and Rehabilitation, 86*(8), 1516-1520. doi:10.1016/j.apmr.2004.11.049.

Crary, M. A., Humphrey, J. L., Carnaby-Mann, G., Sambandam, R., Miller, L., & Silliman, S. (2013). Dysphagia, nutrition, and hydration in ischemic stroke patients at admission and discharge from acute care. *Dysphagia, 28*(1), 69-76. doi:10.1007/s00455-012-9414-0.

De Cock, E., Batens, K., Hemelsoet, D., Boon, P., Oostra, K. and De Herdt, V. (2020). Dysphagia, dysarthria and aphasia following a first acute ischaemic stroke: incidence and associated factors. *European Journal of Neurology, 27:* 2014-2021. https://doi.org/10.1111/ene.14385.

De Rango, P. (2016). Prospective cohort studies. *European Journal of Vascular and Endovascular Surgery, 51*(1), 151-151. doi:10.1016/j.ejvs.2015.09.021.

Department of Health (2011). Green Paper: National Health Insurance in South Africa. [Cited 11 October 2020]. Available from: http://www.hst.org.za/publications/green-paper-national-health-insurance-south-africa.

De Villiers, K. (2021). Bridging the health inequality gap: An examination of South Africa's social innovation in health landscape. *Infectious Diseases of Poverty, 10*(1), 19. doi:10.1186/s40249-021-00804-9.

De Villiers, L., Badri, M., Ferreira, M., & Bryer, A. (2011). Stroke outcomes in a socio-economically disadvantaged urban community. *South African Medical Journal = Suid-Afrikaanse Tydskrif Vir Geneeskunde, 101*(5), 345. doi:10.7196/SAMJ.4588.

DiBardino, D.M. & Wunderink, R.G. (2015). Aspiration pneumonia: A review of modern trends. *Journal of Critical Care, 30*(1), 40-48.

Dong, X., Yu-Hong, C., Lan -Tao, W., Bin, Y., Zhi -Bin, R., & Li, C. (2021). Evaluation of the therapeutic effect of high-flow nasal cannula oxygen therapy on patients with aspiration pneumonia accompanied by respiratory failure in the post-stroke sequelae stage. *BMC Pulmonary Medicine, 21*(1), 1-17. doi:10.1186/s12890-020-01359-5.

Dudaryk, R., Epstein, R. H., & Varon, A. J. (2018). Nil Per Os consideration for emergency procedures: Cornerstone of safety or an obstacle to patient care? *Anesthesia and Analgesia, 127*(3). Retrieved from https://journals.lww.com/anesthesia-analgesia/Fulltext/2018/09000/Nil_Per_Os_Consideration_for_Emergency_Procedures_.33.aspx.

Dye et al., (2013). World Health Report: Research for universal health coverage. Geneva: WHO. [Cited 11 October 2020].

Dziewas, R., Ritter, M., Schilling, M., Konrad, C., Oelenberg, S., Nabavi, D. G., . . . Lüdemann, P. (2004). Pneumonia in acute stroke patients fed by nasogastric tube. *Journal of Neurology, Neurosurgery & Psychiatry, 75*(6), 852. doi:10.1136/jnnp.2003.019075.

Eisenstadt, E.S. (2010). Dysphagia and aspiration pneumonia in older adults. *Journal of the American Academy of Nurse Practitioners, 22*(1), 17. doi:10.1111/j.1745-7599.2009.00470.x.

Ellul, M. A., Benjamin, L., Singh, B., Lant, S., Michael, B. D., Easton, A., . . . Solomon, T. (2020). Neurological associations of COVID-19. *Lancet Neurology, 19*(9), 767-783. doi:10.1016/s1474-4422(20)30221-0.

Eltringham, S. A., Kilner, K., Gee, M., Sage, K., Bray, B. D., Pownall, S., & Smith, C. J. (2018). Impact of dysphagia assessment and management on risk of stroke-associated pneumonia: A Systematic Review. *Cerebrovascular Diseases, 46*(3-4), 97-105. doi:10.1159/000492730.

Eltringham, S. A., Kilner, K., Gee, M., Sage, K., Bray, B. D., Smith, C. J., & Pownall, S. (2019). Factors associated with risk of stroke-associated pneumonia in patients with dysphagia: A systematic review. *Dysphagia*. doi:10.1007/s00455-019-10061-6.

Erasmus, M., & Kean, H. (2018). Private hospital expenditure and relation to utilisation: Observations from the data. *South African Journal of Economic and Management Sciences. 21*, 1-14. Retrieved from

http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2222-34362018000100005&nrm=iso.

Erdur, H., Siegerink, B., Leithner, C., Franke, C., Lorenz-Meyer, I., Theen, S., . . . Audebert, H. J. (2021). Stroke admissions, stroke severity, and treatment rates in urban and rural areas during the COVID-19 pandemic. *Frontiers in Neurology, 11*(1836). doi:10.3389/fneur.2020.607193.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1-4.

Ethicist, P. (2015). Simplifying the complexity of confidentiality in research. *Journal of Empirical Research on Human Research Ethics, 10*(1), 100-102. doi:10.1177/1556264614568783.

The European Stroke Organisation (ESO) Executive Committee (2008). Guidelines for management of ischaemic stroke and transient ischaemic attack.

Fairfield, C. A., & G Smithard, D. (2020). Assessment and management of dysphagia in acute stroke: An initial service review of international practice. *Geriatrics, 5*(1), 4.

Farneti, D., Turroni, V., & Genovese, E. (2018). Aspiration: diagnostic contributions from bedside swallowing evaluation and endoscopy. *Acta otorhinolaryngologica Italica : organo ufficiale della Societa italiana di otorinolaringologia e chirurgia cervico-facciale, 38*(6), 511-516. doi:10.14639/0392-100X-1967.

Farrag, K., Shastri, Y. M., Beilenhoff, U., Aksan, A., & Stein, J. (2019). Percutaneous endoscopic gastrostomy (PEG): a practical approach for long term management. *BMJ, 364*, k5311. doi:10.1136/bmj.k5311.

Fattori, B., Giusti, P., Mancini, V., Grosso, M., Barillari, M. R., Bastiani, L., . . . Nacci, A. (2016). Comparison between videofluoroscopy, fiberoptic endoscopy and scintigraphy for diagnosis of oro-pharyngeal dysphagia. [Confronto tra videofluoroscopia, endoscopia a fibre ottiche e scintigrafia per la diagnosi di disfagia oro-faringea]. *Acta otorhinolaryngologica Italica : organo ufficiale della Societa italiana di*

otorinolaringologia e chirurgia cervico-facciale, 36(5), 395-402. doi:10.14639/0392-100X-829.

Feigin, V. L., Forouzanfar, M. H., Krishnamurthi, R., Mensah, G. A., Connor, M., Bennett, D. A., . . . Murray, C. (2014). Global and regional burden of stroke during 1990-2010: findings from the Global Burden of Disease Study 2010. *Lancet, 383*(9913), 245-254. doi:10.1016/s0140-6736(13)61953-4.

Feng, M.-C., Lin, Y.-C., Chang, Y.-H., Chen, C.-H., Chiang, H.-C., Huang, L.-C., . . . Hung, C.-H. (2019). The mortality and the risk of aspiration pneumonia related with dysphagia in stroke patients. *Journal of Stroke and Cerebrovascular Diseases, 28*(5), 1381-1387. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2019.02.011.

Field, M., Wenke, R., Sabet, A., Lawrie, M., & Cardell, E. (2018). Implementing cough reflex testing in a clinical pathway for acute stroke: a Pragmatic randomised controlled trial. *Dysphagia, 33*(6), 827-839. doi:10.1007/s00455-018-9908-5.

Finlayson, O., Kapral, M., Hall, R., Asllani, E., Selchen, D., & Saposnik, G. (2011). Risk factors, inpatient care, and outcomes of pneumonia after ischemic stroke. *Neurology, 77*(14), 1338. doi:10.1212/WNL.0b013e31823152b1.

Flowers, H. L., Silver, F. L., Fang, J., Rochon, E., & Martino, R. (2013). The incidence, co-occurrence, and predictors of dysphagia, dysarthria, and aphasia after first-ever acute ischemic stroke. *Journal of Communication Disorders, 46*(3), 238-248. doi:https://doi.org/10.1016/j.jcomdis.2013.04.001.

Flowers, H. L., AlHarbi, M. A., Mikulis, D., Silver, F. L., Rochon, E., Streiner, D., & Martino, R. (2017). MRI-Based neuroanatomical predictors of dysphagia, dysarthria, and aphasia in patients with first acute ischemic stroke. *Cerebrovasc Dis Extra, 7*(1), 21-34. doi:10.1159/000457810.

Frajkova, Z., Tedla, M., Tedlova, E., Suchankova, M., & Geneid, A. (2020). Postintubation dysphagia during COVID-19 outbreak-contemporary review. *Dysphagia, 35*(4), 549-557. doi:10.1007/s00455-020-10139-6.

Gatto, A. R., Cola, P. C., da Silva, R. G., Ribeiro, P. W., Spadotto, A. A., & Henry, M. A. d. A. C. (2021). Influence of Thermal and Gustatory Stimulus in the Initiation of the Pharyngeal Swallow and Bolus Location Instroke. *Journal of Stroke and Cerebrovascular Diseases, 30*(4), 105349. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.105349.

GBD (2019). Global, regional and national burden of stroke 1990-2016: A Systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*. 11 March 2019. Doi: 10.1016/s1474-4422(19)30034-1.

Gearing, R. E., Mian, I. A., Barber, J., & Ickowicz, A. (2006). A methodology for conducting retrospective chart review research in child and adolescent psychiatry. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, *15*(3), 126.

Gillman, A., Winkler, R., & Taylor, N. F. (2017). Implementing the Free Water Protocol does not result in aspiration pneumonia in carefully selected patients with dysphagia: A Systematic review. *Dysphagia, 32*(3), 345-361. doi:10.1007/s00455-016-9761-3.

Giordano, J., O'Reilly, M., Taylor, H., & Dogra, N. (2007). Confidentiality and autonomy: The challenge(s) of offering research participants a choice of disclosing their identity. *Qualitative Health Research*, *17*(2), 264-275.

Glize, B. D., Vellay, M., Richert, L. D., Le Taillandier De Gabory, I., Mazaux, J. M. P., Dehail, P. P., . . . Joseph, P. A. P. (2015). Language screening test in the acute phase of post-stroke aphasia associated with clinical outcome. *Annals of Physical and Rehabilitation Medicine, 58*, e4-e4. doi:10.1016/j.rehab.2015.07.014.

Godecke, E., Rai, T., Ciccone, N., Armstrong, E., Granger, A., & Hankey, G. J. (2013). *Amount of therapy matters in very early aphasia rehabilitation after stroke: A clinical prognostic model.* Paper presented at the Seminars in Speech and Language.

Gomes, F., Emery, P. W., & Weekes, C. E. (2016). Risk of malnutrition is an independent predictor of mortality, length of hospital stay, and hospitalization costs in stroke patients. *Journal of Stroke and Cerebrovascular Diseases, 25*(4), 799-806. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2015.12.017.

Gregory, K.E. & Radovinsky, L. (2012). Research strategies that result in optimal data collection from the patient medical record. *Applied Nursing Research: ANR, 25*(2), 108-16.

Hägglund, P., Hägg, M., Levring Jäghagen, E., Larsson, B., & Wester, P. (2020). Oral neuromuscular training in patients with dysphagia after stroke: a prospective, randomized, open-label study with blinded evaluators. *BMC Neurology, 20*(1), 405. doi:10.1186/s12883-020-01980-1.

Haley, K. L., Cunningham, K. T., Eaton, C. T., & Jacks, A. (2018). Error consistency in acquired apraxia of speech with aphasia: Effects of the analysis unit. *Journal of Speech, Language, and Hearing Research, 61*(2), 210-226. doi:10.1044/2017_JSLHR-S-16-0381.

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutor Quant Methods Psychol, 8*(1), 23-34.

Han, T., Lean, M., Fluck, D., Affley, B., Gulli, G., Patel, T., . . . Sharma, P. (2018). Impact of delay in early swallow screening on pneumonia, length of stay in hospital, disability and mortality in acute stroke patients. *European Journal of Clinical Nutrition, 72*(11), 1548-1554. doi:10.1038/s41430-018-0148-4.

Hannawi, Y., Hannawi, B., Rao, C. P., Suarez, J. I., & Bershad, E. M. (2013). Stroke-associated pneumonia: major advances and obstacles. *Cerebrovascular Diseases, 35*(5), 430-443. doi:10.1159/000350199.

Harrison, J. K., McArthur, K. S., & Quinn, T. J. (2013). Assessment scales in stroke: clinometric and clinical considerations. *Clinical Interventions in Aging, 8*, 201-211. doi:10.2147/cia.s32405.

