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Demographic factors effect stoke-related healthcare utilisation among Australian stroke survivors

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Health equity is a fast emerging priority for most healthcare systems around the world. Factors impacting health equity include education level, geographical location, age, gender, employment status and income. However, research examining the effect of these demographic variables on health service utilisation among mid-aged and older post-stroke adults is limited. Data was obtained from a sub-study of the Sax Institute's 45 and Up Study, which is conducted in Australia. The sub-study survey collected demographic, health service utilisation and health status information from 576 participants who had a previous stroke diagnosis. Poisson regression was used to examine the association between demographic characteristics and number of consultations with a doctor and/or an allied health practitioner over a 12 month period. All demographic measures were significantly associated with the number of consultations with doctors and/or allied health practitioners. The number of doctor consultations increased for those who struggled to live on their available income (IRR = 1.41), but decreased for females (IRR = 0.81), those who reside in an inner regional area (IRR = 0.83), those who were separated, divorced or widowed (IRR = 0.61), and for those who completed a trade, apprenticeship or diploma (IRR = 0.83). The number of allied health practitioner consultations increased for those who completed a trade, apprenticeship or diploma (IRR = 1.27), and for those who struggled to live on their available income (IRR = 1.38), but decreased for increasing age (IRR = 0.87), females (IRR = 0.78), and for those who reside in an outer regional or remote area (IRR = 0.49). We identified several demographic factors associated with a lower frequency and type of health care services used by post-stroke adults. These possible barriers need to be explored further, as reduced use of healthcare services may lead to poorer stroke outcomes in these demographics. Specifically, researching strategies to best support individuals facing these additional challenges is necessary to ensure equitable healthcare for all Australians.

Keywords Stroke, Rehabilitation, Health equity, Healthcare

Stroke is a leading cause of death and disability worldwide, and is estimated to affect approximately 17 million people each year[1–3]. Research predicts a rise in stroke prevalence in countries such as Australia, who have an aging population living into their eighties and nineties[4]. Additionally, recent improvements in acute stroke care has led to more patients surviving the acute stroke phase, and for many, stroke is now a long-term chronic condition[5]. This could lead to an increased burden across all areas of stroke care, from acute management to rehabilitation and long-term care[4]. It is therefore important to establish the utilisation of healthcare services by post-stroke individuals and potential barriers to their use.

Health equity is a fast emerging priority for most healthcare systems around the world[1]. Social inequalities in health appear to be increasing in many of the world's most developed countries, despite predictions to the contrary[2]. Horizontal inequity (HI) occurs when individuals with the same condition or level of health need have different levels of treatment or utilisation[1]. For example, some individuals may get more, higher quality, or faster care than others with the same health condition[1]. In particular stroke care is a rapidly evolving field and many changes have occurred in the last 10 years. Factors impacting health equity include education level, geographical location, age, gender, race/ethnicity, employment status and income[2].

Multiple studies have shown individuals who develop a chronic disease face an increased risk of falling into income poverty, even in high income countries with welfare systems in place[6–8]. Several countries utilise a universal health care system as a means of protecting against the impoverishing impact of high healthcare

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costs[9]. Australia's publicly financed national universal health insurance scheme, Medicare, was introduced to promote equity by improving access and affordability of health services[9]. However, out-of-pocket expenditure is still considerable for ambulatory care, which encompasses a large range of services, including allied health, complementary medicine and dental services, many of which receive no subsidy[10]. Additionally, recent research reports that Australian adults with chronic conditions are more likely to forego health care due to cost compared to individuals with no health condition[11]. Income, employment status and cost are therefore significant barriers to accessing healthcare in Australia.

Several countries, such as Canada[12], the United States[13] and Australia have vast landscapes and scattered rural and remote communities, which can lead to challenges accessing primary health care[14]. Australians in rural and remote areas experience poorer health status compared with many metropolitan residents, due partly to this inequitable access to primary health care services[14]. Further, research has shown that acute stroke patients living in rural areas are less likely to receive reperfusion therapy[15,16] and have higher in-hospital mortality[15]. In Australia, only 3% of acute stroke patients in regional, rural and remote communities are able to access a stroke unit compared to around 70% in metropolitan areas, with many required to travel over 200 km to reach a hospital with adequate stroke care[17]. Furthermore, the lack of imaging availability in rural and remote areas directly translates to less stroke patients in these areas receiving effective time sensitive interventions[18]. Recently, the healthy aging of Australia's older population has resulted in significant retirement migration from metropolitan areas to urban fringes and rural areas in the ≥ 65 years of age group[19]. Unfortunately, health services in rural areas have not kept pace with the increasing demand[19].

