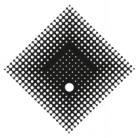

Does English proficiency impact on health outcomes for inpatients undergoing stroke rehabilitation?

Does English proficiency impact on health outcomes for inpatients undergoing stroke rehabilitation?

Authors and affiliations:

Sarah E Davies[1,2] , Karen J Dodd[2], April Tu[1], Emiliano Zucchi[3], Stefania Zen[3], Keith D Hill[4]

[1] Physiotherapy Department, Northern Health, Victoria, Australia

[2] College of Science, Health and Engineering, La Trobe University, Victoria, Australia.

[3] Transcultural and Language Services Department, Northern Health, Victoria, Australia

[4] Faculty of Health Sciences, Curtin University, Western Australia, Australia

Corresponding author: Sarah E Davies, Physiotherapy Department, Northern Health, Broadmeadows Health Service, Victoria, 3047, AUSTRALIA.

Email: sarah.davies@nh.org.au

Keywords:

Stroke, inpatient rehabilitation, English proficiency, interpreter use, culture, Australia

ABSTRACT:

PURPOSE: To determine whether English proficiency and/or the frequency of interpreter use impacts on health outcomes for inpatient stroke rehabilitation.

METHOD: Study Design: Retrospective case control study.
Participants: People admitted for inpatient stroke rehabilitation. A high English proficiency group comprised people with native or near native English proficiency (n=80), and a low English proficiency group comprised people who preferred a language other than English (n=80). Outcome measures: Length of stay, discharge destination and Functional Independence Measure (FIM).

RESULTS: The low English proficiency group showed a greater improvement in FIM from admission to discharge (p=0.04). No significant differences were found between groups in length of stay, discharge destination and number of encounters with allied health professionals. Increased interpreter usage improved FIM efficiency but did not significantly alter other outcomes.

CONCLUSION: English proficiency does not appear to impact on health outcomes in inpatient rehabilitation with a primarily in-house professional interpreter service. However there is a need for a larger powered study to confirm these findings.

INTRODUCTION:

Stroke is a leading cause of death and disability among adults in Australia [1]. It is estimated that up to 74% of people who have experienced a stroke require some assistance or are fully dependent on care givers for activities of daily living after stroke [2]. The cost burden of stroke in Australia is estimated to be around $2.14 billion a year [1]. The impact of stroke is similar throughout the developed world [3] and it is recognised as an important issue worldwide [4].

Much of the economic costs relating to stroke are associated with inpatient care because stroke rehabilitation is mainly provided in hospital [5]. International data indicates that the average length of rehabilitation stay for stroke patients in hospital range between 22-35 days [6,7]. Stroke specific rehabilitation services have been shown to reduce the odds of death, dependency and institutionalisation [8]. Making gains during inpatient rehabilitation is important because patients often need to reach a certain level of independence to be able to return home (with or without additional community supports).

English proficiency and its effect on stroke rehabilitation outcomes and therapy time has not been comprehensively explored. There is some evidence that difficulties in being able to communicate in the native language of the health professionals providing therapy and care can lead to patients receiving reduced intensity of therapy service and increased lengths of hospital stay. One study [9] explored data collected over 10 years from studies conducted in Australia and Norway that had monitored the amount, frequency and intensity of acute stroke therapy. People whose first language was different to the country they resided in were shown to

receive 23% less high intensity therapy per week day where intensity was related to the expected physical exertion involved in the activities undertaken with the therapists. For example, high intensity therapy activities included sitting to standing, standing or gait retraining, whereas low intensity activities included lying down, bed mobility or sitting retraining. In a separate study [10], retrospective analysis was performed on data from medical and surgical inpatients at three tertiary hospitals in Toronto, Canada. After adjustments were made for variables such as co-morbidities, the stroke patients with limited English proficiency were found to spend an average of 3.6 days (or just below 30%) longer in hospital than those who were proficient at English. The extent to which English proficiency affects health outcomes and use of health services has not been extensively evaluated in Australia [11]. Differences in health service provision, average length of stay and access and use of interpreters may limit the ability to generalise these results to the Australian health care system. Australia is a multicultural society, with 24.6% of the population born overseas, and 62% of the population in the state of Victoria being able to speak a language other than English [12]. It is important to establish the extent of impact of language proficiency in the context of usual interpreter use, for stroke patients in the Australian inpatient rehabilitation setting.