Harvey, S. R., Carragher, M., Dickey, M. W., Pierce, J. E., & Rose, M. L. (2021). Treatment dose in post-stroke aphasia: A systematic scoping review. *Neuropsychological Rehabilitation, 31*(10), 1629-1660. doi:10.1080/09602011.2020.1786412.

Hassan, Z. A., Schattner, P., & Mazza, D. (2006). Doing a pilot study: why is it essential? *Malaysian Family Physician*, *1*(2-3), 70.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence Based Nursing, 18*(3), 66. doi:10.1136/eb-2015-102129.

Herpich, F., & Rincon, F. (2020). Management of Acute Ischemic Stroke. *Critical Care Medicine, 48*(11). Retrieved from https://journals.lww.com/ccmjournal/Fulltext/2020/11000/Management_of_Acute_Ischemic_Stroke.13.aspx.

Hess, D. C., Eldahshan, W., & Rutkowski, E. (2020). COVID-19-related stroke. *Transl Stroke Res, 11*(3), 322-325. doi:10.1007/s12975-020-00818-9.

Hibberd, J., Fraser, J., Chapman, C., McQueen, H., & Wilson, A. (2013). Can we use influencing factors to predict aspiration pneumonia in the United Kingdom? *Multidisciplinary Respiratory Medicine, 8*(1), 39. doi:10.1186/2049-6958-8-39.

Higgins, JPT., Sterne, JAC., Savovic, J., Page, MJ., Hrobjartsson, A., Boutron, I., Reeves, B., Eldridge, S. A revised tool for assessing risk of bias in randomised trials in: Chandler, J., Mckenzie, J., Boutron, I., Welch, V. (editors). Cochrane Methods. Cochrane Database of systematic reviews (2016), 10(1). Dx.doi.org/10.1002/14651858.CD201601.

Hilari, K., Efstratiadou, E., Holland, R., & Papathanasiou, I. (2016). Investigating the effectiveness of elaborated semantic features analysis as a word level therapy for people with aphasia. *Archives of Physical Medicine and Rehabilitation, 97*(12), e22-e23. doi:10.1016/j.apmr.2016.09.061.

Hirshon, J. M., Risko, N., Calvello, E. J. B., Stewart de Ramirez, S., Narayan, M., Theodosis, C., . . . Acute care research collaborative at the University of Maryland Global Health. (2013). Health systems and services: the role of acute care. *Bulletin of the World Health Organization, 91*(5), 386-388. doi:10.2471/BLT.12.112664.

Hoffman, J. I. E. (2015). Chapter 20 - Some epidemiological considerations: Odds ratio, relative risk, and attributable risk. In J. I. E. Hoffman (Ed.), *Biostatistics for Medical and Biomedical Practitioners* (pp. 287-306): Academic Press.

Huang, J., Zhang, D., Yao, Y., Xia, Q., & Fan, Q. (2006). Training in swallowing prevents aspiration pneumonia in stroke patients with dysphagia. *Journal of International Medical Research, 34*(3), 303-306. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/147323000603400310.

Huang, S.-T., Chiou, C.-C., & Liu, H.-Y. (2017). Risk factors of aspiration pneumonia related to improper oral hygiene behavior in community dysphagia persons with nasogastric tube feeding. *Journal of Dental Sciences, 12*(4), 375-381. doi:https://doi.org/10.1016/j.jds.2017.06.001.

Immovilli, P., Rota, E., Morelli, N., Marchesi, E., Terracciano, C., Zaino, D., . . . Guidetti, D. (2021). Diagnostic accuracy of a bedside screening tool for dysphagia (BSTD) in acute stroke patients. *Journal of Stroke and Cerebrovascular Diseases, 30*(2), 105470. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.105470.

Inamoto, Y., Pongpipatpaiboon, K., Shibata, S., Aoyagai, Y., Kagaya, H., & Matsuo, K. (2018). Swallowing Exercises. In E. Saitoh, K. Pongpipatpaiboon, Y. Inamoto, & H. Kagaya (Eds.), *Dysphagia Evaluation and Treatment: From the Perspective of Rehabilitation Medicine* (pp. 109-155). Singapore: Springer Singapore.

The International Dysphagia Diet Standardisation Initiative (2019). Resources. Retrieved from https://iddsi.org/framework.

Institute for Health Metrics and Evaluation (IHME) (2019). GBD Compare Data Visualization. Seattle, WA: IHME, University of Washington, 2019. Available from http://vizhub.healthdata.org/gbd-compare. Retrieved from http://www.healthdata.org/south-africa.

Irvine, H. J., Battey, T. W., Ostwaldt, A. C., Campbell, B. C., Davis, S. M., Donnan, G. A., . . . Kimberly, W. T. (2016). Early neurological stability predicts adverse outcome after acute ischemic stroke. *International Journal of Stroke, 11*(8), 882-889. doi:10.1177/1747493016654484.

Janzen, S., Mirkowski, M., McIntyre, A., Mehta, S., Iruthayarajah, J., & Teasell, R. (2019). Referral patterns of stroke rehabilitation inpatients to a model system of outpatient

services in Ontario, Canada: a 7-year retrospective analysis. *BMC Health Services Research, 19*(1), 399. doi:10.1186/s12913-019-4236-.

Jelsma, J., & Clow, S. (2005). Ethical issues relating to qualitative research. *South African Journal of Physiotherapy, 61*(1).

Jeong Leem, M., Im Moon, H., & Kim, K. H. (2018). Differences in nutrition and hydration status related to swallowing function and age in acute stroke patients. *Journal of Food and Nutrition Research, 6*(12), 719-724.

Johnson, D. N., Herring, H. J., & Daniels, S. K. (2014). Dysphagia management in stroke rehabilitation. *Current Physical Medicine and Rehabilitation Reports, 2*(4), 207-218. doi:10.1007/s40141-014-0059-9.

Johnson, W., Onuma, O., Owolabi, M., & Sachdev, S. (2016). Stroke: a global response is needed. *Bulletin of the World Health Organization, 94*(9), 634-634A. doi:10.2471/BLT.16.181636.

Jönsson, A.-C., Lindgren, I., Norrving, B., & Lindgren, A. (2008). Weight loss after stroke: a population-based study from the Lund Stroke Register. *Stroke, 39*(3), 918-923.

Joundi, R. A., Martino, R., Saposnik, G., Giannakeas, V., Fang, J., & Kapral, M. K. (2017). Predictors and outcomes of dysphagia screening after acute ischemic stroke. *Stroke, 48*(4), 900-906. doi:10.1161/STROKEAHA.116.015332.

Joundi, R. A., Saposnik, G., Martino, R., Fang, J., Porter, J., & Kapral, M. K. (2018). Outcomes among patients with direct enteral vs nasogastric tube placement after acute stroke. *Neurology, 90*(7), e544. doi:10.1212/WNL.0000000000004962.

Kaiser, K. (2009). Protecting respondent confidentiality in qualitative research. *Qualtitative Health Research, 19*(11), 1632-1641.

Kang, H. (2013). The prevention and handling of the missing data. *Korean Journal of Anesthesiology, 64*(5), 402-406. doi:10.4097/kjae.2013.64.5.402.

Katan, M., & Luft, A. (2018). Global Burden of Stroke. *Seminars in Neurology, 38*(02), 208-211.

Kasner, S. E. (2006). Clinical interpretation and use of stroke scales. *The Lancet Neurology, 5*(7), 603-612. doi:https://doi.org/10.1016/S1474-4422(06)70495-1.

Kelly, H., Cronin, M., Hynes, H., Duxbury, S., & Twomey, O. (2021). Learning to swallow together: Medical and speech and language therapy student interprofessional learning about dysphagia. *Advances in Communication and Swallowing, Preprint*, 1-12. doi:10.3233/ACS-210027.

Kenzaka, T., Takeshima, T., Kosami, K., Kumabe, A., Ueda, Y., Takahashi, T., . . . Okayama, M. (2017). Factors involved in the discontinuation of oral intake in elderly patients with recurrent aspiration pneumonia: a multicenter study. *Clinical Interventions in Aging, 12*, 283-291. doi:10.2147/CIA.S122309.

Kim, G., Min, D., Lee, E.-O., & Kang, E. K. (2016). Impact of co-occurring dysarthria and aphasia on functional recovery in post-stroke patients. *Annals of Rehabilitation Medicine, 40*(6), 1010-1017. doi:10.5535/arm.2016.40.6.1010.

Kim, H. C., & Oh, S. M. (2013). Noncommunicable diseases: current status of major modifiable risk factors in Korea. *Journal of Preventive Medicine and Public Health. Yebang Uihakhoe Chi, 46*(4), 165-172. doi:10.3961/jpmph.2013.46.4.165.

Kovács, A., Szabó, T. P., & Folyovich, A. (2021). Relationships between COVID-19 disease, nutritional status, and dysphagia, particularly in stroke patients. *Ideggyogyaszati szemle, 74*(11-12), 367-378. doi:10.18071/isz.74.036.

Kruse, R. L., & Mehr, D. (2008). Data management for prospective research studies using SAS® software. *BMC Medical Research Methodology, 8*(1), 61.

Kunieda, K., Ohno, T., Fujishima, I., Hojo, K., & Morita, T. (2013). Reliability and Validity of a Tool to Measure the Severity of Dysphagia: The Food Intake LEVEL Scale. *Journal of Pain and Symptom Management, 46*(2), 201-206. doi:https://doi.org/10.1016/j.jpainsymman.2012.07.020.

Kwak, S. K., & Kim, J. H. (2017). Statistical data preparation: management of missing values and outliers. *Korean Journal of Anesthesiology, 70*(4), 407-411. doi:10.4097/kjae.2017.70.4.407.

Kwok, C., McIntyre, A., Janzen, S., Mays, R., & Teasell, R. (2015). Oral care post stroke: a scoping review. *Journal of Oral Rehabilitation, 42*(1), 65-74. doi:10.1111/joor.12229.

Langdon, P. C., Lee, A. H., & Binns, C. W. (2009). High incidence of respiratory infections in 'nil by mouth' tube-fed acute ischemic stroke patients. *Neuroepidemiology, 32*(2), 107-113.

Langhorne, P., Bernhardt, J., & Kwakkel, G. (2011). Stroke rehabilitation. *The Lancet, 377*(9778), 1693-1702. doi:https://doi.org/10.1016/S0140-6736(11)60325-5.

Langmore, S. E., Terpenning, M. S., Schork, A., Chen, Y., Murray, J. T., Lopatin, D., & Loesche, W. J. (1998). Predictors of aspiration pneumonia: How important is dysphagia? *Dysphagia, 13*(2), 69-81. doi:10.1007/PL00009559.

Langmore, S. E., Skarupski, K. A., Park, P. S., & Fries, B. E. (2002). Predictors of aspiration pneumonia in nursing home residents. *Dysphagia, 17*(4), 298-307. doi:10.1007/s00455-002-0072-5.

Lauretani, F., Saccavini, M., Zaccaria, B., Agosti, M., Zampolini, M., Franceschini, M., & Group, I. (2010). Rehabilitation in patients affected by different types of stroke. A one-year follow-up study. *European Journal of Physical and Rehabilitation Medicine, 46*(4), 511-516.

Lazar, R. M., & Boehme, A. K. (2017). Aphasia as a predictor of stroke outcome. *Current Neurology and Neuroscience Reports, 17*(11), 83. doi:10.1007/s11910-017-0797-z.

Lazarus, C. L. (2017). History of the use and impact of compensatory strategies in management of swallowing disorders. *Dysphagia, 32*(1), 3-10. doi:10.1007/s00455-016-9779-6.

Lee, J. H., Kim, H.-S., Yun, D. H., Chon, J., Han, Y. J., Yoo, S. D., . . . Soh, Y. (2016). The relationship between tongue pressure and oral dysphagia in stroke patients. *Annals of rehabilitation medicine, 40*(4), 620-628. doi:10.5535/arm.2016.40.4.620.

Liaw, M.-Y., Hsu, C.-H., Leong, C.-P., Liao, C.-Y., Wang, L.-Y., Lu, C.-H., & Lin, M.-C. (2020). Respiratory muscle training in stroke patients with respiratory muscle weakness, dysphagia, and dysarthria – a prospective randomized trial. *Medicine,*

99(10). Retrieved from https://journals.lww.com/md-journal/Fulltext/2020/03060/Respiratory_muscle_training_in_stroke_patients.28.aspx.

Li, J., Wang, D., Tao, W., Dong, W., Zhang, J., Yang, J., & Liu, M. (2016). Early consciousness disorder in acute ischemic stroke: incidence, risk factors and outcome. *BMC Neurology, 16*(1), 140. doi:10.1186/s12883-016-0666-4.