Another factor potentially impacting health inequity in Australia is the incorporation of *e*-health services[20]. The utilisation of digital technologies and platforms, such as telehealth, is becoming popular in regional Australia partly because of shortages in health workers, reductions in healthcare expenditure and technological advances[20]. While these recent developments in technology and the integration of these innovations into healthcare could be improving general public health, it could actually be increasing inequalities in health[2]. Research shows that high speed internet, higher education level and adequate digital literacy are necessary for uptake and utilisation of *e*-health services[20]. While living in a remote location, lower socioeconomic status (SES) and low education level negatively impact the use of these services[20].

Evidence shows that specific demographic factors such as income, education level, geographical location, age and gender, can affect access and utilisation of health services in the general population[21–23]. In conditions which require significant ongoing healthcare and rehabilitation such as stroke, many survivors have impaired functional health outcomes and rely on a wide variety of healthcare services for a prolonged period of time[24]. Research shows that lower SES leads to an increased risk of primary stroke, and also lends support to the hypothesis that stroke patients in lower SES groups are exposed to a double disadvantage or are subjected to what has been called a double suffering[24]. This theory suggests that not only is there a relatively high prevalence of stroke among lower SES groups, but that the impact of stroke upon them is greater[24].

Research examining the effect of demographic variables on health service utilisation among post-stroke adults has produced conflicting findings. A study of 465 Dutch patients with stroke concluded that inequalities in long term health outcomes were observed, but solid indications for large inequalities in health care utilisation were not found[24]. A Canadian study identified socioeconomic status as affecting mortality and access to some health services after stroke, however this research looked at data from 1994 to 1997 and health services have experienced significant change over the last 25 years rendering such findings limited in their applicability to contemporary analysis[25]. More up to date research is needed to determine the effects of demographic factors on inequalities in health care utilisation in post-stroke adults. Therefore, the aim of this study was to assess demographic characteristics, such as age, gender, marital status, area of residence, education level and income and evaluate the relationship between these factors and the frequency of stroke-related healthcare utilisation by Australian adult's post-stroke.

Methods

Sample

Data was obtained from a sub-study of the Sax Institute's 45 and Up Study, which is conducted in Australia. The baseline questionnaire of the 45 and Up Study collected information from 267,153 men and women aged 45 and above who resided in the state of New South Wales, Australia[26]. Participants were randomly sampled from the Services Australia (formerly the Australian Government Department of Human Services) Medicare enrolment database; with oversampling of people aged 80 + years and residents of rural and remote areas. The sample represented approximately 11% of the NSW population aged 45 years and over with a response rate of about 18%. The 45 and Up Study was approved by the University of New South Wales Human Research Ethics Committee.

Participants joined the study by completing a baseline questionnaire (between January 2006 and December 2009). The sub-study survey of participants from the 45 and Up Study occurred between April and October 2017. For this sub-study, 1300 participants who had previously indicated on the baseline questionnaire that a doctor had diagnosed them as having had a stroke were mailed a sub-study questionnaire, with 576 (44.3% response) returning a completed questionnaire.

Demographic measures

Participants were asked for their date of birth, to enable us to generate their age in years. Participants were also asked to indicate their gender, marital status (married or defacto, separated or divorced or widowed, single), education qualifications (no formal education or school only, trade or apprentice or diploma, university or higher degree), and their ability to manage on available income (no or a little difficulty, some difficulties, struggles with available income). In addition, participants were asked to provide their postcode of residence, to allow

us to determine their area of residence (major city, inner regional, outer regional or remote), defined using the ARIA + remoteness score, which uses post codes to determine road distances to service centres, and thus participants were categorised as residing in a major city, inner regional area, or outer regional/remote area[27].

Health service utilisation measures

Participants were asked to indicate the number of stroke-related consultations they had in the previous 12-month, with a medical doctor (general practitioner, neurologist, cardiologist, hospital doctor) and/or an allied health practitioner (nurse, pharmacist/chemist, counsellor, psychologist, dietician, physiotherapist, occupational therapist, speech pathologist).

Health status measures

The participants were asked to rate the degree of disability or dependence in their daily activities using the modified Rankin Scale (mRS)[28]. Based on the mRS score, participants' level of stroke-related disability was classified as: no disability, no significant disability, slight disability, moderate disability, or severe disability. To determine comorbidities, participants were also asked if they had been diagnosed or treated by a doctor for any of the following conditions: anxiety, asthma, cancer, dementia, depression, diabetes, heart disease, high cholesterol, hypertension, osteoarthritis, osteoporosis and/or Parkinson's disease.

