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Do clinical nurse specialist led stroke follow-up clinics reduce post-stroke hospital readmissions and recurrent vascular events?

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Key words
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Abstract

Background: Post-discharge stroke follow-up clinics intend to improve care and may reduce readmission. Pre-2013, there was no consistent post-stroke specialist follow up offered at Wellington Hospital. We tested whether the establishment of a clinical nurse specialist follow-up clinic reduced the 12-month readmission rate.
Methods: This is a sequential comparison of stroke patients admitted 1 year prior and 1 year after clinic establishment in 2013. The primary outcome was 12-month hospital readmission rate; main secondary outcomes were guideline adherence and recurrent vascular events. Patients were identified from hospital discharge records and underwent chart review. We adjusted results for differences in baseline characteristics.
Results: We identified 603 eligible patients; 288 pre- and 315 post-nurse clinic implementations. There was no difference based on study cohort in the 1-year readmission rate (adjusted odds ratio (aOR) = 1.14; 95% CI, 0.7–1.89; $P = 0.583$), or recurrent composite vascular events at 1 year (aOR = 1.56; 95% CI, 0.89–2.9; $P = 0.159$). When looking at clinic attendance as the main variable of interest, a pre-specified subgroup analysis, there was a significant difference in implementation of best medical therapy (aOR 2.66 (1.19–5.94); $P = 0.017$), and a trend towards reduction of vascular events and/or death at 1 year post discharge (aOR 0.53 (0.28–1.02); $P = 0.056$).
Conclusions: There was no reduction in the 1-year hospital readmission or vascular event recurrence rate for patients admitted with stroke following the establishment of a specialist nurse-led stroke follow-up clinic. Actual clinic attendance, however, did appear to confer some benefit. This study suggests that more consistent and potentially earlier timed follow up is probably desirable.

Introduction

Structured stroke prevention follow-up clinics have been associated with improvement in outpatient care and reduced hospital readmission rates.[1–3] Strokes are associated with significant morbidity, disability and mortality.[4–6] Previous studies have shown that the risk of recurrence following a transient ischaemic attack or stroke still remains significant after 1 year.[7,8] Secondary prevention is also vital in preventing recurrent vascular events and the resultant disability, especially with the most to gain in patients who were discharged well enough to return to their own residence.

Prior to 2013, there was no consistent outpatient specialist service follow up offered for patients who were discharged following a stroke at Wellington Regional Hospital (WRH), New Zealand, due to clinical resource limitations. Instead, patients were instructed to follow up with their primary care physician to provide ongoing post-stroke medical care. A subset of patients was referred to the community rehabilitation team, but this service focusses on rehabilitation rather than ongoing medical care or optimisation of secondary prevention. Selected patients were offered a specialist neurologist clinic follow up, generally where there remained diagnostic uncertainties. In early 2013, a clinical nurse specialist (CNS)-led clinic was established to make contact routinely with all patients discharged with stroke from WRH. This included follow-up phone calls and face-to-face clinical review in the outpatient department. The clinic was established with the goal to contact patients within 3 months

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of discharge to discuss outstanding test results, monitor medication compliance, discuss secondary prevention focussing on modifiable risk factors, assess post-stroke recovery and the potential need for further rehabilitation input, and of course answer any outstanding questions. We hoped to improve patient care, outcome and experience with the CNS-led clinic.

There is oversight with the CNS-led clinic appointments from a supervising stroke neurologist from WRH and multiple factors are addressed (Supporting Information Appendix S1). Interval symptoms and recovery since discharge from hospital are reviewed including the use of the National Institutes of Health Stroke Scale. Patients' medications and ongoing vascular risk factors are addressed such as hypertension and hyperlipidaemia. Any additional investigations not previously completed during the hospital admission are requested if indicated, such as a Holter or event monitor to check for the presence of atrial fibrillation. Other interventions that may be applicable on an individual basis may include smoking cessation, exercise or referral for green prescription and dietary advice.

The primary aim of this study was to determine whether the establishment of a CNS follow-up clinic at Wellington Regional Hospital reduced the subsequent readmission rate to hospital for patients who were acutely hospitalised with an ischaemic or haemorrhagic stroke at 1-year post-stroke. This outcome was chosen as a crude indicator of not only improved patient outcomes, but also potential health economic value of this new service delivery model.