Li, S., Francisco, G. E., & Zhou, P. (2018). Post-stroke hemiplegic gait: New perspective and insights. *Frontiers in Physiology, 9*(1021). doi:10.3389/fphys.2018.01021.

Li, W., Kang, X., Ren, J., Lai, X., & Tai, L. (2017). Effects of extended in-patient treatment training on outcome of post-stroke dysphagia. *European Review for Medical and Pharmacological Sciences, 12713*.

Lima, R. R., Rose, M. L., Lima, H. N., Cabral, N. L., Silveira, N. C., & Massi, G. A. (2020). Prevalence of aphasia after stroke in a hospital population in southern Brazil: a retrospective cohort study. *Topics in Stroke Rehabilitation, 27*(3), 215-223.

Lindsay, M. P., Norrving, B., Sacco, R. L., Brainin, M., Hacke, W., Martins, S., . . . Feigin, V. (2019). World Stroke Organization (WSO): Global Stroke Fact Sheet 2019. *International Journal of Stroke, 14*(8), 806-817. doi:10.1177/1747493019881353.

Lim, C.-Y., & In, J. (2019). Randomization in clinical studies. *Korean Journal of Anesthesiology, 72*(3), 221-232. doi:10.4097/kja.19049.

Liu, R., Zhao, J., & Fisher, M. (2020). The global impact of COVID-19 on acute stroke care. *CNS Neuroscience & Therapeutics, n/a*(n/a). doi:10.1111/cns.13442.

Lv, Y., Sun, Q., Li, J., Zhang, W., He, Y., & Zhou, Y. (2021). Disability status and its influencing factors among stroke patients in Northeast China: A 3-Year follow-up study. *Neuropsychiatric Disease and Treatment, 17*, 2567-2573. doi:10.2147/NDT.S320785.

Lyons, M., Smith, C., Boaden, E., Brady, M. C., Brocklehurst, P., Dickinson, H., . . . Watkins, D. C. (2018). Oral care after stroke: Where are we now? *European Stroke Journal, 3*(4), 347-354. doi:10.1177/2396987318775206.

MacFarland T.W. & Yates J.M. (2016). Mann–Whitney U Test. In: Introduction to Nonparametric Statistics for the Biological Sciences Using R. Springer, Cham. https://doi.org/10.1007/978-3-319-30634-6_4.

Mackenzie, C. (2011). Dysarthria in stroke: A narrative review of its description and the outcome of intervention. *International Journal of Speech-Language Pathology, 13*(2), 125-136. doi:10.3109/17549507.2011.524940.

Mackenzie, C., Muir, M., Allen, C., & Jensen, A. (2014). Non-speech oro-motor exercises in post-stroke dysarthria intervention: a randomized feasibility trial. *International Journal of Language and Communication Disorders, 49*(5), 602-617. doi:https://doi.org/10.1111/1460-6984.12096.

Maeda, K., Murotani, K., Kamoshita, S., Horikoshi, Y., & Kuroda, A. (2021). Nutritional management in inpatients with aspiration pneumonia: a cohort medical claims database study. *Archives of Gerontology and Geriatrics, 95*, 104398. doi:https://doi.org/10.1016/j.archger.2021.104398.

Manabe, T., Teramoto, S., Tamiya, N., Okochi, J., & Hizawa, N. (2015). Risk factors for aspiration pneumonia in older adults. *PloS One, 10*(10), e0140060. doi:10.1371/journal.pone.0140060.

Mancopes, R., Gonçalves, B. F. d. T., Costa, C. C., Favero, T. C., Drozdz, D. R. C., Bilheri, D. F. D., & Schumacher, S. F. (2014). Correlation between the reason for referral, clinical, and objective assessment of the risk for dysphagia. *CoDAS, 26*, 471-475. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2317-17822014000600471&nrm=iso.

Mandell, L.A. & Niederman, M.S. (2019). Aspiration pneumonia. *The New England Journal of Medicine, 380*:651-63.

Mandizvidza, V., London, L., & Bryer, A. (2021). Shortfall in stroke care: A study of ischaemic stroke care practices in a South African metropole. *South African Medical Journal, 111*(3), 215-219. doi:10.7196/SAMJ.2021.v111i3.15104.

Manyisa, Z. M., & Van Aswegen, E. J. (2017). Factors affecting working conditions in public hospitals: A literature review. *International Journal of Africa Nursing Sciences, 6*, 28-38. doi:https://doi.org/10.1016/j.ijans.2017.02.002.

Maphumulo, W. T., & Bhengu, B. R. (2019). Challenges of quality improvement in the healthcare of South Africa post-apartheid: A critical review. *Curationis, 42*(1), e1-e9. doi:10.4102/curationis.v42i1.1901.

Martino, R., Foley, N., Bhogal, S., Diamant, N., Speechley, M., & Teasell, R. (2005). Dysphagia after stroke. *Stroke, 36*(12), 2756-2763. doi:10.1161/01.STR.0000190056.76543.eb.

Martino, R., Martin, R. E., & Black, S., (2012). Dysphagia after stroke and its management. *CMAJ, 184*(10), 1127-1128.

Martins, I. P., Leal, G., Fonseca, I., Farrajota, L., Aguiar, M., Fonseca, J., . . . Ferro, J. M. (2013). A randomized, rater-blinded, parallel trial of intensive speech therapy in sub-acute post-stroke aphasia: the SP-I-R-IT study. *International Journal of Language and Communication Disorders, 48*(4), 421-431. doi:10.1111/1460-6984.12018.

Maseko, L., & Harris, B. (2018). People-centeredness in health system reform. Public perceptions of private and public hospitals in South Africa. *South African Journal of Occupational Therapy, 48*, 22-27. Retrieved from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2310-38332018000100005&nrm=iso.

Mashaphu, S., & Chiliza, B. (2016). Private practice-driven research. *South African Medical Journal, 106*(10), 955-955.

Matthew, S. & Mash, R. (2019). Exploring the beliefs and attitudes of private general practitioners towards national health insurance in Cape Town, South Africa. *African Journal of Primary Health Care and Family Medicine, 11* (1):1-10.

Matthews, C.T. & Coyle, J.L. (2010). Reducing pneumonia risk factors in patients with dysphagia who have a tracheostomy: What role can SLPs play? *ASHA Leader*, May 18.

Mattioli, F. (2019). The clinical management and rehabilitation of post stroke aphasia in Italy: evidences from the literature and clinical experience. *Neurological Sciences, 40*(7), 1329-1334. doi:10.1007/s10072-019-03844-0.

Matsuo, T., Ishikawa, H., Tachi, H., Yoshida, K., & Teramoto, S. (2014). [Development of exudative tuberculosis during treatment for aspiration pneumonia in an elderly post-stroke patient with symptomatic epilepsy]. *Nihon Ronen Igakkai Zasshi. Japanese Journal of Geriatrics, 51*(5), 460-465. doi:10.3143/geriatrics.51.460.

Mauszycki, S. C., & Wambaugh, J. (2011). Acquired apraxia of speech: A treatment overview. *The ASHA Leader, 16*(5), 16-19.

Mayosi, B. M., Flisher, A. J., Lalloo, U. G., Sitas, F., Tollman, S. M., & Bradshaw, D. (2009). The burden of non-communicable diseases in South Africa. *The Lancet, 374*(9693), 934-947. doi:https://doi.org/10.1016/S0140-6736(09)61087-4.

McCormick, M., Bose, A., & Marinis, T. (2017). Decision-making capacity in aphasia: SLT's contribution in England. *Aphasiology, 31*(11), 1344-1358. doi:10.1080/02687038.2017.1355441.

McCurtin, A., Healy, C., Kelly, L., Murphy, F., Ryan, J., & Walsh, J. (2018). Plugging the patient evidence gap: what patients with swallowing disorders post-stroke say about thickened liquids. *International Journal of Language and Communication Disorders, 53*(1), 30-39. doi:10.1111/1460-6984.12324.

McHutchison, C. A., Cvoro, V., Makin, S., Chappell, F. M., Shuler, K., & Wardlaw, J. M. (2019). Functional, cognitive and physical outcomes 3 years after minor lacunar or cortical ischaemic stroke. *Journal of Neurology, Neurosurgery & Psychiatry, 90*(4), 436. doi:10.1136/jnnp-2018-319134.

Mc Menamin, R., Tierney, E., & Mac Farlane, A. (2015). Addressing the long-term impacts of aphasia: how far does the Conversation Partner Programme go? *Aphasiology, 29*(8), 889-913. doi:10.1080/02687038.2015.1004155.

Mitchell, C., Gittins, M., Tyson, S., Vail, A., Conroy, P., Paley, L., & Bowen, A. (2021). Prevalence of aphasia and dysarthria among inpatient stroke survivors: describing

the population, therapy provision and outcomes on discharge. *Aphasiology, 35*(7), 950-960. doi:10.1080/02687038.2020.1759772.

Miyata, E., Tanaka, A., Emori, H., Taruya, A., Miyai, S., & Sakagoshi, N. (2017). Incidence and risk factors for aspiration pneumonia after cardiovascular surgery in elderly patients. *General Thoracic and Cardiovascular Surgery, 65*(2), 96. doi:10.1007/s11748-016-0710-8.

Mogensen, U. B., Olsen, T. S., Andersen, K. K., & Gerds, T. A. (2013). Cause-specific mortality after stroke: relation to age, sex, stroke severity, and risk factors in a 10-year follow-up study. *Journal of Stroke and Cerebrovascular Diseases, 22*(7), e59-e65.

Mohan, R., & Mohapatra, B. (2020). Shedding Light on Dysphagia Associated With COVID-19: The What and Why. *OTO Open, 4*(2), 2473974X20934770. doi:10.1177/2473974X20934770.

Müller, F. (2015). Oral hygiene reduces the mortality from aspiration pneumonia in frail elders. *JDR Clinical Research Supplement, 94*(3_suppl), 14S-16S.

Murray, J., & Scholten, I. (2018). An oral hygiene protocol improves oral health for patients in inpatient stroke rehabilitation. *Gerodontology, 35*(1), 18-24. doi:10.1111/ger.12309.

Nacci, A., Ursino, F., La Vela, R., Matteucci, F., Mallardi, V., & Fattori, B. (2008). Fiberoptic endoscopic evaluation of swallowing (FEES): proposal for informed consent. *Acta otorhinolaryngologica Italica : organo ufficiale della Societa italiana di otorinolaringologia e chirurgia cervico-facciale, 28*(4), 206-211. Retrieved from https://pubmed.ncbi.nlm.nih.gov/18939710 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2644994/ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2644994/pdf/0392-100X.28.206.pdf.

Nakazora, T., Maeda, J., Iwamoto, K., Hanashiro, S., Nakamura, Y., Kiyozuka, T., & Domen, K. (2017). Intervention by Speech Therapists to Promote Oral Intake of Patients with Acute Stroke: A Retrospective Cohort Study. *Journal of Stroke and Cerebrovascular*

Diseases, 26(3), 480-487. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2016.12.007.

Nakamura, T., & Fujishima, I. (2013). Usefulness of ice massage in triggering the swallow reflex. *Journal of Stroke and Cerebrovascular Diseases, 22*(4), 378-382. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2011.09.016.

Napierala, M. A. (2012). What is the Bonferroni correction. *AAOS Now, 6*(4), 40.

Newington, L. & Metcalfe, A. (2014). Factors influencing recruitment to research: Qualitative study of the experiences and perceptions of research teams. *BMC Medical Research Methodology, 14*(1).

Nørgaard, M., Ehrenstein, V., & Vandenbroucke, J. P. (2017). Confounding in observational studies based on large health care databases: problems and potential solutions - a primer for the clinician. *Clinical Epidemiology, 9*, 185-193. doi:10.2147/CLEP.S129879.

National Health Insurance Bill. (2019). Available: http://www.gov.za/documents/national-health-insurance-bill-b-11-2019-6-aug-2019-0000.

O'Keeffe, S. T. (2018). Use of modified diets to prevent aspiration in oropharyngeal dysphagia: is current practice justified? *BMC Geriatrics, 18*(1), 167. doi:10.1186/s12877-018-0839-7.

Omari, T. I., Dejaeger, E., Tack, J., Van Beckevoort, D., & Rommel, N. (2013). Effect of bolus volume and viscosity on pharyngeal automated impedance manometry variables derived for broad dysphagia patients. *Dysphagia, 28*(2), 146-152. doi:10.1007/s00455-012-9423-z.

Owolabi, M., Olowoyo, P., Popoola, F., Lackland, D., Jenkins, C., Arulogun, O., . . . Ovbiagele, B. (2018). The epidemiology of stroke in Africa: A systematic review of existing methods and new approaches. *The Journal of Clinical Hypertension, 20*(1), 47-55. doi:10.1111/jch.13152.

