Journal of Multidisciplinary Healthcare

Dovepress
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Open Access Full Text Article

ORIGINAL RESEARCH

Demographic and stroke-related factors as predictors of quality of acute stroke care provided by allied health professionals

This article was published in the following Dove Press journal:
Journal of Multidisciplinary Healthcare
20 July 2011
Number of times this article has been viewed

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Background: We recently indicated that patient age on its own is not a determinant of quality of allied health care received after an acute stroke. It has not been tested whether other non-age variables influence care decisions made by allied health professionals. This paper explores demographic and stroke-related variables that are putatively associated with the quality of care provided to acute stroke patients by allied health professionals.

Methods: Data were retrospectively audited from 300 acute stroke patient records regarding allied health care. Compliance with each of 20 indicators of allied health care quality was established. The influence of various demographic and stroke-related variables on each performance indicator was examined. We undertook a series of analyses using univariate logistic regression models to establish the influence of these variables on care quality.

Results: Patient age had a significant correlation with only one process indicator (early mobilization). Seven variables, including stroke severity and level of dependence, were associated with patient age. The majority of these age proxies had significant associations with process indicator compliance. Correlations between non-age variables, in particular stroke severity and comorbidity, suggest the potential for complex confounding relationships between non-age variables and quality of allied health care.

Conclusion: Compliance with individual indicators of allied health care was significantly associated with variables other than patient age, and included stroke severity, previous independence, comorbidities, day of admission, stroke unit admission, and length of stay. The inter-relationships between these non-age variables suggest that their influence on quality of care is complex.

Keywords: predictor variables, stroke severity, allied health care, comorbidity levels

Introduction

Ensuring the highest quality of health care for all stroke patients is important in the current climate of scarce resources and the increasing burden of stroke to the health sector. There is a strong international momentum to improve the quality of acute stroke management.[1] This is supported by high level evidence that now underpins many acute stroke interventions, including several provided by allied health professionals.[2]

Although much of the current research on quality in stroke care has focused on factors that may influence medical interventions,[3–7] allied health professionals are similarly interested in ways to implement best practice care.[8] Allied health professionals are members of multidisciplinary stroke teams and contribute to patient care from early in acute admission, through the stroke rehabilitation phase, and beyond. The professional composition of acute stroke teams may vary internationally. In the Australian context

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of this study, allied health members include physiotherapists, occupational therapists, speech pathologists, social workers, dietitians, and psychologists.[2]

Several researchers suggest that patient age is a determinant of the quality of medical and allied health care patients receive following acute stroke.[3–5,9–13] We have previously reported that age and gender, on their own, are not related to an overall index of allied health care quality.[14] Further investigation is now required to determine whether patient age and gender are associated with individual measures of allied health care, and further, whether other variables, such as comorbidity, prestroke independence, and stroke severity, are putatively associated with allied health care. If there are differences in allied health care provided to patients with acute stroke, it is important to understand why care might differ, so that quality improvement strategies can be effectively targeted at problem areas.

This paper explores demographic and stroke-related factors (predictor variables), including patient age, which may be associated with individual measures of quality of care provided to acute stroke patients by allied health professionals. Our aim was to provide systematically determined information to guide clinical quality audits and targeted quality improvement strategies in stroke care.

Methods

Ethical considerations and our sampling framework have been reported in detail previously.[14] In summary, we conducted a retrospective clinical audit of medical records for 300 acute stroke patients from three metropolitan tertiary hospitals in Adelaide, South Australia, Australia. Sampled patients had been consecutively admitted to hospital prior to August 2009, and the audit was conducted between November 2009 and April 2010.

Quality of care

We previously reported on an overall index of 20 performance indicators of allied health service quality, identified from a literature review (listed in Table 2).[14,15] Although several of these indicators relate to interdisciplinary elements of stroke care which may be shared within a stroke team, the focus of this study is the ability of allied health professionals to contribute to this work, because this is largely unexplored. In our earlier study, quality of care was determined by per patient compliance with all 20 process indicators.[14] In the current study phase, compliance with each process indicator was considered individually and associations were explored with predictor variables. Allied health professionals of interest in our research were from physiotherapy, occupational therapy, speech pathology, dietetics, social work, and psychology.

Predictor variables

Previous clinical audits and literature reviews of stroke provided awareness of the demographic and clinical variables that could be extracted retrospectively from medical records.[13–15] These variables are captured by stroke clinicians to assist diagnosis and clinical management, or for service monitoring.

Data were extracted from medical records on patient age, gender, premorbid levels of independence and accommodation type, English proficiency, comorbidity levels, weekend or weekday admission, stroke unit admission, initial stroke severity, length of stay in the acute hospital, and process indicator compliance. Many of these demographic and clinical variables have been associated with care quality in the stroke literature, especially for medical care,[14] or as predictors of stroke outcomes. However, none of these predictor variables have previously been well explored for their influence on stroke care by allied health professionals.