Interpreter services are one important avenue to support quality health care for people with low English proficiency. In Australia, the impact of interpreter services on ensuring equality of care has not been comprehensively examined [11]. In a systematic review of the impact of professional interpreters on quality of health care [13], it was concluded that professional interpreters benefitted patients with limited proficiency in the native language. Interpreters decreased communication errors,

increased patient comprehension, equalised health care utilisation, improved clinical outcomes and increased satisfaction with communication and health services [13]. Professional interpreters and ad hoc interpreters, such as a family member, friend or bilingual member of staff, were both shown to benefit clinical care when compared to no interpreter. However, professional interpreters were able to raise the quality of care provided to those with limited proficiency in the native language to approach or equal that of those without language barriers. The studies in this review [13] were of varying quality and were all performed in outpatient, emergency department and acute settings where people have relatively short length of stays and the focus of health care is primarily on diagnosis and early management. Communication may be impacted less in this setting when patients are potentially sicker, less aware of their surrounds and therapy is consequently less collaborative. This means the results of these studies cannot necessarily be generalised to inpatient stroke rehabilitation where length of stays are longer and communication could be impacted differently. A separate systematic review [14] relating to the impact of medical interpreters on quality of health care, which included some of the same literature as the previous study, found that patients who did not access professional interpreters had a poor self-reported understanding of diagnosis and treatment plan. Professional interpreters were also found to have significantly lower clinically meaningful error rates in accurate interpreting than ad hoc interpreters. These ad hoc interpreters are frequently used during allied health therapies [15].

Research evidence about health related outcomes for culturally and linguistically diverse stroke populations is limited because those who do not speak the dominant language of a population are frequently excluded from studies [16]. Given the

prevalence of stroke and the high demand for rehabilitation services, factors contributing to poorer outcomes including increased length of stay need to be addressed and low English proficiency may be one of these.

The primary aim of this study was to identify the impact of English proficiency on length of stay, discharge living arrangements, therapy time, independence with personal care and Functional Independence Measures (FIM) for in-patients undergoing stroke rehabilitation. The secondary aim was to determine whether the frequency of professional interpreter use impacts on the health outcomes of patients with low English proficiency participating in stroke inpatient rehabilitation.

METHOD:

Study Design:

A retrospective case control study was performed. Cases were retrieved retrospectively backwards from May 2012 until the required number of participants in each group was reached. This resulted in electronic medical records being included for patients who were admitted for inpatient rehabilitation following stroke between 25/09/2008 and 07/05/2012.

Setting:

The study was conducted at two rehabilitation hospitals within a single health service located in the north-western suburbs of a large metropolitan city. The catchment area for the health service encompasses people who come from over 120 different countries [17]. For the 2011/2012 financial year, the most common requests for interpreter services in these hospitals were for Arabic (17%), Turkish (15%), Italian

(13.5%), Greek (10%), Macedonian (8.5%), Assyrian and Chaldean (8%), Vietnamese (4.5%) and Chinese (4.5%) speaking people [18]. In-house health service interpreters are available for each of these languages, which could allow people greater access to the service than when external interpreters are required. Cultural competence training, run by the in-house Transcultural and Language Service is available to all staff at the two participating rehabilitation hospitals. Approximately 100 sessions ranging from 30-60 minutes are run throughout the year and new staff are expected to undertake the training. A range of topics are included such as 'Language policies and guidelines', covering topics such as 'When, why and how to book a professional interpreter', 'How to work with an interpreter', 'Communicating with patients with low English proficiency' and 'Diversity in the Health context'.