Palli, C., Fandler, S., Doppelhofer, K., Niederkorn, K., Enzinger, C., Vetta, C., . . . Gattringer, T. (2017). Early dysphagia screening by trained nurses reduces pneumonia rate in

stroke patients: A clinical intervention study. *Stroke, 48*(9), 2583-2585. doi:10.1161/strokeaha.117.018157.

Parfrey, P.S. & Barrett, B.J. (2015). *Clinical epidemiology: Practice and methods. (Second edition. ed.).* New York: Humana Press.

Park, C. S., & An, S. H. (2016). Reliability and validity of the modified functional ambulation category scale in patients with hemiparalysis. *Journal of physical therapy science, 28*(8), 2264-2267. doi:10.1589/jpts.28.2264.

Park, J. S., Oh, D. H., Chang, M. Y., & Kim, K. M. (2016). Effects of expiratory muscle strength training on oropharyngeal dysphagia in subacute stroke patients: a randomised controlled trial. *Journal of Oral Rehabilitation, 43*(5), 364-372. doi:10.1111/joor.12382.

Park, S., Theodoros, D., Finch, E. & Cardell, E. (2016). Be Clear: A new intensive speech treatment for adults with nonprogressive dysarthria. *American Journal of Speech-Language Pathology, 25* (97-110).

Passchier, R. V. (2017). Exploring the barriers to implementing National Health Insurance in South Africa: The people's perspective. *SAMJ: South African Medical Journal, 107*, 836-838. Retrieved from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0256-95742017001000010&nrm=iso http://www.samj.org.za/index.php/samj/article/download/12085/8257

Pedra, E., Pontes, V. L., Mourão, A. M., Braga, M. A., & Vicente, L. C. (2020). *Post-stroke patients with and without thrombolysis: Analysis of deglutition in the acute phase of the disease.* Paper presented at the CoDAS..

Perin, C., Bolis, M., Limonta, M., Meroni, R., Ostasiewicz, K., Cornaggia, C. M., . . . Piscitelli, D. (2020). Differences in rehabilitation needs after stroke: A similarity analysis on the ICF core set for stroke. *International Journal of Environmental Research and Public Health, 17*(12). doi:10.3390/ijerph17124291.

Pierpoint, M., & Pillay, M. (2020). Post-stroke dysphagia: An exploration of initial identification and management performed by nurses and doctors. *South African Journal of Communication Disorders, 67*, 1-13. Retrieved from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2225-47652020000100007&nrm=iso.

Pillay, M., Tiwari, R., Kathard, H., & Chikte, U. (2020). Sustainable workforce: South African Audiologists and Speech Therapists. *Human Resources for Health, 18*(1), 47. doi:10.1186/s12960-020-00488-6.

Pitthayapong, S., Thiangtam, W., Powwattana, A., Leelacharas, S., & Waters, C. M. (2017). A Community based program for family caregivers for post stroke survivors in Thailand. *Asian Nursing Research, 11*(2), 150-157. doi:https://doi.org/10.1016/j.anr.2017.05.009.

Qian, Y., Chopp, M., & Chen, J. (2020). Emerging role of microRNAs in ischemic stroke with comorbidities. *Experimental Neurology, 331*, 113382. doi:https://doi.org/10.1016/j.expneurol.2020.113382.

Ranchod, S., Adams, C., Burger, R., Carvounes, A., Dreyer, K., Smith, A, Stewart, J., & Van Biljon, C. (2017). South Africa's hospital sector: Old divisions and new developments. *South African Health Review 2017 20-year anniversary edition,* Midrand, South Africa: South African Health Systems Trust.

Ransohoff, R. M., & Engelhardt, B. (2012). The anatomical and cellular basis of immune surveillance in the central nervous system. *Nature Reviews Immunology, 12*(9), 623-635. doi:10.1038/nri3265.

Rhyou, K. S., & Yang, Y. H. (2018). Characteristics and clinical outcomes of elders with aspiration pneumonia. *J Korean Gerontol Nurs, 20*(1), 45-55. doi:10.17079/jkgn.2018.20.1.45.

Rinkel, L. A., Prick, J. C. M., Slot, R. E. R., Sombroek, N. M. A., Burggraaff, J., Groot, A. E., . . . Coutinho, J. M. (2020). Impact of the COVID-19 outbreak on acute stroke care. *Journal of Neurology*. doi:10.1007/s00415-020-10069-1.

Robbins, J. P., Kays, S. A. M. S., Gangnon, R. E. P., Hind, J. A. M. S., Hewitt, A. L. M. S., Gentry, L. R. M. D., & Taylor, A. J. M. D. (2007). The effects of lingual exercise in stroke patients with dysphagia. *Archives of Physical Medicine and Rehabilitation, 88*(2), 150-158. doi:10.1016/j.apmr.2006.11.002.

Rose, T. A., Wallace, S. J., & Leow, S. (2019). Family members' experiences and preferences for receiving aphasia information during early phases in the continuum of care. *International Journal of Speech-Language Pathology, 21*(5), 470-482. doi:10.1080/17549507.2019.1651396.

Roth, G. A., Mensah, G. A., Johnson, C. O., Addolorato, G., Ammirati, E., Baddour, L. M., . . . Fuster, V. (2020). Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019: Update From the GBD 2019 Study. *Journal of the American College of Cardiology, 76*(25), 2982-3021. doi:https://doi.org/10.1016/j.jacc.2020.11.010 .

Rowat, A., Graham, C., & Dennis, M. (2012). Dehydration in hospital-admitted stroke patients. *Stroke, 43*(3), 857-859. doi:10.1161/STROKEAHA.111.640821.

The Royal College of Speech and Language Therapists (RCSLT) (2013). Videofluroscopic evaluation of oropharyngeal swallowing function (VFS): The Role of speech and Language Therapists. RCSLT position paper. London.

Ruiz-Sandoval, J. L., Briseño-Godínez, M. E., Chiquete-Anaya, E., Arauz-Góngora, A., Troyo-Sanromán, R., Parada-Garza, J. D., . . . Cantú-Brito, C. (2018). Public and private hospital care disparities of ischemic stroke in mexico: Results from the Primer Registro Mexicano de Isquemia Cerebral (PREMIER) Study. *Journal of Stroke and Cerebrovascular Diseases, 27*(2), 445-453. doi:10.1016/j.jstrokecerebrovasdis.2017.09.025.

Sabbouh, T., & Torbey, M. T. (2018). Malnutrition in stroke patients: Risk factors, assessment, and management. *Neurocritical Care, 29*(3), 374-384. doi:10.1007/s12028-017-0436-1.

Sacco, R. L., Kasner, S. E., Broderick, J. P., Caplan, L. R., Connors, J. J., Culebras, A., ... & Hoh, B. L. (2013). An updated definition of stroke for the 21st century: A statement

for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *44*(7), 2064-2089.

Scheel, C., Mecham, J., Zuccarello, V., & Mattes, R. (2018). An evaluation of the inter-rater and intra-rater reliability of OccuPro's functional capacity evaluation. *Work, 60*(3), 465-473. doi:10.3233/WOR-182754.

Schimmel, M., Ono, T., Lam, O. L. T., & Müller, F. (2017). Oro-facial impairment in stroke patients. *Journal of Oral Rehabilitation, 44*(4), 313-326. doi:https://doi.org/10.1111/joor.12486.

Schindler, A., Ginocchio, D., & Ruoppolo, G. (2008). What we don't know about dysphagia complications? *Revue de Laryngologie Otologie Rhinologie, 129*(2), 75-78.

Schwarz, M., Coccetti, A., Murdoch, A., & Cardell, E. (2018). The impact of aspiration pneumonia and nasogastric feeding on clinical outcomes in stroke patients: A retrospective cohort study. *Journal of Clinical Nursing, 27*(1-2), e235-e241. doi:10.1111/jocn.13922.

Seedat, J., & Penn, C. (2016). Implementing oral care to reduce aspiration pneumonia amongst patients with dysphagia in a South African setting. *The South African Journal of Communication Disorders, 63*(1). doi:10.4102/sajcd.v63i1.102.

Sedgwick, P. (2013a). Prospective cohort studies: advantages and disadvantages. *BMJ : British Medical Journal, 347*, f6726. doi:10.1136/bmj.f6726.

Sedgwick, P. (2013b). Convenience sampling. *BMJ, 347*.

Sellars, C., Bowie, L., Bagg, J., Sweeney, M. P., Miller, H., Tilston, J., . . . Stott, D. J. (2007). Risk factors for chest infection in acute stroke: a prospective cohort study. *Stroke, 38*(8), 2284-2291. doi:10.1161/strokeaha.106.478156.

Seo, J. S., Ku, K. H., & Park, Y. S. (2021). Comparison of videofluoroscopic swallowing study in patients with stroke-associated pneumonia. *Journal of the Korean Dysphagia Society, 11*(1), 52-58. doi:10.34160/jkds.2021.11.1.007.

Sinanović, O., Mrkonjić, Z., Zukić, S., Vidović, M. & Imamović, K. (2011). Post-stroke language disorders. *Acta Clinica Croatica, 50*:79-94.

Slavin, D., & Fabus, R. (2018). A case study using a multimodal approach to melodic intonation therapy. *American Journal of Speech-Language Pathology, 27*(4), 1352-1362. doi:10.1044/2018_AJSLP-17-0030.

Smaoui, S., Steele, C., Peladeau-Pigeon, M., & Richardson, D. (2019). Tongue pressure training protocol for swallowing impairment post-stroke. *International Journal of Stroke, 14*(3), 30-31. doi:10.1177/1747493019872147.

Smithard, D. G. (2016). Dysphagia management and stroke Units. *Curr Phys Med Rehabil Rep, 4*(4), 287-294. doi:10.1007/s40141-016-0137-2.

Solazzo, A., Monaco, L., Del Vecchio, L., Tamburrini, S., Iacobellis, F., Berritto, D., Pizza, N. L., Reginelli, A., Di Martino, N., & Grassi, R. (2012). Investigation of compensatory postures with videofluoromanometry in dysphagia patients. *World journal of gastroenterology*, *18*(23), 2973–2978. https://doi.org/10.3748/wjg.v18.i23.2973.

Souchon, N. M., Krüger, E., Eccles, R., & Pillay, B. S. (2020). Perspectives of working-age adults with aphasia regarding social participation. *African journal of disability, 9*, 713-713. doi:10.4102/ajod.v9i0.713.

Souza, J. T., Ribeiro, P. W., de Paiva, S. A. R., Tanni, S. E., Minicucci, M. F., Zornoff, L. A. M., . . . Azevedo, P. S. (2019). Dysphagia and tube feeding after stroke are associated with poorer functional and mortality outcomes. *Clinical Nutrition*. doi:https://doi.org/10.1016/j.clnu.2019.11.042.

Spencer, K. A., & Brown, K. A. (2018). Dysarthria following Stroke. *Seminars in Speech and Language, 39*(1), 15-24. doi:10.1055/s-0037-1608852.

Statistics South Africa (2016). *Mortality and causes of death in South Africa, 2016: Findings from death notification*. Pretoria: Statistics South Africa; Retrieved from http://www.statssa.gov.za/?cat=19: 26/10/2018.

Steele, S. J., Ennis, S. L., & Dobler, C. C. (2021). Treatment burden associated with the intake of thickened fluids. *Breathe, 17*(1).

Stipancic K. L., Borders James, C., Brates, D., & Thibeault S. L. (2019). Prospective investigation of incidence and co-occurrence of dysphagia, dysarthria, and aphasia

following ischemic stroke. *American Journal of Speech-Language Pathology, 28*(1), 188-194. doi:10.1044/2018_AJSLP-18-0136.

Streiner, D.L. & Norman, G.R. (2011). Correction for multiple testing: Is there a resolution? *Chest, 140*(1):16-18.

Stroke Foundation (2019). Clinical guidelines for stroke management. Melbourne (Australia). http: 11informme.org.au/en/Guidelines/Living-guidelines-for-stroke-management.

Sungsinchai, S., Niamnuy, C., Wattanapan, P., Charoenchaitrakool, M., & Devahastin, S. (2019). Texture modification technologies and their opportunities for the production of dysphagia Foods: A Review. *Comprehensive Reviews in Food Science and Food Safety, 18*(6), 1898-1912. doi:https://doi.org/10.1111/1541-4337.12495.

Sura, L., Madhavan, A., Carnaby, G., & Crary, M. A. (2012). Dysphagia in the elderly: Management and nutritional considerations. *Clinical Interventions in Aging*, *7*, 287.

Taylor, A., & Ntusi, N. A. (2019). Guest Editorial: Evolving concepts of stroke and stroke management in South Africa: Quo vadis?. *South African Medical Journal*, *109*(2), 69-71.