In addition to the evidence discussed above regarding age-related differences in care, researchers have reported associations between gender and stroke care quality.[16–18] Stroke severity is strongly linked to survival and discharge destination outcomes,[19,20] and a priori reasoning suggests that it may prompt allied health care processes, such as swallow assessment, in patients with obvious risks of poor outcome. Stroke severity may also influence the ease with which specific care, such as early rehabilitation, can be achieved. Admission over a weekend has previously been reported to influence care standards and patient outcomes following acute stroke.[12,21] The scarcity of allied health staff at the research sites over weekends suggested that day of admission may alter care. Patient outcomes following stroke have been associated with previous levels of independence and accommodation,[22,23] comorbidity levels,[24,25] and length of stay in the acute hospital.[26,27] These factors may influence allied health staff decisions regarding care, for example, the priority given to early rehabilitation interventions. Factors such as length of stay may also influence the achievability of some care processes for patients. We considered English proficiency in our study because it has previously been linked to stroke outcomes and the quality of health care patients receive.[28,29]

Development of a priori causal pathway

A simple causal pathway was constructed to assist in our understanding of how to undertake the analysis of the

putative predictors of the allied health indicators of care. We constructed a flowchart of conditions and events (Figure 1). This approach was based on the causal modeling theory of Rothman and Greenland.[30] We called this a simple causal pathway because we had no understanding at this point of the ongoing influence of early predictor variables on other variables which become important along the pathway.

Statistical analysis

We undertook a series of analyses to understand the relationships between the putative predictor variables and each care process indicator, using our causal pathway as an analysis model. Univariate logistic regression models were constructed between: adherence with individual process indicators and age; adherence with individual process indicators and non-age predictor variables; the association of age with other predictor variables; and the association between non-age variables.

Data were analyzed using SAS proprietary software (v 9.2; SAS Institute, Cary, NC). Correlations between variables were expressed as relative risks, odds ratios (OR, as appropriate), and 95% confidence intervals (CI). We report relative risks for the first two of the analyses because we were examining associations between independent care predictors with dependent variables (indicators of care quality derived from cross-sectional observational data). We reported OR for the third and fourth analyses because we were examining the association between independent variables.

Data management

As reported in our earlier paper, age was most appropriately dichotomized as younger (<75 years) and older (75+ years) patients.[14] Stroke severity on admission was determined by retrospectively extracting data from medical records to complete a National Institute of Health Stroke Scale (NIHSS) for each patient. The NIHSS is a widely used, valid, and reliable measure of stroke severity.[31,32] It is also reliable and valid when data are extracted retrospectively from patient medical records.[33,34] Based on previous stroke studies, NIHSS scores were divided into three groups for analysis, ie, mild strokes (NIHSS < 8), moderate severity strokes (NIHSS 8–16), and severe strokes (NIHSS > 16).[35]

Comorbidity levels were measured using the Charlson Comorbidity Index (CCI), which is a summary score of the existence or absence of 17 medical conditions, weighted to account for disease severity.[36] This index has been validated as a predictive comorbidity index for patients with stroke. It has been used in previous stroke outcome studies and has also been validity and reliability tested for retrospective data extraction.[37,38] Comorbidity information was extracted from