Participants:

The records of stroke rehabilitation patients were categorised into two groups. The high English proficiency group comprised patients who nominated their preferred language as English on admission. The low English proficiency group comprised patients whose preferred language was not English or patients who accessed an interpreter throughout their hospital stay despite nominating English as their preferred language on admission.

Participants in the high English proficiency and the low English proficiency groups were matched for age (+/- 3 years) and gender to minimise confounding factors.

Inclusion criteria:

Patients were included if they were admitted to the participating rehabilitation hospitals for inpatient rehabilitation following a new stroke in the study period. The diagnosis of stroke was based on the diagnosis classification decided by the admitting doctor, which included confirmed diagnosis from scans (if available) as well as clinical decision making based on patient presenting signs and symptoms.
Patients with premorbid conditions such as cognitive deficits, diabetes and arthritis were included in the study as long as they were admitted as rehabilitation patients for the management of their stroke.
Patients who met the criteria for the high English proficiency group were included in the study if they could be matched for age (+/- 3 years) and gender with someone in the low English proficiency group.

Exclusion Criteria:

Patients were excluded from the study if they were not admitted to subacute rehabilitation directly from an acute hospital (e.g. if they were discharged home then re-admitted).Those who had already received some form of rehabilitation for this stroke, prior to this episode of in-patient rehabilitation, were also excluded as they may have commenced this rehabilitation episode at a higher admission functional level which could have skewed the results.
Additionally, if at the time of the stroke, patients developed a new comorbidity that might significantly prolong length of stay, such as fracture following a fall at the time the stroke occurred, they were excluded.

Audit process:

Patient records with an International Statistical Classification of Diseases (ICD) version 10 code 160-164 which included: subarachnoid haemorrhage, intracerebral haemorrhage, cerebral infarction, stroke (not specified as haemorrhage or infarction), and admission history to a rehabilitation ward were requested retrospectively from May, 2012 to September, 2008 through the Health Information Service at the health service where the research project took place.

A single researcher (SD) examined all records using the online medical record system, Clinical Patient Folder (Supplier: InfoMedix Pty Ltd, Company name: - InfoMedix Pty Ltd, Address: Level 5, 451 Little Bourke St, Melbourne 3000) to determine eligibility of participants against inclusion and exclusion criteria.

Demographic data including age, gender, preferred language, country of origin, type of stroke, previous history of stroke, number of comorbidities, pre-stroke living arrangements, pre-stroke independence with personal care, pre-stroke mobility, cognition and communication, as recorded by clinicians at time of assessment, were retrieved from the electronic medical record.

In addition, the following health outcome measures were also retrieved:

Primary Outcomes:

1. Patient length of stay – defined as the number of days the patient stayed overnight on an inpatient rehabilitation ward.
2. Functional Independence Measure [19]: The Functional Independence Measure contains 18 items in two domains: motor (13 items) and cognitive (5

items). Each item is rated on a seven point scale where 1 reflects complete dependence and 7 reflects complete independence. Performance on these items is rated over a 24 hour period. The maximum achievable score is 126. The Functional Independence Measure has been shown to have strong psychometric properties in the rehabilitation setting with good reliability as well as responsiveness and validity for patients receiving rehabilitation [20]. An increase in Functional Independence Measure of 22 points or more is considered to reflect a clinically significant difference in functional independence [21]. The Functional Independence Measure was assessed by the rehabilitation treating team and recorded on admission to rehabilitation and discharge from rehabilitation. In eleven cases (13.8%), the Functional Independence Measure was not recorded in the medical records and the Barthel Index [22] was used instead. Previously, it has been shown that the Barthel score can be converted to a Functional Independence Measure Motor score using a mapping algorithm [23]. This same algorithm was also used in this study to calculate the motor component of the Functional Independence Measure (maximum score 91) where the total Functional Independence Measures were unavailable. An increase of 13 points is considered to reflect a clinically significant difference in the motor component of the Functional Independence Measure [21].