Teh, W. H., Smith, C. J., Barlas, R. S., Wood, A. D., Bettencourt-Silva, J. H., Clark, A. B., . . . Myint, P. K. (2018). Impact of stroke-associated pneumonia on mortality, length of hospitalization, and functional outcome. *Acta Neurologica Scandinavica, 138*(4), 293-300. doi:https://doi.org/10.1111/ane.12956.

Teismann, I. K., Steinsträter, O., Warnecke, T., Suntrup, S., Ringelstein, E. B., Pantev, C., & Dziewas, R. (2009). Tactile thermal oral stimulation increases the cortical representation of swallowing. *BMC Neuroscience, 10*(1), 71. doi:10.1186/1471-2202-10-71.

Teramoto, S. (2009). Novel preventive and therapeutic strategy for post-stroke pneumonia. *Expert Review of Neurotherapeutics, 9*, 1187+. Retrieved from https://link-gale-com.ezproxy.uct.ac.za/apps/doc/A222571248/AONE?u=unict&sid=AONE&xid=d6ee0c41

https://www.tandfonline.com/doi/full/10.1586/ern.09.72

Terre Blanche, M. J., Durrheim, K., & Painter, D. (2006). *Research in practice: Applied methods for the social sciences*: Juta and Company Ltd.

Thorpe, E. R., Garrett, K. B., Smith, A. M., Reneker, J. C., & Phillips, R. S. (2018). Outcome measure scores predict discharge destination in patients with acute and subacute stroke: A Systematic review and series of meta-analyses. *Journal of Neurologic Physical Therapy, 42*(1), 2-11. doi:10.1097/npt.0000000000000211.

Thrift, A. G., Thayabaranathan, T., Howard, G., Howard, V. J., Rothwell, P. M., Feigin, V. L., . . . Cadilhac, D. A. (2017). Global stroke statistics. *International Journal of Stroke, 12*(1), 13-32. doi:10.1177/1747493016676285.

Tredoux, C., & Durrheim, K. (2002). *Number, Hypotheses & Conclusions: A Course in Statistics for the Social Sciences.* Cape Town: University of Cape Town Press.

Tyrer, S., & Heyman, B. J. B. b. (2016). Sampling in epidemiological research: issues, hazards and pitfalls. *BJ Psych Bulletin, 40*(2), 57-60.

Umay, E. K., Yilmaz, V., Gundogdu, I., Ozturk, E., Gurcay, E., Karaahmet, O., . . . Cakci, A. (2019). What happens to swallowing muscles after stroke?: A prospective randomized controlled electrophysiological study. *Neurology India, 67*(6), 1459. Retrieved from https://www.neurologyindia.com/article.asp?issn=0028-3886;year=2019;volume=67;issue=6;spage=1459;epage=1466;aulast=Umay.

VanderWeele, T. J., & Mathur, M. B. (2019). SOME DESIRABLE PROPERTIES OF THE BONFERRONI CORRECTION: IS THE BONFERRONI CORRECTION REALLY SO BAD? *American Journal of Epidemiology, 188*(3), 617-618. doi:10.1093/aje/kwy250.

Van Niekerk, S.-M., Inglis-Jassiem, G., Kamalakannan, S., Fernandes, S., Webster, J., English, R., . . . Louw, Q. A. (2020). Achieving universal health coverage for people with stroke in South Africa: protocol for a scoping review. *BMJ Open, 10*(10), e041221. doi:10.1136/bmjopen-2020-041221.

Van Sickle, A. (2016). Evidence-based intervention for individuals with acquired apraxia of speech. *EBP Briefs, 11*(2), 1-9.

Vassar, M., & Holzmann, M. (2013). The retrospective chart review: important methodological considerations. *Journal of Educational Evaluation for Health Professions*, *10*.

Vilardell, N., Rofes, L., Arreola, V., Martin, A., Muriana, D., Palomeras, E., . . . Clavé, P. (2017). Videofluoroscopic assessment of the pathophysiology of chronic poststroke oropharyngeal dysphagia. *Neurogastroenterology and Motility, 29*(10), e13111. doi:https://doi.org/10.1111/nmo.13111.

Viljoen C.A., Dalmeyer L., & De Villiers L. (2014). Cost of acute stroke care in South Africa. *Stroke*, 8(1), 3–4.

Virvidaki, I. E., Nasios, G., Kosmidou, M., Giannopoulos, S., & Milionis, H. (2018). Swallowing and aspiration risk: A critical review of non instrumental bedside screening tests. *Journal of Clinical Neurology (Seoul, Korea), 14*(3), 265-274. doi:10.3988/jcn.2018.14.3.265.

Wambaugh, J. L., Nessler, C., Cameron, R., & Mauszycki, S. C. (2012). Acquired apraxia of speech: The effects of repeated practice and rate/rhythm control treatments on sound production accuracy. *American Journal of Speech - Language Pathology (Online), 21*(2), S5-S27. doi:http://dx.doi.org/10.1044/1058-0360(2011/11-0102).

Wambaugh, J. L. (2021). An expanding apraxia of speech (AOS) treatment evidence base: An update of recent developments. *Aphasiology, 35*(4), 442-461. doi:10.1080/02687038.2020.1732289.

Wang, S., Wang, C.-X., Zhang, N., Xiang, Y.-T., Yang, Y., Shi, Y.-Z., . . . Ng, C. H. (2018). The association between post-stroke depression, aphasia, and physical independence in stroke patients at 3-Month follow-ip. *Frontiers in Psychiatry, 9*(374). doi:10.3389/fpsyt.2018.00374.

Wang, X., & Kattan, M. W. (2020). Cohort studies: design, analysis, and reporting. *Chest, 158*(1), S72-S78. doi:10.1016/j.chest.2020.03.014.

Wang, Y., Li, H., Wei, H., Xu, X., Jin, P., Wang, Z., . . . Yang, L. (2019). Assessment of the quality and content of clinical practice guidelines for post-stroke rehabilitation of aphasia. *Medicine, 98*(31), e16629-e16629. doi:10.1097/MD.0000000000016629.

Warnecke T., Dziewas R., Langmore S. (2021) Using FEES in the stroke unit and the intensive care unit. In: Neurogenic Dysphagia. Springer, Cham. https://doi.org/10.1007/978-3-030-42140-36.

Watila.M.M, & Balarabe, S.A. (2015). Factors predicting post-stroke aphasia recovery. *Journal of the Neurological Sciences, 352*(1-2), 12-18. doi:10.1016/j.jns.2015.03.020.

Waza, M., Maeda, K., Katsuragawa, C., Sugita, A., Tanaka, R., Ohtsuka, A., . . . Fukui, H. (2019). Comprehensive tool to assess oral feeding support for functional recovery in post-acute rehabilitation. *Journal of the American Medical Directors Association, 20*(4), 426-431. Retrieved from https://www.jamda.com/article/S1525-8610(18)30602-9/fulltext.

Weir, C. J., Bradford, A. P., & Lees, K. R. (2003). The prognostic value of the components of the Glasgow Coma Scale following acute stroke. *QJM, 96*(1), 67-74. doi:10.1093/qjmed/hcg008.

Whitehead, S., & Baalbergen, E. (2019). Post-stroke rehabilitation (CME). *SAMJ South African Medical Journal, 109*(2), 81. doi:10.7196/SAMJ.2019.v109i2.00011.

WHODAS 2.0 Translation Package (Version 1.0). Translation and Linguistic Evaluation Protocol and Supporting Material. https://terrance.who.int/mediacentre/data/WHODAS/Guidelines/WHODAS%202.0%20Translation%20guidelines.pdf.

World Health Organisation (WHO). (2001). International Classification of Functioning, Disability and Health (ICF), Geneva: World Health Organisation.

World Health Organisation (WHO). (2010). Bridging the gap in South Africa. *Past issues, volume 88*(11), November 2010, 797-876.

World Health Organisation (WHO). (2020). Coronavirus. www.who.int/health-topics/coronavirus#tab=tab_1.

World Medical Association. (2013). World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *Jama*, *310* (20), 2191 -2194. doi:10.1001/jama.2013.281053.

Wright, L., Cotter, D., & Hickson, M. (2008). The effectiveness of targeted feeding assistance to improve the nutritional intake of elderly dysphagic patients in hospital. *Journal of Human Nutrition and Dietetics, 21*(6), 555-562. doi:10.1111/j.1365-277X.2008.00915.x.

Wu, X. S., Miles, A., & Braakhuis, A. J. (2021). Texture-modified Diets, nutritional status and mealtime satisfaction: A systematic review. *Healthcare, 9*(6). doi:10.3390/healthcare9060624.

Xirasagar, S., Tsai, M.-h., Heidari, K., Hardin, J. W., Wu, Y., Wronski, R., . . . Sen, S. (2019). Why acute ischemic stroke patients in the United States use or do not use emergency medical services transport? Findings of an inpatient survey. *BMC Health Services Research, 19*(1), 929. doi:10.1186/s12913-019-4741-6.

Yang, Y., Wang, A., Zhao, X., Wang, C., Liu, L., Zheng, H., . . . Wang, Y. (2016). The Oxfordshire Community Stroke Project classification system predicts clinical outcomes following intravenous thrombolysis: a prospective cohort study. *Therapeutics and Clinical Risk Management, 12*, 1049-1056. doi:10.2147/TCRM.S107053.

Yeh, S.-J., Huang, K.-Y., Wang, T.-G., Chen, Y.-C., Chen, C.-H., Tang, S.-C., . . . Jeng, J.-S. (2011). Dysphagia screening decreases pneumonia in acute stroke patients admitted to the stroke intensive care unit. *Journal of the Neurological Sciences, 306*(1), 38-41. doi:https://doi.org/10.1016/j.jns.2011.04.001.

Young, M. (2016). Private vs. public healthcare in South Africa.

Zamanzadeh, V., Ghahramanian, A., Rassouli, M., Abbaszadeh, A., Alavi-Majd, H., & Nikanfar, A.-R. (2015). Design and implementation content validity Study: Development of an instrument for measuring patient-centred communication. *Journal of caring sciences, 4*(2), 165-178. doi:10.15171/jcs.2015.017.

Zohrabi, M. (2013). Mixed method research: Instruments, validity, reliability and reporting findings. *Theory and Practice in Language Studies, 3*(2). doi:10.4304/tpls.3.2.254-262.

Appendix A - Information Letter

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders, Disability Studies, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building,
Groote Schuur Hospital
Observatory, Cape Town, W Cape, 7925
Tel: +27 (0) 21 406 6593

RE: PARTICIPATION IN UCT RESEARCH STUDY

Dear Participant,

I am a post-graduate student from the Division of Communication Sciences and Disorders at the University of Cape Town, currently completing my MSc Degree in Speech-Language Pathology. I am inviting you to participate in my study entitled "Clinical Outcomes Associated with Speech, Language and Swallowing Disorders Post-Stroke – A Prospective Cohort Study".

Purpose of Study

The purpose of the study is to determine how many people have speech, language, and swallowing difficulties after they have a stroke and what this means for how long they stay in the hospital, how they eat or get nutrition, whether they become dehydrated, or get chest infections. We will also note your medical information, including information on the type of stroke, and whether any other problems were experienced, what type of treatment was provided, and your status when you are discharged.

Why have you been asked to participate in this study?

You have had a stroke and have been admitted to a private hospital in Cape Town.

What is expected of you if you decide to take part in the study?

Once you give permission to take part in the study, I or my assistant researcher will review your folder while you are in hospital from admission to discharge, to record the relevant information. If missing information cannot be obtained from hospital folders, then the researcher may contact you or your next of kin to obtain the relevant information.

What will you have to do if you agree to take part in this study?

Once you agree to participate in the study, you will not be required to do anything. I or my assistant researcher will access your medical and speech therapy information from hospital folders, and record this information. We will also need to consult with your Physiotherapist, for

information on physical mobility. Your Speech-Language Therapist (SLT) will continue to treat you for Speech Therapy during your hospitalisation.

Risks and Benefits

There is no concern for risk or harm. There is no benefit to participating in the study; however, the results from the study may be used to improve management of other individuals with strokes, who have speech, language and swallowing difficulties.

Ethical Considerations

The study has met the ethical obligations expected by the UCT Faculty of Health Sciences Human Research Ethics Committee (FHS HREC) (HREC 730/2019). The SLTs involved in the study will respect the privacy of your medical information by using a coding system. You will be assigned a code so that you cannot be identified by name during the study. A separate password-protected document will be constructed including your name and corresponding code to ensure that data analysis checks can be performed. Data will be deleted after at least two years post publication of the study.

Do you have to take part in this study?

You have the right to decide whether you wish to take part in this study. If you decide not to take part in the study, your treatment will not be affected in any way. You have the right to withdraw from the study at any point. Should you decide to withdraw from the study, you need to inform your treating SLT or the researcher.