Methods

Study population

This is a single-centre retrospective sequential comparison performed at WRH, Capital and Coast District Health Board (CCDHB), New Zealand, comparing patients admitted with stroke to WRH the year before (2012) to the year after (2014) the establishment of the CNS clinic in 2013.

WRH serves a local population of approximately 300 000 people, but also provides tertiary services to a wider area of about 1 million. Patients who are not domiciled in Wellington and would thus routinely follow up with a different hospital service were excluded from this study. This also included patients who moved out of the region within the 1 year after discharge from hospital as they would not have been available for follow up. Similarly, patients under the age of 16 were excluded as they are managed by the paediatrics service. Patients who died prior to discharge from hospital were excluded because they could not benefit from CNS follow up. Finally, some patients had to be excluded because either their primary diagnosis was not in fact a stroke or their files contained insufficient information to confirm the diagnosis. For those patients who presented with more than one event during the study cohort, only the first event was included for the purposes of the study. Patients who died prior to discharge were excluded from the final statistical analysis for the primary and secondary outcomes.

Data collection and statistical analysis

The hospital administrative database was queried for all patients discharged during the study period with a primary discharge diagnosis of ischaemic stroke (ICD-10-AM I63), haemorrhagic stroke (ICD-10-AM I61) or unspecified stroke (ICD-10-AM I64). The diagnosis was confirmed and detailed data collection completed through review of electronic patient medical records via Concerto Medical Applications Portal (Apollo Information Technologies) used at WRH.

Baseline patient demographics including age, sex, ethnicity and predisposing vascular risk factors were recorded. Stroke aetiology was defined as primary ischaemic or haemorrhagic. Time from discharge to follow-up review in CNS clinic was also recorded.

The primary outcome assessed was the 1-year hospital readmission rate and the main secondary outcome was the composite 1-year rate of all recurrent vascular events including stroke, TIA, myocardial infarction and all-cause mortality. Other outcomes included the 1-year rate of stroke and TIA events and adherence to guidelines with the best medical therapy. The best medical therapy was defined as adherence to the current practice for clinical therapeutic guidelines and if appropriate for the patient.[9] For ischaemic stroke, this included the initiation of antiplatelet therapy, a statin and an antihypertensive, oral anticoagulation for atrial fibrillation and carotid endarterectomy for carotid artery stenosis if appropriate for the patient. For haemorrhagic stroke, initiation of an antihypertensive agent was required unless a clear alternative cause not requiring this intervention was identified. In addition, any other underlying causes of the stroke if identified, for example, the closure of patent foramen ovale, had to be addressed.

A pre-specified sub-group analysis included looking at outcomes comparing clinic attendees versus those who did not attend clinic across both year groups and excluding patients who were discharged to a rest home including hospital level care as these patients have more severe strokes and are not routinely seen in the CNS clinic.

Statistical analysis was performed using StataIC 13.0. The primary outcome for 1-year hospital readmission rate and secondary outcomes of 1-year composite vascular events were estimated using a multivariate logistic regression model. Univariate analysis of the baseline patient demographics and risk factors were assessed using the Chi-squared test. Baseline variables with

differences of <0.2 were considered in regression models and retained if required to optimise model fit. Variables were also assessed for possible interactions. Patients with incomplete data were excluded from the analysis for the variable being analysed, under the assumption that the rate of missing data was random and mutually exclusive to the variable.

This audit was approved by the WRH, CCDHB Ethics Committee. There was no funding provided for this clinical audit and no conflict of interest by the authors involved in this study.

Results

During the study period, 874 patients were admitted with a coded discharge diagnosis of 'stroke' of whom 603 met study inclusion criteria (Fig. 1); 288 patients who presented during the year prior to the establishment of the CNS clinic (1 January 2012 to 31 January 2013) and 315 who presented after the establishment of the CNS clinic (1 January 2014 to 31 January 2015). Baseline characteristics of the two cohorts are as outlined in Table 1.