Secondary Outcomes:

1. Discharge destination – The patients were classified as ‘same’ if they were able to return to their previous living arrangements or ‘worse’ if they required more supported accommodation on discharge. This classification

has been used in a previous study with discharge destination as an outcome measure [24]. In addition, patients' actual discharge destination was noted and classified into three groups. The first group (Home Alone) comprised those who were discharged to their home to live alone. The second group (Home with Others) comprised those who were discharged to their home where they lived with others. The third group (Discharged Elsewhere) comprised people who were not discharged to their previous home, but to a residential facility or to an acute hospital where they did not return to rehabilitation. Participants who died during rehabilitation, or were discharged to an acute hospital and did not return to rehabilitation, were also classified in this third group.

2. Level of independence with personal care (recorded as independent or not independent) at discharge was noted. This information, whilst recorded within the Functional Independence Measure was supplemented by Occupational Therapy reports to ensure accuracy of information.

The amount of Allied Health therapy each patient received in minutes was also recorded.

For the purposes of this study, all data for the allied health disciplines that recorded their time in Health Power was classified as Allied Health therapy time, and was divided by discipline. Health Power is a statistical reporting program used by allied health disciplines to capture hours and occasions of interventions (Supplier: Northern Health IT Department, Company name: Northern Health, Address: 185 Copper St, Epping 3076). The disciplines using Health Power included: Dietetics, Exercise Physiology, Occupational Therapy, Physiotherapy, Podiatry, Recreational Therapy,

Social Work, Speech Pathology, Music Therapy, Psychology, Orthotics and Diabetes Education.

Data on interpreter use was obtained from the Transcultural and Language Services department records, so that time spent with an interpreter during Allied Health therapy could be compared with total time spent in therapy.

Data relating to total time spent with medical or nursing staff or residential care management was not recorded as these disciplines do not report their statistical data through the same Health Power program within Allied Health.

After all data were collected, a second reviewer cross checked 10% of the data for accuracy and the data was found to be 99.5% accurate.

Statistical analysis:

Patient demographic data were reported with descriptive statistics. All interval or ratio measures were assessed for normality of distribution and analyses were repeated with outliers excluded if indicated (ie if any individual measures were greater than three standard deviations from the mean). Comparisons between groups on demographic data were made using independent group t-tests or chi squared analysis. The high English proficiency group and the low English proficiency group were compared for admission and discharge Functional Independence Measure (FIM), FIM efficiency (the change in FIM score from admission to discharge divided by length of stay), and the primary outcome of rehabilitation length of stay using independent group t-tests. Discharge destination

and independence with personal care were compared between groups using chi squared analyses. Data for people who accessed an interpreter were divided into quartiles relating to percentage of therapy encounters when an interpreter was present, and comparison of Functional Independence Measure and length of stay between quartiles was made using one way ANOVA. The critical p value for all analyses was set at $p<0.05$.

Sample size calculation for the comparison between the high English proficiency group and the low English proficiency group was based on data retrieved from a small sample of consecutive stroke patient discharges from one of the participating hospitals prior to commencement of the study. Based on an average Length of Stay (LOS) for a high English proficiency group of 34 days (SD 18), and an estimated 20% increase in LOS for the low English proficiency group (as indicated in the small pilot sample, and less than the % length of stay difference in a previous study [10]), and with power of 80% and alpha = 0.05, it was estimated that 77 patients would be required for each of the high English proficiency and the low English proficiency groups to identify a significant difference in length of stay between groups.