Post-Research

At the end of the study, you may be transferred to a step-down facility for rehabilitation and in that case, the SLT will give handover to the SLT at that facility. You may go home after discharge and not require follow up treatment. You may go home and require outpatient speech therapy, which will be organized by your SLT.

Findings will be disseminated to the wider research community by publishing an article in a peer reviewed journal. If you are interested in the study's results, you will be able to access the results post-publication on the UCT Faculty of Health Sciences website.

You are welcome to contact the researchers if you have any questions. The Chair of the UCT FHS HREC, Professor Marc Blockman, can be contacted on 021 406 6338, in case you have any queries regarding individuals' rights and welfare as research subjects in the study.

Yours Sincerely,

Associate Prof. Shajila A. Singh (shajila.singh@uct.ac.za) / 021 406 6593

Student Researcher:
Stephanie Kaylor (stephkaylor@gmail.com) / +27 78 815 5125

Appendix B - Consent Form

Consent Form (Participants to complete):

I have read the information letter. I have had the opportunity to ask questions and have these answered, and I understand what the research study is about. I agree to take part in this study.

Full Name (in block letters): _____
Signature: _____
Cell phone number: _____
Email Address: _____
Date: _____

Witness signature: _____
Full name (in block letters): _____
Email: _____
Cell phone number: _____

Proxy Consent Form (Participants' Next of Kin to complete if participant is unable to physically complete form and/or is unable to make an informed decision):

I have read the information letter. I have had the opportunity to ask questions and have these answered, and I understand what the research study is about. I _____ (name of next of kin) agree for _____ (name of participant) to take part in this study.

Name of Participant (in block letters): _____
Name of Next of Kin (in block letters): _____
Signature: _____
Cell phone number: _____
Email Address: _____

Date: _____

Witness signature: _____

Full name (in block letters): _____

Email: _____

Cell phone number: _____

Appendix C – Excerpt from Data Abstraction Tool

Patient Ref	English	English & Afrikaans	Afrikaans	English & isiXhosa	isiXhosa	Afrikaans & isiXhosa	English, Afrikaans & isiXhosa		Male	Female	Employed	Unemployed	Home-maker	Retired/ Pensioner	Number of days from stroke diagnosis to admission	Thrombolysed
A1																
A2																
A3																
A4																
A5																
A6																
A7																
A8																
A9																
A10																
A11																
A12																
A13																

Appendix D - Coding Manual

Key

For all participants:

- 1 = For applicable or present characteristics
- 0 = For non-applicable/not present
- Solid red block = missing information/ unable to be deduced
- The number 1 to tally the number of incidences occurred (e.g. 1,1,1...Final total = 3)

Demographic Information

- Patient Reference: ALIVE = A + number serially
- Age = Number in whole years on date of admission
- Language = Enter 1 or 0 under the respective language/combination of languages (e.g. English, English and Afrikaans) the participant speaks.
- Sex = Enter 1 or 0 under the respective sex (e.g. female, male) of the participant.
- Employment = Enter 1 or 0 under the respective employment status of the participant (e.g. employed, unemployed).

Admission

- Date of admission (i.e. the day the patient was admitted to hospital for a stroke diagnosis) = DD/MM/YYYY (record on participant coding document)
- Level of physical ability at admission according to mRS (value of 0-6) – Consult with participants' Physiotherapists. Modified Rankin Scale (mRS) value 0–6 = Record 1 under appropriate score; if not assigned by PT then assign based on PT notes. Enter the score (e.g. 6) under the column 'mRS' score.
    - 0 = no symptoms
    - 1 = no significant disability despite symptoms; able to carry out all usual duties and activities
    - 2 = slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
    - 3 = moderate disability; requires some help, but able to walk without assistance
    - 4 = moderately severe disability; unable to walk and attend to bodily needs without assistance
    - 5 = severe disability; bedridden, incontinent and requiring constant nursing care and attention
    - 6 = dead
- Mode of nutritional intake according to FOIS (refer to scale). FOIS value 1-7 = Record 1 under appropriate score, and enter the score (e.g. 4) under the column 'FOIS' score.
    - 1 = NPO
    - 2 = tube dependent, minimal attempts of food or liquid
    - 3 = tube dependent with consistent oral intake of food or liquid
    - 4 = oral diet; single consistency
    - 5 = oral diet; multiple consistencies; requiring special preparation or compensations
    - 6 = oral diet; multiple consistencies; no special preparation; specific food limitations

- 7 = total oral diet with no restrictions

- Level of consciousness/GCS scale score: If GCS score is recorded, and if the score is above 12/15, then consider the patient alert. If the score is below 11/15, then consider the patient low level of consciousness.

Discharge

- Date/Duration
    - Discharge date = DD/MM/YYYY (record on participant coding document).
    - Length of hospital stay (days) = Number – i.e. the number of NIGHTS between admission date and discharge date.
- Destination
    - Rehabilitation/Intermediate care facility – patient is going here primarily for rehabilitation (e.g. Life Rehab; Nurture Cape View).
    - Long-term care facility – patient is being placed here indefinitely for long-term nursing care (e.g. Oasis Care Centre).
- Status
    - Level of physical ability at discharge according to mRS (vale of 0-6) – Consult with participants' Physiotherapists: Record 1 under appropriate score and enter the mRS score under the column 'mRS Score'. Mode of nutritional intake according to FOIS (refer to scale): Record 1 under appropriate score, and enter the FOIS score under 'FOIS score'.
    - Level of consciousness according to GCS: If GCS score is recorded, and if the score is above 12/15, then consider the patient alert. If the score is below 11/15, then consider the patient low level of consciousness.

Stroke Details

- Ischaemic = infarct.
- Haemorrhagic = bleeding.
- Previous stroke = Any stroke that occurred prior to the stroke for which they were currently admitted for.
- Type of stroke
    - Unspecified – unknown whether the stroke is ischaemic or haemorrhagic (stated by the patient's Doctor).
    - Record detailed information on type of stroke on participant coding document.
    - NIH Stroke Scale Score: Record 1 under appropriate score, and enter the
- NIH score under the column 'NIH score'.

  0= No stroke.
  1-4 = Minor stroke.
  5-15 = Moderate stroke.
  16-20 = Moderate to severe stroke.
  21-42 = Severe stroke.
- Hemiparesis: Any weakness or slight paralysis on one side of the body.
- Hemiparalysis: Paralysis of one side of body.

Comorbidities

- Incidences of new co-morbidities: List all new conditions which has been diagnosed during length of current hospitalisation – Record this on participant coding document.

- Other comorbidities – List any additional comorbidities on participant coding document.
- Cardiac: Check for specific cardiac conditions (e.g. Atrial Fibrillation (AF)).
- Take note of the following abbreviations:
  - AF = Atrial Fibrillation
  - AKA = Above the Knee Amputation
  - ARF: Acute Renal (kidney) Failure
  - BKA = Below the Knee Amputation
  - BP = Blood Pressure
  - Ca = Cancer
  - CHD = Coronary Heart Disease (type of Hypertensive Heart Disease)
  - CHF/CCF = Congestive Heart Failure/ Congestive Cardiac Failure
  - CKD = Chronic Kidney Disease
  - COPD = Chronic Obstructive Pulmonary Disease
  - CVD = Cardiovascular Disease
    * CVD also includes Coronary Artery Diseases (CAD), such as angina
  - DM = Diabetes Mellitus
  - DNR = Do Not Resuscitate
  - DVT = Deep Vein Thrombosis
  - ESLD = Hepatic/ Liver Failure
  - ESRD = Kidney/ Renal Failure
  - GO/ERD = Gastroesophageal Reflux Disorder
  - HBP = High Blood Pressure/ Hypertension
  - HPT/ HPN = Hypertension
  - IBD = Inflammatory Bowel Disease
  - IBS = Irritable Bowel Syndrome
  - IDDM = Insulin-dependent diabetes mellitus/ Type 1 diabetes
  - IHD = Ischaemic Heart Disease
  - LVH = Left Ventricular Hypertrophy (type of Hypertensive Heart Disease)
  - MI = Myocardial Infarction
  - MNE = Motor Neuron Disease
  - PE = Pulmonary embolism (a type of blood clot in the lungs)
  - PVD = Peripheral Vascular Disease
  - RDS = Respiratory Distress Syndrome
  - SOB = Shortness of breath
  - UTI = Urinary tract infection

- Types of liver disease:
  - Nonalcoholic fatty liver disease
  - Hepatitis C
  - Hepatitis B
  - Cirrhosis of the liver
  - Alcoholic hepatitis
  - Hepatitis A
  - Hemochromatosis

Dentition

- Oral hygiene status: Good/Clean = Tongue is clean with no white colouring; no food particles in between teeth/dentures/cheeks; mouth is cleaned with mouthwash/toothpaste and mouth kit (i.e. sponge stick, gauze, toothbrush).
- Oral hygiene status: Poor = Oral thrush (white colouring on tongue); food particles in between teeth/cheeks/palate; skin peeling off lips; mouth sores; no mouthwash/toothpaste or mouth kit.
- Tally the number of times oral hygiene was reported good/per total no. of sessions, and give the total number when patient is discharged. Does not include assessment session.
- Consider oral care "good" if reported or not reported in case notes. Consider oral care "poor" if reported in case notes.
- >50% (e.g. 6/10 sessions) of oral hygiene noted good/per total. no. of sessions = Consider routine oral care implemented.
- <50% (e.g. 3/10 sessions) of oral hygiene noted/per total no. of sessions = Consider lack of routine oral implemented.
- Enter 1 under "good" or "poor" depending on percentage (no. of times oral hygiene noted good/total no. of sessions).

Pneumonia (as verified by Radiologists' interpretation of chest-xrays and by the medical diagnosis made by the participants' Physicians)

- Hospital-acquired pneumonia = Any pneumonia contracted by a person that is hospitalised (e.g. Klebsiella pneumonia).
- Aspiration pneumonia = Pneumonia caused as a result of aspiration of food or liquid.
- Community-acquired pneumonia = Any pneumonia contracted by a person outside of the hospital environment (i.e. before admitted to hospital).

*Enter 1 or 0 under the respective pneumonia options.

Dysphagia Interventions

- Mode of nutritional intake = Any modification to the method of eating or feeding a patient (e.g. slow pace, small bolus volumes, via syringe instead of straw etc.).
- Sensory intervention = Icing to facial musculature, different tastes (e.g. sour, cold), thermal tactile stimulation.
- Oral diet and oral supplements = The patient receives an oral diet (e.g. puree/soft/full) and also oral supplements (e.g. Fresubin drinks, Kcal crème etc.).
- Enteral nutrition and oral intake = The patient is tube-fed via Nasogastric Tube (NGT) or PEG tube, and also receives small volumes of food and/or liquid orally.

Nature of SLT Services

- The number of dysphagia/aphasia/dysarthria/apraxia of speech sessions does **not** include the assessment session.
- Time from admission to SLT referral (hours) = Number (e.g. 24).
- Aphasia Rx: Consider word retrieval rx as part of expressive language rx.
- Total number of intervention sessions = Number of 15-minute interval therapy sessions (i.e. the number of therapy/contact time sessions we've had with the patient).

- If there are combined therapy sessions (e.g. dysphagia and aphasia rx in one session) then count as one session for each condition (1 session for dysphagia and 1 session for aphasia).
- Length of Intervention = The period of time the patient could have received therapy in hospital (i.e. excluding assessment session, count all days till discharge, irrespective of whether the patient was or wasn't seen by Speech Therapy for therapy sessions).
- "Other" aphasia/apraxia of speech/dysarthria therapy content = Record which other therapy techniques were used in sessions, on participant coding document.
- Referrals = State the number of referrals by SLT. If referrals were made, state which Health Professionals were referred to (e.g. Dietitian, OT) on the participant coding document.

Appendix E - Functional Oral Intake Scale[1]

TUBE DEPENDENT (levels 1-3)

1 No oral intake

2 Tube dependent with minimal/inconsistent oral intake

3 Tube supplements with consistent oral intake

TOTAL ORAL INTAKE (levels 4-7)

4 Total oral intake of a single consistency

5 Total oral intake of multiple consistencies requiring special preparation

6 Total oral intake with no special preparation, but must avoid specific foods or liquid items

7 Total oral intake with no restrictions

[1] Crary MA, Carnaby-Mann GD, Groher ME. Initial psychometric assessment of a functional oral intake scale for dysphagia in stroke patients. *Arch Phys Med Rehabil* 2005;86:1516-1520.