Statistical analyses

Poisson regression was used to examine the association between demographic characteristics and number of consultations with a doctor and/or an allied health practitioner over a 12 month period. Specifically, two multivariable Poisson regression models were generated; one each for the doctor consultations and allied health practitioner consultations. For each model, the dependent variable was number of consultations, the independent variables were the six demographic measures described above, and the models were adjusted for comorbidities and stroke disability (modified Rankin Scale (mRS). All analyses were conducted using the statistical software Stata, version 14.1. Statistical significance was set at the $\alpha = 0.05$ level.

Results

Numerical descriptions of each demographic measure are provided in Table 1. The average age of participants was 75.8 (SD = 9.1) years, with the majority being (n = 333, 57.8%) aged 75 years or over. Most participants were male (n = 316, 54.9%), married or in a defacto relationship (n = 359, 62.3%) and just over one half of participants (n = 296, 51.4%) resided in a major city. The majority of participants (n = 276, 47.9%) had no formal education or school only education and most participants (n = 381, 66.1%) had little or no difficulty living on their available income.

Table 2 shows the association between the demographic measures and the number of stroke-related consultations with a doctor and/or an allied health practitioner over a 12 month period. It can be seen that all six demographic measures were significantly associated with the number of consultations with doctors and/or allied health practitioners. Specifically, for every 10-year increase in age, there was a 12.2% (IRR = 1.122; 95% CI 1.045, 1.204) increase in the number of doctor consultations, but a 12.6% (IRR = 0.874; 95% CI 0.796, 0.958) decrease in the number of allied health practitioner consultations. In terms of education, participants who completed a

Demographic characteristics		Number of doctor consultations	Number of allied health consultations
		Mean (SD)	Mean (SD)
Age	< 75 years (*n* = 243; 42%)	2.0 (3.3)	1.6 (4.4)
	≥ 75 years (*n* = 333; 58%)	2.3 (3.7)	1.1 (3.3)
Gender	Male (*n* = 316; 55%)	2.4 (3.6)	1.5 (4.3)
	Female (*n* = 260; 45%)	1.7 (3.5)	1.0 (3.1)
Marital status	Married/Defacto (*n* = 359; 62%)	2.5 (3.7)	1.4 (3.9)
	Separated/Divorced/Widowed (*n* = 157; 27%)	1.6 (3.0)	0.8 (2.3)
	Single (*n* = 51; 1%)	2.3 (3.8)	2.5 (5.9)
Area of	Major cities (*n* = 296; 52%)	2.3 (3.7)	1.3 (3.8)
Residence	Inner regional (*n* = 192; 34%)	2.0 (3.5)	1.5 (4.4)
	Outer regional/Remote (*n* = 79; 14%)	2.2 (3.3)	0.9 (2.2)
Education	No formal/School only (*n* = 276; 48%)	2.3 (3.8)	1.2 (3.8)
	Trade/Apprentice/Diploma (*n* = 187; 33%)	2.0 (3.4)	1.5 (4.3)
	University/Higher degree (*n* = 108; 19%)	2.1 (3.2)	1.1 (2.9)
Income	No/Little difficulties (*n* = 381; 66%)	1.8 (3.2)	1.0 (3.5)
(Management)	Some difficulties (*n* = 123; 22%)	2.6 (3.8)	1.4 (2.9)
	Struggles with income (*n* = 69; 12%)	3.3 (4.4)	2.6 (5.9)

Table 1. The number of consultations with medical doctors and/or allied health practitioners over a 12 month period, across demographic characteristics, among Australian adults post-stroke. SD: standard deviation.