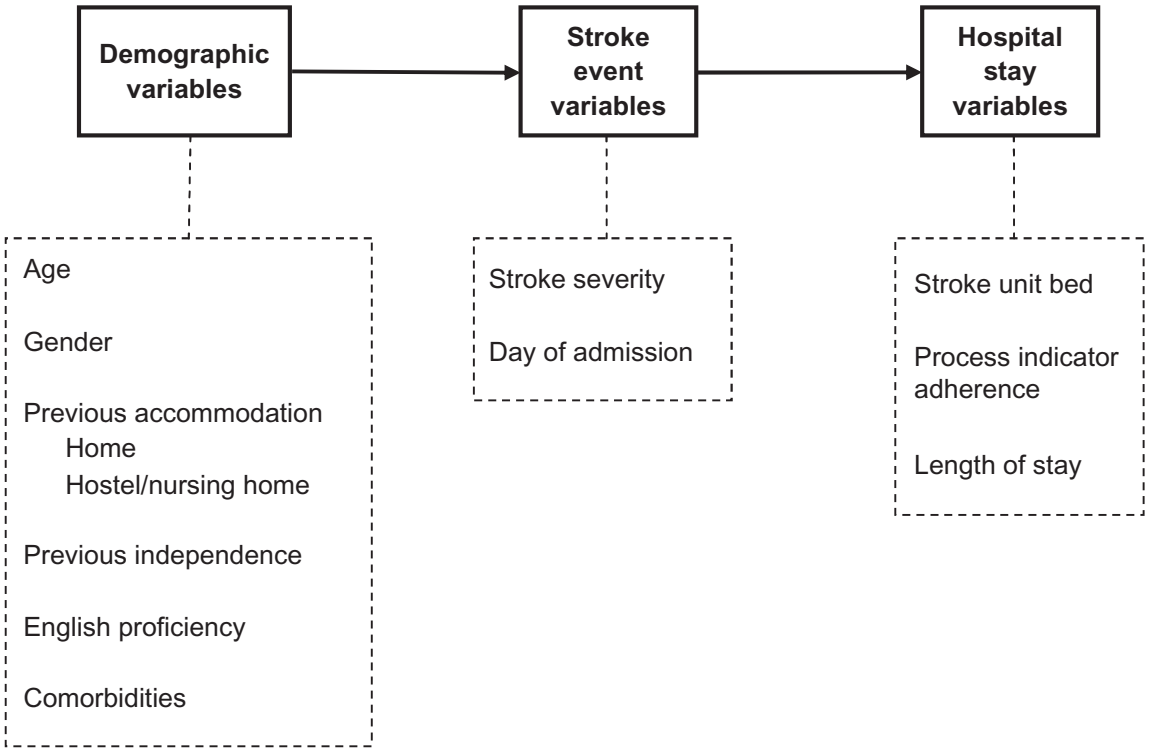

Figure 1 Simple causal pathway of variables associated with a patient journey following acute stroke.

the medical records to complete a CCI for each patient. Based on analysis reported in previous studies, patient CCI scores were dichotomized as low comorbidity levels (CCI ≤ 1) vs high comorbidity levels (CCI > 1).[38]

Patients admitted between 1600 hours on a Friday and 2400 hours on a Sunday, when access to allied health professionals was scarce, were recorded as weekend admissions. Admission directly from the emergency department to a stroke unit was recorded in binary terms (yes = 1, no = 0).

Nonaphasic patients were recorded as not proficient in English if there was evidence that assistance had been required with language translation, or if "limited English" or similar was found in the medical records.

Premorbid dependence level was recorded as independent or dependent, according to whether assistance was required with activities of daily living or instrumental activities of daily living.[39] Premorbid accommodation was recorded as a private home or a residential care facility (nursing home or hostel).

Length of stay was a measure of days spent in the acute hospital. Length of stay data (in days) was broadly classified for analysis. For univariate analysis, length of stay was dichotomized into shorter stay (<12 days) and longer stay (≥12 days). The cut point of 12 days was the mean length of stay for the data set and was also the average length of stay for acute stroke patients at the three data collection hospitals in 2007/08 and 2008/09.[40] To provide more detailed consideration of the possible influence of length of stay on care, analysis considered length of stay in three groups divided at the data tertiles (<4 days, 4–9 days, and ≥10 days).

Results

Description of participants

The characteristics of the 300 sampled patients are reported in Table 1. Mean age at stroke onset was 74.7 years (standard deviation [SD]: 13.5, range 18–100 years). The mean length of stay in acute care was 12.5 days (SD: 15.6, range 1–98 days). The sample was proportionally balanced for gender. Despite similar mean ages for males and females, a larger proportion of females were in the older age groups, with 72% females aged 75 years or older, compared with 53% of males. A greater proportion of females suffered a moderate or severe stroke (28%) than males (18%). For the whole sample, there were weak relationships between increasing age and increasing stroke severity ($r^2 = 0.21$) and comorbidity levels ($r^2 = 0.20$).

Table 1 Patients characteristics (n = 300)

Patient characteristics	No.	(%)
Gender		
Male	159	(53)
Female	141	(47)
Age group (years)		
<65	62	(20.6)
65–74	50	(16.7)
75–84	123	(41.0)
85+	65	(21.7)
Comorbidities (CCI)		
≤1 (low level)	91	(30.3)
>1 (high level)	208	(69.3)
Missing data	1	
Pre-morbid residential care	35	(11.7)
Pre-morbid independence	208	(69.3)
Not proficient in English (%)	24	(8.0)
Stroke severity (NIHSS)		
<8 (mild)	158	(52.7)
8–16 (moderate)	93	(31.0)
>16 (severe)	49	(16.3)
Weekend admission	101	(33.7)
Stroke unit admission	146	(48.7)
Not applicable (eg, died in emergency)	7	(2.0)
Missing data	2	
Length of stay (days)		
<4	68	(22.7)
4–9	116	(38.7)
10+	116	(38.7)
Died during admission	64	(21.3)

Process indicator adherence

Compliance with each process indicator was generally poor (Table 2, columns 2 and 3). For 16 of the process indicators (80%), less than half of the appropriate patients received recommended care.

Analysis 1: process indicator adherence and age

The outcome of univariate logistic regression models, associating process indicator adherence with age, is reported as relative risks in Table 2, column 4. Only one process indicator had a significant association with age, where patients younger than 75 years were significantly more likely to receive first mobilization within 24 hours of stroke onset than older patients.