Appendix F - Modified Rankin Scale

MODIFIED RANKIN SCALE (MRS)

Patient Name: _____

Rater Name: _____

Date: _____

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

TOTAL (0–6):_____

Appendix G - HREC Ethics Approval Letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.arlefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

26 November 2019

HREC REF: 730/2019

Prof S Singh
Department of Health & Rehab Sciences
F-45 OMB

Dear Prof Singh

PROJECT TITLE: CLINICAL OUTCOMES ASSOCIATED WITH SPEECH, LANGUAGE AND SWALLOWING DIFFICULTIES POST-STROKE - A PROPESTIVE COHORT STUDY (MSC DEGREE - MISS S KAYLOR)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 November 2020.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Miss S Kaylor will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Appendix H - Permission Letter to CEOs of Hospital sites

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders, Disability Studies, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building,
Groote Schuur Hospital
Observatory, Cape Town, W Cape, 7925
Tel: +27 (0) 21 406 6593

RE: UCT POST-GRADUATE STUDENT REQUEST FOR APPROVAL to RECRUIT PARTICIPANTS FOR A PROSPECTIVE RESEARCH STUDY

Dear _____

I am a post-graduate student from the Division of Communication Sciences and Disorders at the University of Cape Town, currently completing my MSc Degree in Speech-Language Pathology.

Purpose of Study

I am completing my Master's degree in adult neurology and dysphagia, and plan to conduct a prospective cohort research study within the private acute care setting. This study has been approved by the UCT FHS HREC (HREC 730/2019). The purpose of the study is to determine the incidence of speech, language and swallowing disorders post-stroke, and their associations with clinical outcomes (i.e. length of hospital stay, mortality, level of physical ability, dehydration, and weight loss). Dysphagia, dysarthria, apraxia of speech and aphasia often occur following stroke, and can result in varied outcomes. However, it is unclear as to which of these disorders contribute to the outcomes, and whether Speech Therapy services, within the acute care setting, influences these outcomes. Further, it is unclear why only some individuals who aspirate develop aspiration pneumonia, and which risk factors are likely to predict aspiration pneumonia post-stroke. This study aims to investigate the relationship between risk factors and clinical outcomes. Knowledge about these relationships may guide implementation of protocols to improve clinical outcomes.

Inclusion and Exclusion Criteria

The study will include all individuals who have a diagnosis of stroke and have been admitted to one of the following private hospitals in Cape Town: _____. The study will exclude: individuals presenting with pre-existing dysphagia, dysarthria, aphasia, and apraxia of speech.

Research Personnel

The research personnel will include the researcher and a second data abstractor, who is also a Speech-Language Therapist (SLT). Two additional SLTs who work at the data collection sites will assist with administering outcome measure scales. All SLT personnel involved are registered with the HPCSA, and are employed by _____Speech Therapy Practice. The SLTs will consult with participants' Physiotherapists about the Modified Rankin Score (mRS). Participants' Physiotherapists will be given a letter of information to inform them about the study.

Research Procedure

Recruitment will involve the researcher meeting with the SLTs who work at the hospitals, to brief them about the study and requirements for eligible participants. The SLTs will need to get permission from potential participants, to give their names and contact details to the researcher. Convenience sampling will be used. This means that all individuals' post-stroke who have been admitted, will be selected to participate in the study. Data collection will involve: (1) Administering two outcome measure scales, the Modified Rankin Scale (mRS) and the Functional Oral Intake Scale (FOIS), at admission and discharge to identify any changes in physical independence and mode of nutritional intake; (2) abstracting data from the SLTs files on Dropbox, which is the Practice's standard tool used for storing patient information and (3) recording data onto an electronic data abstraction tool on Excel, which will be password protected. The variables of interest include: Demographic data, medical history including co-morbidities and medication, stroke details, nature of speech, language and swallowing difficulties, nature of speech therapy services and clinical outcomes. A pilot study will be conducted prior to the main study on 10 participants. Data collection will occur for a period of 6 months in 2020 to ensure that the target sample size of 85 is achieved. Data analysis will involve identifying missing information and conducting various statistical measures, to analyse the results. SLTs will continue to treat participants for speech therapy from admission to discharge.

Risks and Benefits

There is no concern for risk or harm. There are no benefits for participants. However, the results from the study may help with improved management of individuals post-stroke, who present with speech, language and swallowing difficulties.

Ethical Considerations

Participants have the right to voluntarily decide whether or not to participate in the study, and to withdraw from the study at any point. The researcher will contact potential participants telephonically/in person, to inform them about the study, what it entails, and to obtain consent. Consent forms will be written in English, and translated into Afrikaans and isiXhosa by translators. If the patient is someone being treated by the researcher, then the research assistant will meet with the patient to recruit them into the study. If participants are medically unstable or have receptive or global aphasia and/or cognitive impairment, they will be given an adapted pictographic consent form. However, if participants' medical, physical, language and/or cognitive impairments are severe (i.e. disoriented, limited verbal ability), and restricting their ability to make an informed decision, proxy consent will need to be obtained from a legally authorised caregiver. The researcher will be responsible for collecting signed consent forms. Consent forms will be scanned and uploaded to an electronic storage system, and physically stored in a safe, secure location for two years post-publication, after which it will be destroyed. Participants will be required to provide their names in consent forms; however, a coding

system will be used to address participants' confidentiality within the study. Each participant will be assigned a code, which will be recorded on the data abstraction tool. In addition, a separate password-protected document will be created with the participants' names and their respective code to ensure that reliability checks can be conducted. Participant information will only be accessible to the researcher and the second data abstractor. Data will be deleted after at least two years post publication of the study.

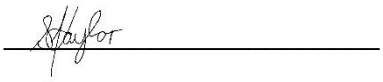
Post-Research

At the end of the study, participants may be transferred to a step-down facility for rehabilitation and in that case, the SLT will give therapy progress handover to the SLT at that facility. Participants may go home after discharge and not require follow up treatment. Participants may go home and require outpatient speech therapy, which will be organized by the SLT who treated them, and therapy will continue post-study for as long as the patient's medical aid allows for, or until the patient does not require further therapy sessions.

Findings will be disseminated to the wider research community by publishing an article in a peer reviewed journal. If you are interested in the study's results, you will be able to access the results post-publication on the UCT Faculty of Health Sciences website.

We hereby request permission to conduct this study at _____. You are welcome to contact the researchers if you have any questions. The Chair of the UCT FHS HREC, Professor Marc Blockman, can be contacted on 021 406 6338, in case you have any queries regarding individuals' rights and welfare as research subjects in the study.

Yours Sincerely,



Associate Prof. Shajila A. Singh (shajila.singh@uct.ac.za) / 021 406 6593

Student Researcher:
Stephanie Kaylor (stephkaylor@gmail.com) / +27 78 815 5125

Appendix I – Pictographic Consent Form

WOULD YOU LIKE TO TAKE PART IN OUR STUDY?

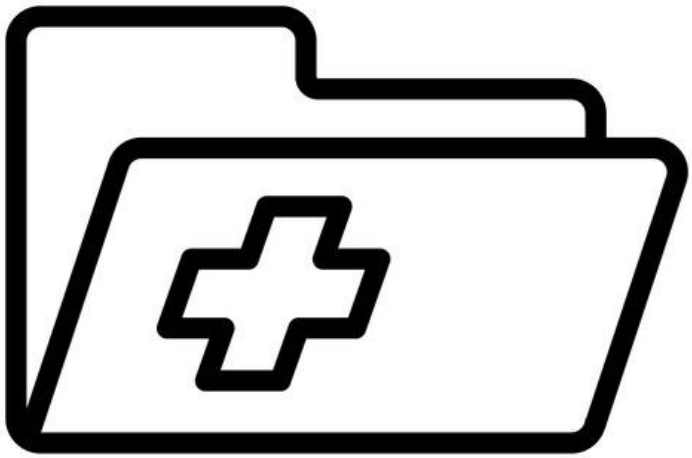
Client Name:

Researcher Name:

I am a student at the University of Cape Town. I am also a Speech and Language Therapist.

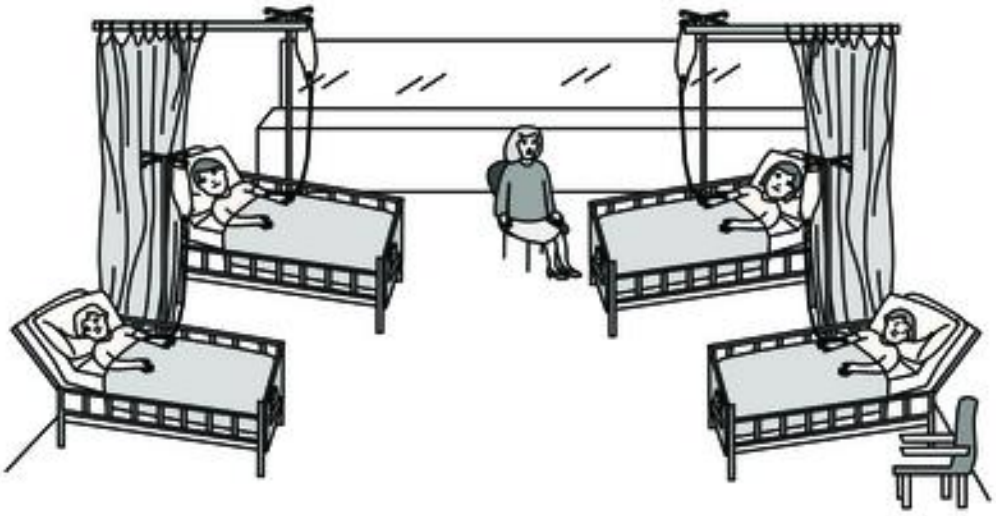
I would like to ask you if you are interested in taking part in my research study.

I want to find out how many people have speech, language and swallowing disorders after stroke, and what type of outcomes this can lead to.



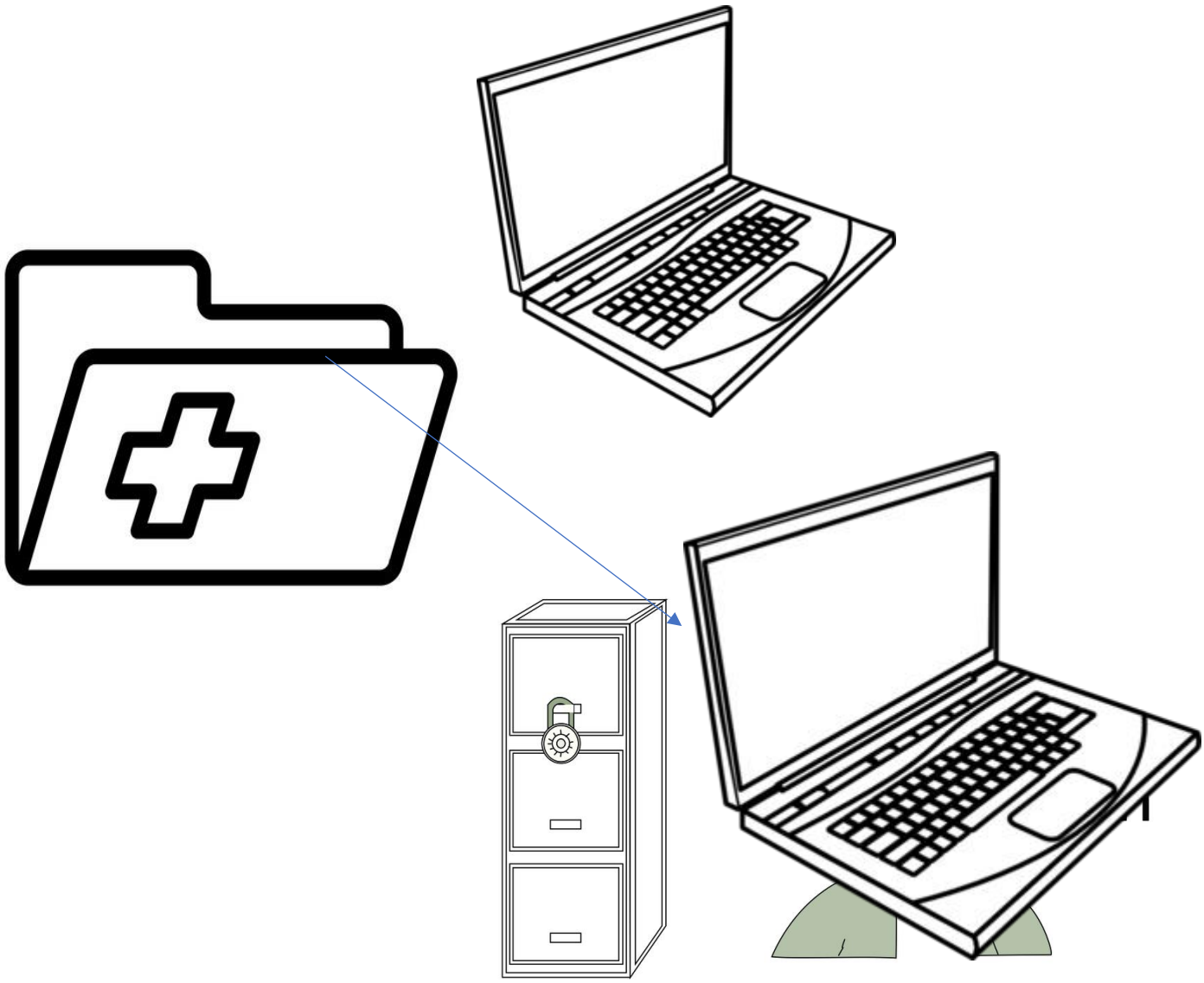
I or my assistant researcher will need to get your details from your medical folder.