Demographic characteristics		Doctor consultations			Allied health consultations		
		IRR	95% CI	*p* value	IRR	95% CI	*p* value
Age	10 year increase	1.122	1.045, 1.204	0.001	0.874	0.796, 0.958	0.004
Gender	Male (*n* = 316)	1.000	–		1.000	–	
	Female (*n* = 260)	0.808	0.713, 0.916	0.001	0.784	0.666, 0.923	0.003
Marital status	Married/Defacto (*n* = 359)	1.000	–		1.000	–	
	Separated/Divorced/Widowed (*n* = 157)	0.608	0.522, 0.708	< 0.001	0.654	0.533, 0.803	< 0.001
	Single (*n* = 51)	0.862	0.700, 1.062	0.163	1.344	1.067, 1.692	0.012
Area of	Major cities (*n* = 296)	1.000	–		1.000	–	
Residence	Inner regional (*n* = 192)	0.829	0.726, 0.947	0.006	1.100	0.934, 1.296	0.254
	Outer regional/Remote (*n* = 79)	0.875	0.736, 1.039	0.127	0.485	0.368, 0.639	< 0.001
Education	No formal/School only (*n* = 276)	1.000	–		1.000	–	
	Trade/Apprentice/Diploma (*n* = 187)	0.828	0.723, 0.949	0.007	1.266	1.066, 1.503	0.007
	University/Higher degree (*n* = 108)	0.980	0.832, 1.154	0.807	1.079	0.858, 1.357	0.516
Income	No/Little difficulties (*n* = 381)	1.000	–		1.000	–	
(Management)	Some difficulties (*n* = 123)	1.095	0.949, 1.262	0.214	0.900	0.739, 1.096	0.294
	Struggles with income (*n* = 69)	1.409	1.189, 1.670	< 0.001	1.382	1.120, 1.707	0.003

Table 2. The association between demographic characteristics and number of consultations with a doctor and/or an allied health practitioner over a 12 month period, among Australian adults post-stroke. IRR: incidence rate ratio obtained from a multivariable Poisson regression, including all demographic measures and adjusted for comorbidities and stroke disability (modified Rankin Scale (mRS)).

trade, apprenticeship or diploma had 17.2% (IRR = 0.828; 95% CI 0.723, 0.949) lower number of doctor consultations, but had 26.6% (IRR = 1.266; 95% CI 1.066, 1.503) higher number of allied health practitioner consultations, compared to those who had no formal education or school only education.

In comparison to males, females had 19.2% (IRR = 0.808; 95% CI 0.713, 0.916) lower number of doctor consultations and 21.6% (IRR = 0.784; 95% CI 0.666, 0.923) lower number of allied health practitioner consultations. In terms of income, participants who struggled to live on their available income had 40.9% (IRR = 1.409; 95% CI 1.189, 1.670) higher number of doctor consultations and 38.2% (IRR = 1.382; 95% CI 1.120, 1.707) higher number of allied health practitioner consultations, compared to those who had no or little difficulty living on their available income.

Participants who were separated, divorced, or widowed had 39.2% (IRR = 0.608; 95% CI 0.522, 0.708) lower number of doctor consultations, while those who were single had 34.4% (IRR = 1.344; 95% CI 1.067, 1.692) higher number of allied health practitioner consultations, compared to those who were married or in a defacto relationship. In comparison to those who resided in a major city, participants who resided in an inner regional area had 17.1% (IRR = 0.829; 95% CI 0.726, 0.947) lower number of doctor consultations, and those who resided in an outer regional or remote area had 51.5% (IRR = 0.485; 95% CI 0.368, 0.639) lower number of allied health practitioner consultations.

Discussion

Our study of mid-age and older Australian post-stroke adults revealed that several demographic characteristics are associated with health care utilisation within our cohort. We found that age, gender, marital status, area of residence, education level and income were all significant factors affecting the type and frequency of health services used. We observed that with increasing age came an increasing number of doctor consultations, but a decreasing number of allied health consultations. A recent review assessed difficulties that older Australian's face when accessing health care services and highlighted potential barriers[29]. They report that affordability, a lack of knowledge of what services are available and where to access them, geographic accessibility and transport challenges present major challenges for older Australians[29]. Our results which show less allied health services use by older post-stroke adults, may therefore be influenced by these factors. Such barriers need to be explored further, as the infrequent use of these allied health services may lead to reduced quality of care and poorer health outcomes in older post stroke adults.

In our cohort of post-stroke adults, we also found that females had fewer consultations with both medical doctors and allied health practitioners. This finding is in line with some previous research which assessed the gender disparities in health and healthcare use among older American adults[30]. This previous US study showed that despite older women in their cohort having substantially greater health needs than the older men, women were less likely to have hospital stays and had fewer visits to a medical doctor than men with similar demographic and health profiles[30]. This could possibly be due to women having fewer economic resources, such as income and wealth, affecting their ability to pay for medical care[30]. Our results suggest that offering additional assistance, such as payment plans, or low-cost healthcare services may increase access to these services for post stroke women who have low economic resources.

Our results also show that post-stroke adults who were separated, divorced or widowed had a lower number of consultations with both doctors and allied health practitioners, compared to those who were married or in a

defacto relationship. This finding supports previous research in the general population which shows that healthcare utilisation patterns differ according to marital status[31]. Research in Medicare beneficiaries suggests that the psychological and physical health effects of spousal cohabitation may influence the volume and distribution of healthcare utilisation[31]. Additionally, those who are separated, divorced, or widowed may not have the same level of resources as married or defacto couples, such as health insurance and disposable income, which may affect healthcare utilisation[31].