Analysis 2: process indicator adherence and other non-age predictor variables

Compliance with 12 of the 20 process indicators (60%) was significantly correlated with non-age variables. The only variables which were not associated with any process

Table 2 Eligibility for process indicator care, care adherence and association with age

Process indicator	Patients eligible for process indicator		Process indicator adherence for those eligible		Process indicator adherence by age <75 vs ≥75 yrs
	N	%	N	%	Odds ratio (95% confidence interval)
1. Swallow screening	279	(93)	144	(51.6)	1.02 (0.63–1.66)
2. PT assessment (<48 hours of admission)	275	(91.7)	167	(60.7)	0.99 (0.60–1.63)
3. OT assessment (<48 hours of admission)	275	(91.7)	97	(35.3)	0.79 (0.47–1.33)
4. SP assessment (<48 hours of admission)	275	(91.7)	174	(63.3)	1.08 (0.65–1.80)
5. DN assessment (<48 hours of admission)	274	(91.3)	24	(8.8)	0.98 (0.41–2.32)
6. SW assessment (<7 days of admission)	277	(92.3)	71	(25.6)	0.93 (0.53–1.62)
7. Cognitive assessment	244	(81.3)	47	(19.3)	1.5929 (0.84–3.02)
8. First mobilization <24 hours of stroke onset	211	(70.3)	25	(11.8)	2.39 (1.03 5.56)**
9. Early PT rehabilitation (<48 hours of admission)	195	(65.0)	20	(10.2)	1.73 (0.68–4.39)
10. Early SP rehabilitation (<48 hours of admission)	168	(56.0)	2	(1.2)	# (NA for small numbers)
11. Early OT rehabilitation (<48 hours of admission)	205	(68.3)	3	(1.5)	#
12. NGT process	42	(14.0)	41	(97.6)	#
13. Nutritional screen	193	(64.3)	0	(0)	#
14. Mood assessment	224	(74.6)	1	(0.5)	#
15. Family meeting	292	(97.3)	34	(11.6)	0.47 (0.20–1.08)
16. Stroke education	273	(91.0)	33*	(12.1)	1.8 (0.88–3.81)
17. Secondary stroke prevention	207	(69.0)	17	(8.2)	#
18. Home visit	49	(16.3)	2	(5.0)	#
19. Carer skills training	39	(13.0)	1	(2.6)	#
20. Discharge plan provided	131	(43.7)	12	(9.2)	#

Notes: *Missing data for one patient; **Significant correlation found; #, NA for small numbers (less than 5 in one cell).
Abbreviations: PT, Physiotherapy; OT, Occupational therapy; SP, Speech pathology; SW, social work; DN, Dietetics.
Definitions: First mobilization, documentation of patient first sitting out of bed or ambulating with or without assistance; Rehabilitation, therapeutic interventions to retrain neurological deficits or teach compensatory techniques aimed at improving function (excludes assessment). NGT process, Naso-gastric tube feeding if no functional swallow during the first month post stroke; Home visit, environmental assessment by OT or PT to facilitate discharge to home (with/without patient present).

indicator compliance were previous accommodation type and English proficiency. For 30% of the process indicators, there was more than one non-age correlate (Table 3).

Analysis 3: associations of age with other predictor variables

Significant correlations were found between patient age, and the predictor variables of stroke severity, comorbidity levels, premorbid accommodation, premorbid independence level, gender, English proficiency, and length of stay.

In summary, compared with younger patients, patients 75 years or older were significantly more likely to have a moderate-to-severe or severe stroke (OR: 1.8, 95% CI: 1.1–3.2 and OR: 2.9, 95% CI: 1.4–6.1, respectively), to have higher comorbidity levels (OR: 2.5, 95% CI: 1.5–4.2), to have lived in residential care (OR: 2.6, 95% CI: 1.1–6.2), or been previously dependent (OR: 6.2, 95% CI: 3.2–12). Older patients were also more likely to be female (OR: 2.2, 95% CI: 1.4–3.6), to have a length of stay of 5–9 days (OR: 0.6, 95% CI: 0.3–0.9), and to have poor English proficiency (OR: 3.2, 95% CI: 1.1–9.7). Detailed results are shown in Appendix 1.

Analysis 4: associations between non-age variables

There were a number of significant associations between non-age predictor variables. Females were less likely than males to have been previously independent (OR: 2.2, 95% CI: 1.4–3.7), more likely to have a moderate or severe (NIHSS ≥ 8) stroke (OR: 0.4, 95% CI: 0.2–0.6), and a length of stay ≥ 10 days (OR: 0.4, 95% CI: 0.2–0.7). Patients who suffered a moderate-to-severe stroke (NIHSS ≥ 8) were more likely to have lived previously in residential care (OR: 0.3, 95% CI: 0.1–0.7), to have high comorbidity levels (OR: 0.6, 95% CI: 0.4–0.98), and to have a length of stay ≥10 days (OR: 2.6, 95% CI: 1.5–4.7). Compared with patients having low comorbidity, high comorbidity levels were associated with previous residential care (OR: 8.3, 95% CI: 2.0–35.6), and previous dependence (OR: 4.1, 95% CI: 2.1–8.0). Patients were less likely to be admitted to a stroke unit if they were previously dependent (OR: 5.5, 95% CI: 2.7–11.3) or living in residential care (OR: 8.5, 95% CI: 3.0–24.3). Patients with poor English proficiency were more likely to be dependent prior to their stroke (OR: 2.9, 95% CI: 1.3–6.9). Patients admitted on a weekend were less likely to have a short length of stay