A severe stroke was defined as failure to discharge home within 5 days of admission (i.e. length of stay (LOS) >5 days). Residential home level care (RHLC) included patients residing at residential level of care or hospital level of care. Among those in the second cohort, 148 were seen in the CNS clinic and the median (interquartile range (IQR)) time to follow up in clinic after discharge was 85 (63–98.5) days. Of those who attended clinic, 54.1% of patients had at least one change made in their medical management.

The establishment of the stroke nurse follow-up clinic was not associated with a statistically significant reduction in 1-year readmission rate (OR = 1.18 (0.85–1.64); $P = 0.323$). This finding persisted after adjusting for clinic attendance, initial hospital LOS >5 days (as a marker of stroke severity), BMT, LDL >2.0, discharged to RHLC, and AF (adjusted OR = 1.14 (0.7–1.89); $P = 0.583$). There was also no difference in composite recurrent vascular events and all-cause mortality at 1-year (adjusted OR = 1.56; $P = 0.159$). These and additional event are listed in Table 1.

There was a higher proportion of patients in the post-clinic year cohort that received 'best medical therapy' (BMT) compared to the pre-clinic year cohort

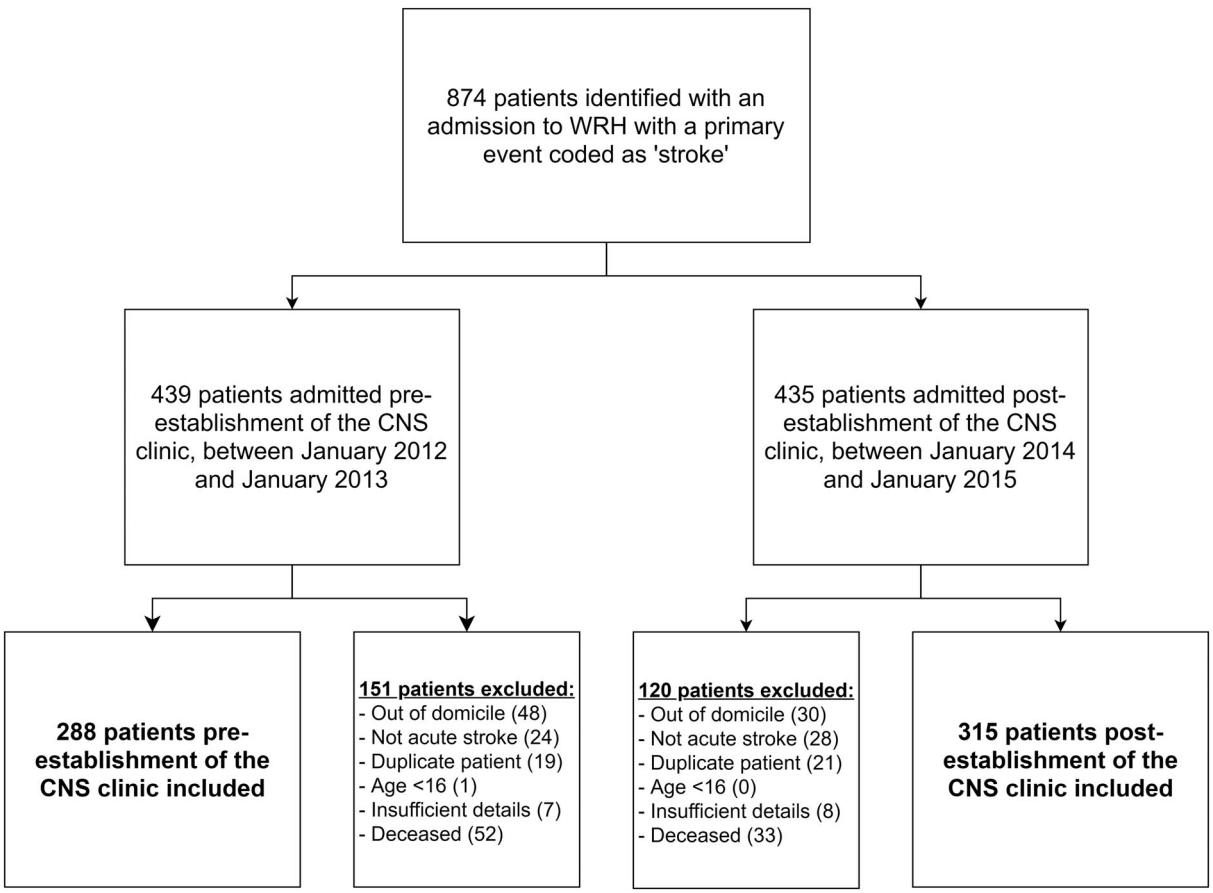

Figure 1 Patients identified with an admission to Wellington Hospital with a primary event coded as 'stroke'.