In our cohort of post-stroke adults, we found that geographical location impacted the type and frequency of health care utilisation. We found that those living in inner regional areas had less doctor consultations and those living in remote areas had less allied health practitioner consultations compared to those living in major cities. This finding supports previous research conducted in the United States which examined geographic inequities and the growing rural–urban disparities in acute stroke care[32]. The researchers suggest that these disparities can be explained by a lack of access, availability and infrastructure in rural areas[32]. Researching strategies for overcoming these barriers in post-stroke adults is necessary to ensure that access to treatment is equitable for all communities in Australia.

Another demographic factor affecting the health service utilisation within our cohort of post-stroke adults was level of education. We found that those who completed no formal education after secondary school had more consultations with a medical doctor but less allied health consultations, compared to those with a trade, apprentice or diploma education. This is somewhat similar to research performed in European adults which assessed inequalities in utilisation of general practitioner and specialist services in nine European countries[33]. The researchers found that individuals with lower education used specialist care services significantly less often in all countries examined[33]. It has been suggested that language, class and educational differences may also influence a patient's ability to have an equal role in making care decisions[34]. Little has been written about these issues in relation to stroke services[34], and more research is needed to explore the impact these factors may have on health outcomes in post-stroke adults.

In our cohort of post stroke adults, we found those who struggle with their income have more consultations with all health care practitioners, compared to those who report having no difficulties managing their income. Previous research shows that lower SES individuals tend to have poorer health and have increased visits to a general practitioners but less visits to specialists[35,36]. However, in our cohort those who struggle with their money had more appointments with allied health practitioners. A possible explanation could be the eligibility for welfare services for low-income earners. In Australia, Health Care Cards are provided to welfare recipients and low-income earners, which entitles holders to pay a lower out of pocket fee for healthcare services or prescription medications[9]. Under the "Medicare Safety Net", once a certain threshold is reached, 100% of the schedule fee for all services is rebated[9]. Therefore, in post-stroke adults who indicated that they struggle to manage their money, more allied health services may be utilised due to welfare entitlements subsidising the cost of those services in Australia. In Australia, many allied health and complementary medicine practitioners are not covered by government subsidies[9]. It would be interesting to examine the impact subsidies have on the utilisation of different allied health practitioners in low SES post stroke adults entitled to welfare assistance.

This study has utilised widely used, validated instruments to measure key variables for analyses and is nested within the largest ongoing cohort study of healthy ageing in the Southern Hemisphere[26]. However, our study has some limitations that need to be taken into consideration when interpreting the findings. The data is based on respondents' self-report and may have the potential for recall bias. In addition, our study is cross-sectional and limited to adults residing in a single State (NSW) and the results may not be generalisable to the wider Australian adult population. Further, while we did assess the level of stroke-related disability we did not assess the severity of stroke, the years since diagnosis, or the specific type of acute stoke care and treatment that they received. These factors may have an impact on the utilisation of care post-stroke, and these factors should be considered in future studies. While the aim of this study was to describe factors influencing health care access in stroke survivors, these factors may not be unique to stroke, and this should also be considered when interpreting the results.

Conclusion

Our research identifies several demographic characteristics as being associated with health service utilisation by mid age and older post-stroke adults. We identified age, gender, marital status, geographical location, education level and income as significant factors associated with lower frequency and type of health care services used. These possible barriers need to be explored further, as reduced use of these services may lead to reduced quality of care and poorer stroke outcomes in these demographics. Specifically, researching strategies to best support individuals facing these additional challenges is necessary to ensure equitable healthcare for all Australians.

Data availability

The data analysed for this study was obtained from the Sax Institute, which coordinates the 45 and Up Study. The data set could potentially be made available to other researchers if they obtain the necessary approvals and pay a fee. Further information on this process can be obtained from the 45 and Up Study (45andUp.research@saxinstitute.org.au).

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Author contributions

DS & JA conceptualised and designed the study; DS analysed the data and performed the statistical analysis. JB and DS drafted the manuscript with edits from JA and WP. All authors approved the final version.

Competing interests
The authors declare no competing interests.

Ethical approval
Ethical approval for the use of the sub-study dataset from the 45 and Up Study was gained from the Human Research Ethics Committees at the University of Technology Sydney (UTS HREC REF NO. 2015000683). All methods were carried out in accordance with the Declaration of Helsinki and informed consent was obtained from all research participants.

Additional information
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