Table 3 Univariate model of independent variables (excluding age) and adherence to process indicators

Process indicator	Independent variables-excluding age. Odds ratios (95% CIs)								
	Stroke severity	Day of admission	CCI	Gender	LOS^	English	Dependence	Accomm	Stroke unit
Comparitor	NIHSS < 8	Weekday	CCI ≤ 1	Female	<12 days	Proficient	Independent	Residential care	Stroke unit bed
1. Swallow screening	**0.37 (0.23–0.61)**	**3.09 (1.84–5.22)**	1.29 (0.77–2.15)	0.75 (0.47–1.21)	**0.50 (0.30–0.82)**	1.31 (0.54–3.13)	0.90 (0.54–1.49)	1.52 (0.73–3.17)	0.99 (0.62–1.60)
2. PT assessment	0.74 (0.45–1.22)	**2.32 (1.39–3.87)**	1.58 (0.92–2.71)	0.91 (0.56–1.48)	0.82 (0.50–1.37)	0.46 (0.16–1.29)	0.87 (0.51–1.49)	1.76 (0.83–3.73)	1.21 (0.74–1.98)
3. OT assessment	1.0 (0.61–1.64)	1.49 (0.87–2.55)	1.47 (0.87–2.50)	0.93 (0.56–1.52)	0.76 (0.45–1.26)	0.88 (0.35–2.19)	1.13 (0.65–1.95)	2.0 (0.83–4.84)	0.81 (0.49–1.32)
4. SP assessment	**0.29 (0.17–0.49)**	**1.89 (1.13–3.16)**	1.19 (0.69–2.03)	**0.60 (0.36–0.99)**	**0.41 (0.24–0.71)**	0.91 (0.37–2.23)	0.96 (0.56–1.65)	0.94 (0.43–2.05)	0.72 (0.44–1.19)
5. DN assessment	**0.17 (0.06–0.48)**	2.10 (0.76–5.82)	1.14 (0.47–2.77)	0.48 (0.20–1.14)	**0.30 (0.13–0.73)**	#	0.67 (0.28–1.61)	0.60 (0.19–1.90)	1.26 (0.54–2.94)
6. SW assessment	0.69 (0.40–1.20)	1.10 (0.62–1.95)	1.08 (0.60–1.93)	**0.64 (0.37–1.09)**	**0.40 (0.23–0.69)**	0.50 (0.21–1.22)	0.82 (0.46–1.46)	2.53 (0.85–7.49)	1.15 (0.67–1.98)
7. Cognitive assessment	0.89 (0.46–1.70)	0.81 (0.42–1.57)	1.31 (0.67–2.55)	0.92 (0.48–1.74)	0.61 (0.32–1.17)	#	**3.77 (1.42–9.99)**	#	1.06 (0.56–2.03)
8. Early mobilization	**3.08 (1.11–8.57)**	1.45 (0.57–3.64)	1.47 (0.60–3.55)	1.14 (0.49–2.65)	#	#	1.58 (0.60–4.16)	#	1.52 (0.65–3.55)
9. PT rehabilitation	1.67 (0.64–4.40)	1.42 (0.49–4.08)	**3.30 (1.29–8.47)**	**3.18 (1.11–9.12)**	2.25 (0.83–6.14)	#	1.56 (0.42–3.16)	#	**2.96 (1.03–8.51)**
10. SP rehabilitation	#	#	#	#	#	#	#	#	#
11. OT rehabilitation	#	#	#	#	#	#	#	#	#
12. NGT process	#	#	#	#	#	#	#	#	#
13. Nutritional screen	#	#	#	#	#	#	#	#	#
14. Mood assessment	#	#	#	#	#	#	#	#	#
15. Family meeting	**0.13 (0.05–0.34)**	1.80 (0.78–4.14)	1.73 (0.83–3.61)	0.68 (0.33–1.39)	**0.17 (0.08–0.37)**	0.46 (0.16–1.33)	1.04 (0.47–2.28)	#	**2.33 (1.06–5.11)**
16. Stroke education	**0.37 (0.17–0.81)**	0.89 (0.42–1.90)	1.05 (0.49–2.28)	1.66 (0.78–3.53)	1.65 (0.71–3.82)	#	1.50 (0.62–3.61)	#	1.12 (0.53–2.39)
17. Secondary prevention	#	0.93 (0.33–2.63)	**2.86 (1.04–7.86)**	#	#	#	#	#	#
18. Home visit	#	#	#	#	#	#	#	#	#
19. Carer skills training	#	#	#	#	#	#	#	#	#
20. Discharge plan	**0.18 (0.05–0.65)**	#	#	#	0.37 (0.11–1.27)	#	#	#	#

Notes: Highlight, significant correlation found; #, insufficient data (less than 5 in one cell); ^, LOS < 12 days versus LOS ≥ 12 days.