RESULTS:

Participant demographics are presented in tables 1 and 2. Participants in the two groups (n=80 each group) were well matched for age and gender ($p<0.05$). The number of patients with stroke due to infarction versus those with stroke due to haemorrhage was similar between groups ($p>0.05$). The two groups were also similar for prior history of stroke, living arrangements, previous independence with personal activities of daily living, and pre-morbid mobility, cognition and

communication (p>0.05). The high English proficiency group had a small but significantly greater average number of comorbidities at time of admission (other than stroke) than the low English proficiency group (p=0.02). Table 2 shows the country of origin and the preferred language spoken by patients in the low English proficiency group, and whether they were serviced by an “in-house” health service interpreter or an external interpreter service. Italian, Greek, Macedonian and Turkish were the most prevalent languages in the low English proficiency group, all of which were languages serviced by the in-house interpreter service (which could mean greater access to interpreters).

Insert table 1 and 2 about here

Average admission and discharge Functional Independence Measure scores are reported in table 3. When Functional Independence Measure was adjusted for length of stay (FIM efficiency), there were no statistically significant differences found between groups. The average admission Functional Independence Measure score of the high English proficiency group was 74.7 compared to 69.2 for the low English proficiency group (p=0.16). This difference was also non-significant (p=0.22) when only Functional Independence Measure admission Motor scores were analysed. However, the changes from admission to discharge in total Functional Independence Measure and in Functional Independence Measure Motor were significantly different between groups, with greater change in the low English proficiency group (p=0.04 and p=0.05 respectively).

Length of stay is reported in table 3. The low English proficiency group had a non-significant greater LOS (four days longer on average) than the high English proficiency group (p=0.28). This analysis was performed with two participants from the high English proficiency group and one from the low English proficiency group

excluded as they were considered outliers because their length of stay was greater than three standard deviations above the mean (117 days). A post hoc analysis was performed to determine the sample size required to demonstrate a statistically significant difference in length of stay using the length of stay data from the current study, and with power of 80% and alpha = 0.05, it was estimated that 405 patients would be required in each group.

Insert table 3 about here

There were no statistically significant between group findings for change in living arrangements from pre-stroke to discharge destination however there was a trend for more people with low English proficiency being discharged home with others rather than home alone or elsewhere (p=0.06). Exploratory sub-analyses were performed within each discharge destination group for Functional Independence Measure and length of stay outcomes, however, there were still no statistically between group significant differences. There was also no statistically significant between group differences in independence with personal care at discharge.

During their inpatient stay, each group received a similar number of encounters and time in minutes spent with Allied Health professionals (p>0.05) as shown in table 4. These exploratory comparisons between high and low English proficiency groups were also not significantly different when sub-analysed by main disciplines (eg physiotherapy, occupational therapy, speech pathology etc – data not shown). However, not all patients in the low English proficiency group accessed an interpreter and on average an interpreter was present for only 13% of therapy time (table 4). Further sub-analysis was performed on the Functional Independence Measure and length of stay results for the low English proficiency group according to

how frequently an interpreter was accessed (quartile divisions relating to percentage of therapy encounters with an interpreter). Significant differences were found for FIM efficiency (p=0.01) and FIM Motor efficiency (p=0.04) with lowest interpreter usage resulting in lowest efficiency and highest interpreter use resulting in largest efficiency, however no statistically significant differences were found between quartiles of % therapy encounters with an interpreter for Functional Independence Measure and length of stay (table 5).

Insert table 4 and 5 about here

DISCUSSION:

At least 16% of the Australian population prefer to speak in a language other than English [12] and there is some literature that suggests that low English proficiency can impact negatively on health outcomes. Particularly in clinical groups such as stroke patients that are associated with relatively long hospital length of stay, there is potential for any difference in length of stay associated with factors such as low English proficiency to impact on important outcomes such as costs and health service utilisation. One previous study demonstrated that patients with limited English proficiency had a longer length of stay [10] and another [13] demonstrated the importance of professional interpreters in maximising outcomes of clinical care. However, the results of the current study do not show a significant difference in outcomes associated with level of English proficiency. A possible explanation for the difference between our results and these studies could be the inpatient rehabilitation setting in our study as opposed to the acute or outpatient setting of the other studies. Perhaps in inpatient rehabilitation settings there is less reliance on verbal communication. Non-verbal communication has been suggested to make up as much as 70-80% of communicative events [25] but this is highly dependent on

factors such as the physical and spatial environment. In addition family may be more closely involved in therapy in an in-patient setting and so they are more accurately able to assist with interpreting. These findings are reassuring that similar outcomes can be achieved regardless of English proficiency.