You will not have to do anything.



We will record your information from your medical folder.

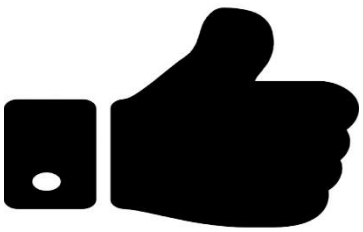
Your information will be kept safe and not shared with anyone.



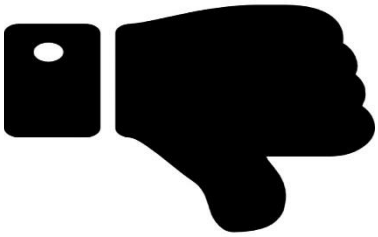
You will be required to provide your name for the consent form, but your name will be protected by using a password-protected code for the study.

Benefits:

Results from the study will help us to improve management of other patients with stroke, who have speech, language and swallowing disorders.



Risk:



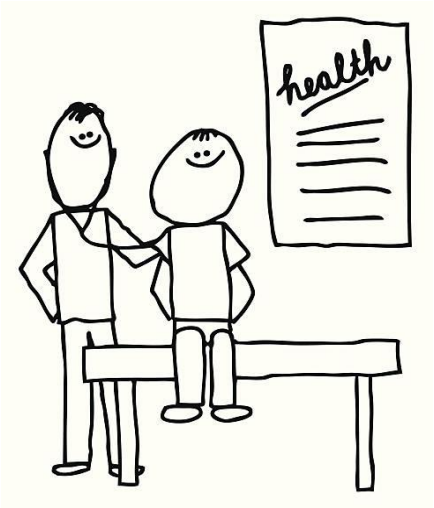
There is no **danger**
to participating **in the**
study.

We will not pay you or give you anything if you take part in our study.

You are allowed to not want to take part in the study.

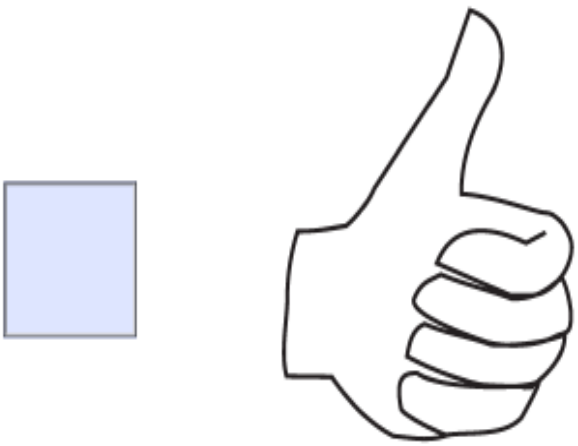
You are allowed to back out of the study at any point.

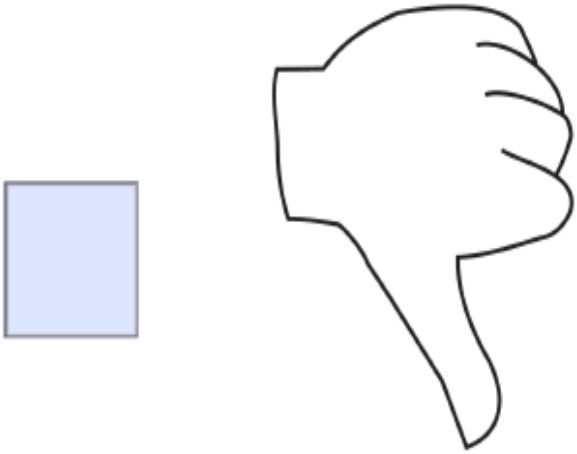
If you don't take part or change your mind, it will not impact on your health care.



Questions?

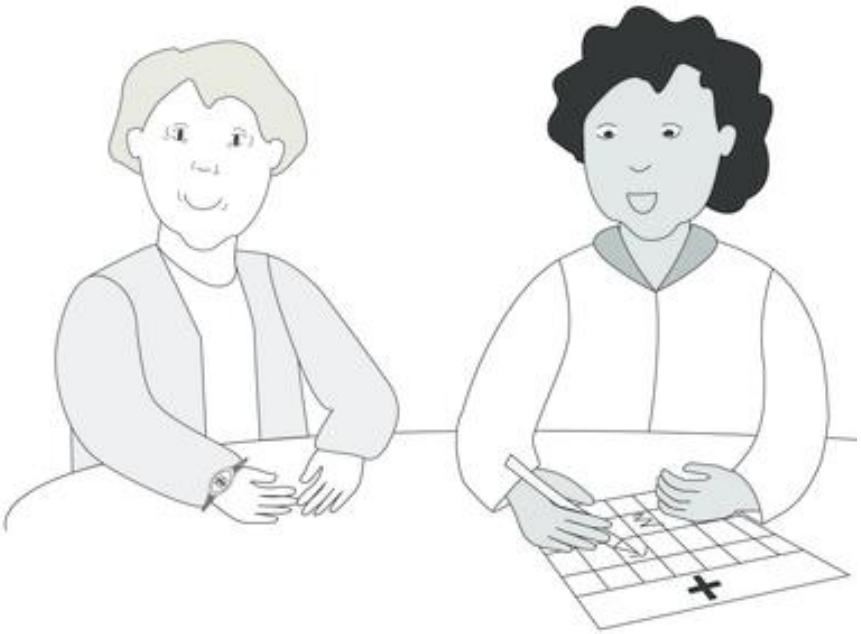
Do you agree to take part in this research study?





YES **NO**

If you agree to take part, we need to sign.



Name:

Signature:

Researcher:

Signature:

Witness:

Date:

Place:

Please contact the research supervisor, Associate Prof. Shajila A. Singh on 021 406 6593/ shajila.singh@uct.ac.za, or the researcher, Stephanie Kaylor at 078 815 5125/ stephkaylor@gmail.com, or the Chair of the Human Research Ethics Committee (HREC), Professor Marc Blockman, at (021) 406 6338 if you have any problems or questions.

Appendix J – Excerpt from Participant Coding Document

	Surname	Name	Hospital	Doctor	Date of Stroke	Stroke Details	Date of Admission	Date of Discharge	Incidences and new co-morbidities	Additional Co-morbidities
A1										
A2										
A3										
A4										
A5										

Appendix K - Additional Results

Table K1*: Degree of Disability at Discharge according to the Modified Rankin Scale (mRS)*

mRS Score *n* (%) N=68	0	1	2	3	4	5	6
Aphasia 3 (4.41)	1 (33.33)	1 (33.33)			1 (33.33)		
Dysarthria 3 (4.41)		2 (66.66)	1 (33.33)				
Dysphagia 2 (2.94)					1 (50)	1 (50)	
Aphasia & Dysarthria 6 (8.82)		3 (50)	1 (16.66)		1 (16.66)		1 (16.66)
Dysarthria & Dysphagia 10 (14.70)			2 (20)	2 (20)	3 (30)		3 (30)
Aphasia & Apraxia 3 (4.41)	1 (33.33)				2 (66.66)	1 (33.33)	
Aphasia & Dysphagia 7 (10.29)				1 (14.28)	1 (14.28)	3 (42.86)	2 (28.57)
Aphasia, Dysarthria & Dysphagia 26 (38.23)	3 (11,54)	2 (7.70)	1 (3.85)	3 (11.54)	12 (46.15)	2 (7.70)	3 (11.54)
Apraxia, Dysarthria, Dysphagia 3 (4.41)				1 (33.33)	2 (66.66)		
Aphasia, Apraxia, Dysphagia 3 (4.41)					1 (33.33)	2 (66.66)	
Aphasia, Apraxia, Dysarthria, Dysphagia 2 (2.94)	1 (50)						1 (50)

Table K2*: **Functional Oral Intake at Discharge According to the Functional Oral Intake Scale (FOIS)***

FOIS Score *n* (%) N=68	1	2	3	4	5	6	7
Aphasia 3 (4.41)							3 (100)
Dysarthria 3 (4.41)							3 (100)
Dysphagia 2 (2.94)					1 (50)	1 (50)	
Aphasia, Dysarthria 6 (8.82)	1 (16.66)						5 (83.33)
Dysarthria, Dysphagia 10 (14.70)	3 (30)				1 (10)	2 (20)	4 (40)
Aphasia, Dysphagia 7 (10.29)	4 (57.14)				1 (14.26)		2 (28.57)
Aphasia, Apraxia 3 (4.41)							3 (100)
Aphasia, Dysarthria, Dysphagia 26 (38.23)	5 (19.23)		2 (7.70)		3 (11.54)	7 (26.92)	9 (34.61)
Aphasia, Apraxia, Dysphagia 3 (4.41)	1 (33.33)					2 (66.66)	
Apraxia, Dysarthria, Dysphagia 3 (4.41)							3 (100)
Aphasia, Dysarthria, Apraxia, Dysphagia 2 (2.94)	1 (50)						1 (50)

Table K3: *Co-occurring Speech, Language and Swallowing Conditions and Mortality*

SLT Conditions	Mortality (n=10 deceased)	
	n	%
Aphasia, Dysarthria, Dysphagia	3	30
Dysarthria, Dysphagia	3	30
Aphasia, Dysphagia	2	20
Aphasia, Apraxia, Dysarthria, Dysphagia	1	10
Aphasia, Dysarthria	1	10

Table K4*: Number of Participants Referred to SLP within 24 hours*

Participants referred to SLT within 24 hours (n=32)	n	%
Aphasia, Dysarthria, Dysphagia	9	28.12
Dysarthria, Dysphagia	8	25
Aphasia, Dysarthria	5	15.62
Dysphagia	2	6.25
Aphasia, Dysphagia	2	6.25
Aphasia, Apraxia, Dysarthria, Dysphagia	2	6.25
Aphasia	2	6.25
Aphasia, Apraxia, Dysphagia	1	3.12
Aphasia, Apraxia	1	3.12

Table K5: *Co-occurring SLT Conditions and Number of Outpatient Referrals*

Co-occurring SLT Conditions (n=26)	n=No. of participants	No. of outpatient referrals (n=26)	%
Aphasia, Dysarthria, Dysphagia	26	15	57.69
Apraxia, Dysarthria, Dysphagia	3	3	100
Aphasia, Apraxia, Dysphagia	3	3	100
Aphasia, Dysphagia	7	2	28.47
Dysarthria, Dysphagia	10	2	20
Aphasia, Dysarthria	6	1	16.60

Table K6: *Nature of SLT Services*

Nature of SLT Services	N	Minimum	Maximum	Mean	SD	Median	95%CI
Referrals							
Number Days Stroke onset to Admission	68	0	3	0.04	0.36	0	0-0
Time admission to SLT Referral (hrs)	68	0	336	53.29	54.04	48	24-72
Length of Hospital Stay (days)	68	2	164	21.19	25.29	15	9-20
Number of SLT Outpatient Referrals	68	0	3	0.51	0.68	0	0-1
Number of Intervention Sessions							
Dysphagia	53	0	89	6.93	14.05	4	0.75-8
Aphasia	50	0	34	3.82	5.02	3	0.5-5
Dysarthria	50	0	18	2.26	3.38	0.5	0-3.25

Apraxia	11	0	22	1.38	4.08	0	0-0
Total Number Intervention Sessions	68	0	112	10.94	16.45	7	4-11.5

Table K7: ***Outcome Measure Scores at Admission and Discharge***

Outcome Measure Scores	N	Minimum	Maximum	Mean	SD	Median	95%CI
[a]NIHSS Score	12	0	22	2.00	5.11	0	0-0
mRS Admission Score	68	1	5	3.83	1.28	4	3-5
mRS Discharge Score	68	0	6	3.46	1.82	4	2-5
FOIS Admission Score	68	1	7	4.66	2.22	5	2.75-6
FOIS Discharge Score	68	1	7	5.16	2.39	6	4.5-7
Admission Weight	34	47	120	77.31	14.88	80	70-85.88
Discharge Weight	22	51	120	80.84	15.35	80	70-88.75

[a]NIHSS Scale: 0= No stroke; 1-4 = Minor stroke; 5-15 = Moderate stroke; 16-20 = Moderate to severe stroke; 21-42 = Severe stroke.