Abbreviations: PT, physiotherapy; OT, occupational therapy; SP, speech pathology; DN, dietitian; SW, social worker; NGT, naso-gastric tube; LOS, length of stay; Accomm, pre-morbid accommodation; Dependence, pre-morbid level of independence; English, English proficiency; Stroke Unit, admitted directly to a stroke unit.

(<4 days) or long length of stay (≥10 days) compared with weekday admissions (OR: 0.4, 95% CI: 0.2–0.8 and OR: 0.6, 95% CI: 0.3–1.0, respectively). There was also a trend for less likelihood of stroke unit care if admitted on a weekend.

This analysis also demonstrated the potential redundancy in considering some non-age variables for their relevance to quality of allied health care. For example, an association between previous accommodation and previous independence was impossible to assess because all patients in residential care were, by default, also dependent. When this is considered in the light of earlier findings, previous independence may be the more important predictor variable because it is associated with process indicator compliance and has a stronger correlation than accommodation, with age.

Further details are provided in Appendix 2. The complex confounding associations between the various non-age predictor variables are illustrated in Figure 2.

In Figure 3 we revisit our initial causal pathway, adding in the associations found between adherence to allied health process indicators, and the early predictor variables captured in patient demographic and stroke event data. This new pathway summarizes the journey for patients admitted with acute stroke and the multiple factors that can impact on the care they receive from allied health professionals.

Discussion

This paper provides new data regarding the possible predictors of allied health care quality for patients with acute stroke. The sample is robust because it is appropriately powered and derived from a consecutive sample of stroke patient records. Based on our findings, we suggest that the quality of acute stroke care contributed by allied health in multidisciplinary settings could be improved. This is the first known study to examine a range of individual processes of care by allied health professionals and the factors which may relate to compliance with these processes. The findings suggest a complex relationship between variables which may be related to the provision of best practice by allied health professionals caring for acute stroke patients.

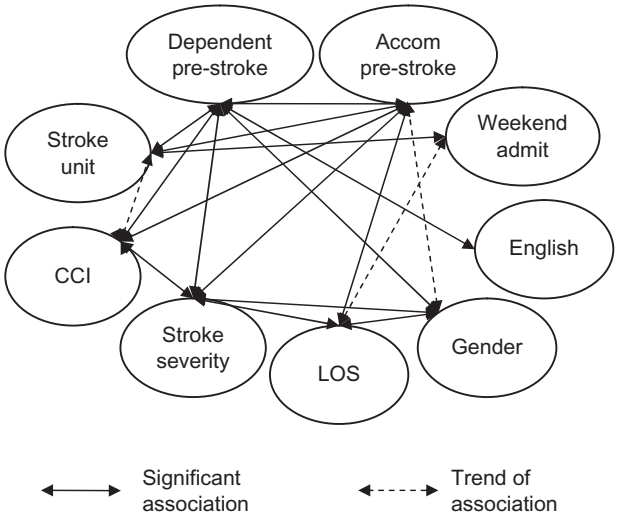

Figure 2 Confounding relationships between non-age variables.
Abbreviations: CCI, Charlson Comorbidity Index; LOS, length of stay.

We acknowledge that the generalizability of the findings for some variables chosen in our study may be limited by international variations in health care systems and policy. Length of stay data and admissions directly to a stroke unit, for example, are both particularly influenced by local contexts. Variability in the roles of stroke team members must also be taken into account when interpreting our results. For example, in the study settings, speech pathologists and dietitians made a strong contribution to team decisions regarding enteral feeding (process indicator 12), but this may not be an allied health role in some settings. Furthermore, we recognize that, as part of a multidisciplinary team with shared roles and responsibilities, the work of the allied health professions can be difficult to consider separately.

Correlates were found for older age, including increased stroke severity, higher comorbidity levels, previous residential care accommodation, previous dependence, female gender, poor English proficiency, and longer length of stay. These predictor variables were age proxies in our sample and may be stronger predictors of care decisions than patient age per se.

Some medical literature suggest that the age of an acute stroke patient is a determinant of the quality of medical care for stroke.[3–5,9–12] In allied health care, we suggest that other factors may be at work. Patient age had a strong correlation with only one quality process indicator (early first mobilization), and this process indicator was even more strongly correlated with stroke severity. Non-age variables were more frequently correlated with process indicator compliance (twelve indicators) than was patient age. Stroke severity was the most frequent predictor variable (seven process indicators), with length of stay the second most common predictor (five process indicators). Both of these variables were also age proxies. This analysis also demonstrated the lack of importance of some non-age variables, such as previous residential care accommodation data made redundant by data on previous independence.