In subanalyses, FIM efficiency was shown in our study to be significantly affected by frequency of interpreter use. This is in line with a previous study [14] that investigated different outcomes such as understanding of diagnosis and treatment plan, accuracy of interpreting, patient satisfaction and nature of medical intervention. Only the highest and lowest quartiles (table 5) clearly demonstrated this trend however the in-between quartiles still demonstrated efficiency scores which were between the highest and lowest quartiles. These results may help to inform therapists about their decisions regarding how frequently to utilise interpreters, as those who accessed an interpreter most demonstrated the most efficient change in function. It is possible that a clear trend was not demonstrated within all quartiles because ad hoc interpreters such as family members or bilingual staff may have been used to bridge the communication gap for low English proficient patients which could have confounded the results. Data in our study is insufficient to determine whether this was a factor and the results need to be taken with caution as the study didn't have sufficient power regarding this exploratory subanalysis between quartiles of interpreter use. However regardless of what communication means were employed in this study, the outcomes of the low English proficient and the English proficient groups appear to be similar with the level and access to interpreters available in this study. Stroke rehabilitation settings need to consider the findings of this study in the context of the level of interpreter use in their unit. The results of our

study are generalisable to other stroke rehabilitation settings with similar levels of interpreter use.

The outcome measures explored in this research didn't show significant differences relating to language proficiency, however perhaps other qualitative outcomes would. There may be merit in exploring differences between groups with differing language proficiency using other outcomes that appear to be highly valued by stroke patients, such as ability to leave the house, pursuing former leisure activities, and effective communication

Our a-priori sample size calculation was based on a small pilot study within the health service used for the main study. Our study had a smaller between group difference and larger standard deviation than was used in our apriori sample size calculation for the primary outcome of Length of Stay, resulting in the study being underpowered. However, across the various outcome measures there was no clear trend of better outcomes with incrementally greater levels of interpreter access by quartile. A possible explanation for this is that the results were affected by the grouping of people from different cultural, socio-economic and health literacy backgrounds. For example, a refugee who has recently arrived in Australia may respond to rehabilitation differently as they adjust to a new country, to someone who has lived in Australia for several years, even if they have the same interpreter needs. In our study, it was not possible to separate these cultural groups for analysis. Results may also have differed depending on whether patients had a language need that could be accommodated using in-house interpreters, or required an external interpreter service, as access to external services may have been more limited. In this study 29% of patients with low English proficiency used an interpreter from outside of the health service. Comparison of outcomes associated with in-house

compared to external interpreters may be worth exploring with larger samples in future research. The exploratory sub-analyses investigating quartile sub-group differences were also likely to be underpowered, and further research with a larger sample size is indicated.

A positive and somewhat unexpected finding of this study was that therapy time did not appear to differ between the two groups in the context of both groups achieving similar outcomes. Previously it has been suggested that people with low English proficiency may require more therapy time to account for use of interpreters [26]. The results of this study do not support this.

There were some other findings worth considering for clinical relevance. For example, the low English proficiency group stayed 4 days longer on average than the high English proficiency group. This could mean an 11-18% difference in average length of stay based on current international data [6,7]. Although not significant, if a larger study with adequate power (based on the post hoc sample size calculation of n=405 / group) identified a similar length of stay difference, this is likely to be a meaningful difference, given that length of stay drives the main costs associated with stroke patient rehabilitation. Whilst these results should be taken with caution as they were not statistically significant, they may be worth considering for future research.