It is possible that systematic variations between professions may contribute to age-related differences in the medical care provided following stroke, which do not apply to allied

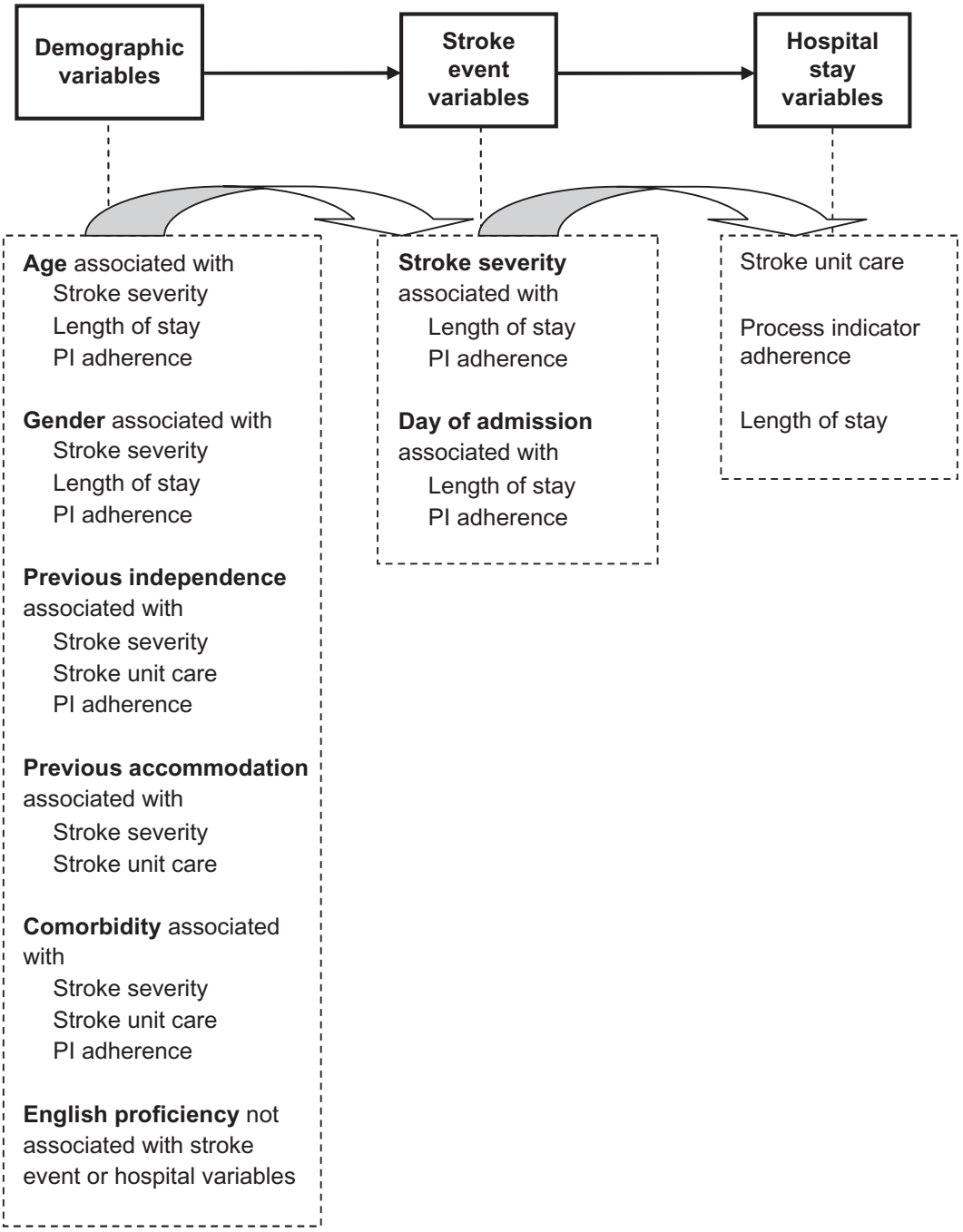

Figure 3 Relationships between variables for the patient journey with acute stroke.
Abbreviation: PI, process indicator.

health care. It is recognized, for example, that older patients are under-represented in some of the primary stroke research which guides evidence-based medical diagnostics and interventions.[3] Patients over 80 years have been excluded from many thrombolysis trials,[41] and similar age exclusions are reported for secondary prevention stroke medications.[42] The evidence base for allied health stroke care is still in early development and may therefore have less influence on which patients receive particular elements of care. As well as practicing within the biomedical framework adopted by medical practice, many areas of care provided by allied health professionals also fit within a biopsychosocial model.[43] These differences may result in different clinical reasoning processes and decision-making by the separate professions.

Allied health professional decision-making regarding the care delivered to patients with stroke has not been well

explored. There may be complex influences on the decisions they make about the care they provide to patients with acute stroke, underpinned by their perspectives of the role of non-age predictor variables on patient outcome. Our causal pathway (Figures 1 and 2) suggests that many factors cannot be adjusted because they are a priori to the stroke. How allied health professionals account for these factors is yet to be established.