Although, to our knowledge, this is the first comparison of English proficient versus low English proficient health outcomes following inpatient stroke rehabilitation, there are some limitations to the study. The apriori sample size estimate differed substantially from the actual study outcomes for the primary outcome of length of stay, resulting in the study being underpowered, despite the apriori estimate being

based on a small sub-sample from the study hospital, and the estimated group difference being lower than that reported in one previous study. As such, study results should be considered preliminary and exploratory. Another limitation is that there were some instances where patients identified their preferred language to be one other than English, however, they did not access an interpreter. It is possible that in these instances the patient was proficient in English as well as another language therefore the interpreter wasn't required, and also that there were instances where patients identified their preferred language to be English despite a low proficiency level. A previous study has indicated that some people with limited English proficiency are reluctant to identify themselves as speaking English poorly due to status, incorrect assumptions about their proficiency for the healthcare environment or fear of prejudice [27]. These instances would mean that the expected group difference in English proficiency could have been diluted because some English proficient people were included in the low English proficient people, and some low English proficient people were included in the high English proficient group. Future prospective research into this area should aim for improved classification of English proficiency rather than relying on the records of preferred language or interpreter usage. Other limitations relating to retrospective data collection could also be associated with this study. There was a reliance on all the data having been recorded accurately in the medical records and, for example, in the instances where Functional Independence Measure scores were not available, Barthel Index data needed to be converted. In these instances only the motor component of the Functional Independence Measure was available, so data about comprehension, expression and problem solving were not captured. It is not therefore possible to comment on the impact of English proficiency on these areas.

CONCLUSION:

English proficiency and frequency of interpreter usage did not impact on length of stay in inpatient rehabilitation, discharge destination or discharge functional status for stroke patients undergoing inpatient rehabilitation in a hospital with a primarily in-house professional interpreter service.

Declaration of Interest Statement:

The Authors report no conflict of interest. This study was supported by a Northern Health Small Research Grant [grant round 11, 2011] and by La Trobe University: Faculty of Health Sciences Postgraduate Support Grant [grant round 1, 2012].

References:

[1] National Stroke Foundation. 2012 12th May. Facts and figures about stroke. <http://strokefoundation.com.au/health-professionals/tools-and-resources/facts-and-figures-about-stroke/>. Accessed 2012 12th May.

[2] Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, De Simone G, Ferguson TB, Ford E, Furie K, Gillespie C. Executive summary: heart disease and stroke statistics--2010 update: a report from the American Heart Association. Circulation 2010;121(7):948.

[3] Gubrium JF, Rittman MR, Williams C, Young ME, Boylstein CA. Benchmarking as everyday functional assessment in stroke recovery. Journals of Gerontology: Series B: Psychological Sciences and Social Sciences 2003;58B(4):S203-S211.

[4] Kakar P, Gunarathne A, Lip GYH. Stroke: ethnic differences do exist. Expert Review of Neurotherapeutics 2006;6(12):1769-71.

[5] Warlow C VJ, Dennis M, Wardlaw J, Bamford J, Hankey G. Stroke: Practical Management. Oxford: Blackwell Publishing; 2008.

[6] National Stroke Foundation. 2014 15th July. National Stroke Audit – Rehabilitation Services Report 2014. Melbourne, AUSTRALIA. <https://strokefoundation.com.au/~/media/strokewebsite/resources/treatment/national-stroke-audit-rehabilitation-services-report-2014.ashx?la=en>. Accessed 2015 15th July.

[7] Grant C, Goldsmith CH, Anton HA. Inpatient stroke rehabilitation lengths of stay in Canada derived from the national rehabilitation reporting system, 2008 and 2009. Archives Of Physical Medicine And Rehabilitation 2014;95(1):74-78.

[8] Langhorne P, Duncan P. Does the organization of postacute stroke care really matter? Stroke 2001;32(1):268-274.

[9] Cosgrave L, Bernhardt J, Churilov L, Indredavik B, Cumming T. Gender and being born overseas influences the amount of acute stroke therapy. J Rehabil Med 2013;45(2):130-6.

[10] John Baptiste A, Naglie G, Tomlinson G, Alibhai SMH, Etchells E, Cheung A, Kapral M, Gold WL, Abrams H, Bacchus M. The Effect of English Language Proficiency on Length of Stay and In hospital Mortality. Journal of general internal medicine 2004;19(3):221-228.

[11] Garrett P. Healthcare Interpreter Policy: Policy determinants and current issues in the Australian context. Translation & Interpreting, The 2009;1(2):44-55.

[12] Australian Bureau of Statistics. 2011 July 19th. 2011 Census community profiles by location. <http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/2?opendocument&navpos=220>. Accessed 2014 July 19th.

[13] Karliner LS, Jacobs EA, Chen AH, Mutha S. Do professional interpreters improve clinical care for patients with limited English proficiency? A systematic review of the literature. Health Services Research 2007;42(2):727-754.

[14] Flores G. The impact of medical interpreter services on the quality of health care: a systematic review. Medical Care Research and Review 2005;62(3):255-299.

[15] Lee T, Lansbury G, Sullivan G. Health care interpreters: A physiotherapy perspective. Australian Journal of Physiotherapy 2005;51(3):161-165.

[16] Fryer C, Mackintosh S, Batchelor F, Hill K, Said C. The effect of limited English proficiency on falls risk and falls prevention after stroke. Age & Ageing 2012;41(1):104-107.

[17] Department of Premier and Cabinet. 2013 6th February. Population diversity in Victoria: 2011 census: local government areas. [Melbourne] [Office of Multicultural Affairs and Citizenship, Victorian Government Department of Premier and Cabinet] <http://trove.nla.gov.au/version/201051638>. Accessed 2014 6th February.

[18] Zucchi E. 2013 6th February. Northern Health Cultural Responsiveness Plan 2013-2015. <http://www.nh.org.au/userfiles/files/TALS/2013-2015%20NH%20Cultural%20Responsiveness%20Framework%20%20Plan.pdf>. Accessed 2014 6th February.

[19] Granger CV, Hamilton BB, Keith RA, Zielezny M, Sherwin FS. Advances in functional assessment for medical rehabilitation. Topics in Geriatric Rehabilitation 1986;1(3):59-74.

[20] Granger CV, Hamilton BB. Disability outcomes following inpatient rehabilitation for stroke. Physical Therapy 1994;74(5):494-503.

[21] Beninato M, Gill-Body KM, Salles S, Stark PC, Black-Schaffer RM, Stein J. Determination of the minimal clinically important difference in the FIM instrument in patients with stroke. Archives Of Physical Medicine And Rehabilitation 2006;87(1):32-39.

[22] Mahoney FI BD. Functional Evaluation: The Barthel Index. Maryland State Medical Journal 1965;14:61-65.
[23] Eager K GR, Hodkinson A, Green J, Eager L, Erven J, Eckstein G, Spooner G, Kennedy C, Owen A, Cromwell D, Leotta T, Rigley A. The Australian National Sub-Acute and Non-Acute Patient Classification (AN-SNAP): report of the National Sub-Acute and Non-Acute Casemix Classification Study. Centre for Health Service Development, University of Wollongong 1997.
[24] Peiris CL, Shields N, Brusco NK, Watts JJ, Taylor NF. Additional Saturday rehabilitation improves functional independence and quality of life and reduces length of stay: a randomized controlled trial. BMC Med 2013;11:198.
[25] Argyle M, editor. Non-verbal communication in human social interaction1972.
[26] Lee TS, Lansbury G, Sullivan G. Health care interpreters: A physiotherapy perspective. Australian Journal of Physiotherapy 2005;51(3):161-165.
[27] Fryer CE, Mackintosh SF, Stanley MJ, Crichton J. 'I understand all the major things': how older people with limited English proficiency decide their need for a professional interpreter during health care after stroke. Ethnicity & Health 2013;18(6):610-625.