Conclusion

Ensuring the highest quality of allied health care for all stroke patients is important in the current climate of scarce resources and the increasing burden of stroke to the health sector. The associations identified between independent variables, including patient age, indicate that there are unlikely to be simple explanations for why some patients receive recommended care and others do not. To understand fully the important factors influencing the quality of care provided to acute stroke patients by allied health professionals will require further investigations into their perspectives on the capacity of stroke patients to improve, and how they make care decisions.

Acknowledgment

JAL undertook this research as part of a PhD candidature which was supported by an Australian Postgraduate Award government scholarship.

Disclosure

The authors report no conflicts of interest in this work.

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Appendix 1 Correlations between age and other predictor variables

	Patients age <75 years compared to patients ≥75 years	
	Odds ratios (95% confidence interval)	**Test finding**
NIHSS <8 (mild stroke)	#	##
NIHSS 8–16 (moderate-to-severe stroke)	1.8 (1.1–3.2)**	Older group significantly more likely to have had a moderate-to-severe stroke or very severe stroke than younger group
NIHSS >16 (very severe stroke)	2.9 (1.4–6.1)**	
Charlson comorbidity index	2.5 (1.5–4.2)**	Older group significantly more likely to have higher comorbidity levels than younger group
Previous accommodation	2.6 (1.1–6.2)**	Older group significantly more likely to live in residential care pre-morbidly, than younger group
Previous independence	6.2 (3.2–12)**	Older group significantly more likely to have been dependent pre-morbidly, than younger group
Admitted to stroke unit bed	1.7 (0.8–3.6)	No correlation
Weekend admission	0.9 (0.6–1.5)	No correlation
Gender	2.2 (1.4–3.6)**	Females significantly more likely to be in the older group than males
English proficiency	3.2 (1.1–9.7)**	Older group significantly more likely to have poor English proficiency
LOS ≤4 days	#	##
LOS 5–9 days	0.6 (0.3–0.9)**	Older group significantly less likely to have LOS of 5–10 days than the younger group
LOS ≥ 10 days	1.7 (0.9–3.2)	Trend for older group to be more likely to have LOS >10 days than the younger group

Notes: **Statistically significant; #, Sub-group used as comparator in analysis (odds ratio = 1).
Abbreviations: LOS, length of stay; NIHSS, National Institute of Health Stroke Scale.

Appendix 2 Matrix of non-age variables

Odds ratios (95% confidence intervals)									
	Comparator	**Stroke severity**	**CCI**	**Gender**	**Accom**	**Dependence**	**Stroke unit**	**Weekend admission**	**English**
Stroke severity	Mild stroke (NIHSS < 8)								
CCI	High level comorbidity	0.6 (0.4–0.98)*							
Gender	Female	0.4 (0.2–0.6)*	1.1 (0.7–1.8)						
Accommodation	Nursing home, hostel	0.3 (0.1–0.7)*	8.3 (2.0–35.6)*	1.8 (0.9–3.7)					
Dependence	Dependent	0.6 (0.4–1.0)	4.1 (2.1–8.0)*	2.2 (1.4–3.7)*	#				
Stroke unit	Not stroke unit	0.7 (0.5–1.2)	1.9 (0.9–4.2)	1.1 (0.6–2.1)	8.5 (3.0–24.3)*	5.5 (2.7–11.3)*			
Weekend admission	Weekend	1.0 (0.6–1.6)	1.1 (0.6–1.9)	1.0 (0.6–1.6)	1.2 (0.6–2.5)	0.9 (0.5–1.5)	1.7 (0.9–3.4)		
English	Not proficiency	0.4 (0.2–0.9)	0.9 (0.3–2.1)	0.9 (0.4–2.2)	0.7 (0.1–3.0)	2.9 (1.3–6.9)*	0.6 (0.2–1.4)	1.2 (0.5–2.8)	
LOS 5–9 days	LOS ≤ 4 days	0.9 (0.5–1.7)	0.9 (0.5–1.7)	0.8 (0.5–1.5)	1.2 (0.5–2.6)	1.1 (0.6–2.1)	1.0 (0.4–2.2)	0.4 (0.2–0.8)*	0.3 (0.1–1.2)
LOS >10 days		2.6 (1.5–4.7)*	0.6 (0.3–1.2)	0.4 (0.2–0.7)*	2.5 (1.0–6.5)	0.8 (0.4–1.5)	1.4 (0.6–3.4)	0.6 (0.3–1.0)	0.3 (0.1–1.1)

Notes: *Significant correlation found; #, Numbers in one cell too small to calculate. An odds ratio of 1 is used as comparator in analysis.

Abbreviations: LOS, length of stay; accom, pre-morbid accommodation; dependence, pre-morbid level of independence; stroke unit, admitted directly to a stroke unit; CCI, Charleson Comorbidity Index; NIHSS, National Institute of Health Stroke Scale.