Table 1 Baseline characteristics

Characteristics	Pre-clinic cohort *n* = 288	Post-clinic cohort *n* = 315	*P*-values
Age, mean ± SD (years)	72.2 ± 15.1	73.2 ± 13.3	0.373
Female sex, *n* (%)	138 (49.9%)	130 (41.3%)	0.101
Ethnicity, *n* (%)			
NZ European	154 (53.5)	167 (53.0)	
Maori	20 (6.9)	19 (6.0)	0.693
Pacific Islander	30 (10.4)	23 (7.3)	
Asian	18 (6.3)	24 (7.6)	
Diabetes, *n* (%)	64 (22.2)	87 (27.6)	0.127
Hypertension, *n* (%)	184 (63.9)	208 (66.0)	0.582
IHD, *n* (%)	66 (22.9)	70 (22.2)	0.839
CHF, *n* (%)	24 (8.3)	23 (7.3)	0.637
Smoker, *n* (%)	35 (12.2)	21 (6.7)	0.020
Previous stroke or TIA, *n* (%)	71 (24.7)	64 (20.3)	0.202
AF, *n* (%)	93 (32.2)	83 (26.4)	0.109
LDL >2.0, *n* (%)†	114 (75.5)	147 (57.0)	<0.001
Stroke type, *n* (%)			
Ischaemic	258 (89.6)	269 (85.7)	0.150
Haemorrhagic	30 (10.4)	45 (14.3)	
Carotid artery stenosis, *n* (%)			
50–69%,	4 (2.5)	7 (3.6)	0.527
>70%	16 (9.8)	18 (9.2)	
BMT, %†	217 (76.7)	264 (85.7)	0.005
Days in hospital, median (IQR)	8 (2–36)	5 (2–19)	0.005
Hospital stay >5 days, *n* (%)	164 (57.0)	149 (47.3)	0.018
Discharge to RHLC, *n* (%)†	73 (25.4)	58 (18.4)	0.037
CNS clinic attended, *n* (%)	0 (0.0)	148 (47.0)	<0.001

†Indicates this variable had some missing valued; these patients were removed from both denominator and numerator. AF, atrial fibrillation; BMT, best medical therapy as per therapeutic guidelines; CHF, congestive heart failure; IHD, ischaemic heart disease; IQR, interquartile range; LDL, low-density lipoprotein; RHLC, residential home level care; SD, standard deviation; TIA, transient ischaemic attack.

(OR 1.82 (1.20–2.78); $P = 0.005$), but the statistical significance was lost when adjusting the model for important differences in baseline characteristics (OR 1.14 (0.60–2.17); $P = 0.692$).

The most consistent predictor of a negative outcome was stroke severity (either on the basis of LOS or discharge to institutionalised care) and the most prominent predictors of a positive outcome were a low LDL cholesterol and clinic attendance. Figure 2 shows model outputs when focussing on clinic attendance as the main variable, which was a pre-specified subgroup analyses.

Removing patients discharged to rest home or hospital level care from the analysis, another pre-specified sub-group analysis did not significantly alter the overall finding.

Discussion

The present study found no significant association between the introduction of a routine post-stroke follow-up specialist nurse contact and reduction in 12-month readmission or vascular events. A greater proportion was started on BMT post establishment of the clinic, but this finding lost statistical significance when adjusted for other differences in baseline variables. Looking at actual clinic attendance, a pre-specified sub-group analysis found that clinic attendance was positively correlated with significantly improved adherence to best practice guidelines and a trend towards a reduction in the rate of vascular events and death at 1 year.

Previous studies have suggested that stroke prevention clinics are associated with a reduction in the readmission rate and mortality after a transient ischaemic attack or stroke.[1–3,10] Condon et al. described a 48% reduction in their 30-day readmission rate, but this did not extend to a 90-day readmission following their nurse-led stroke clinic.[3]

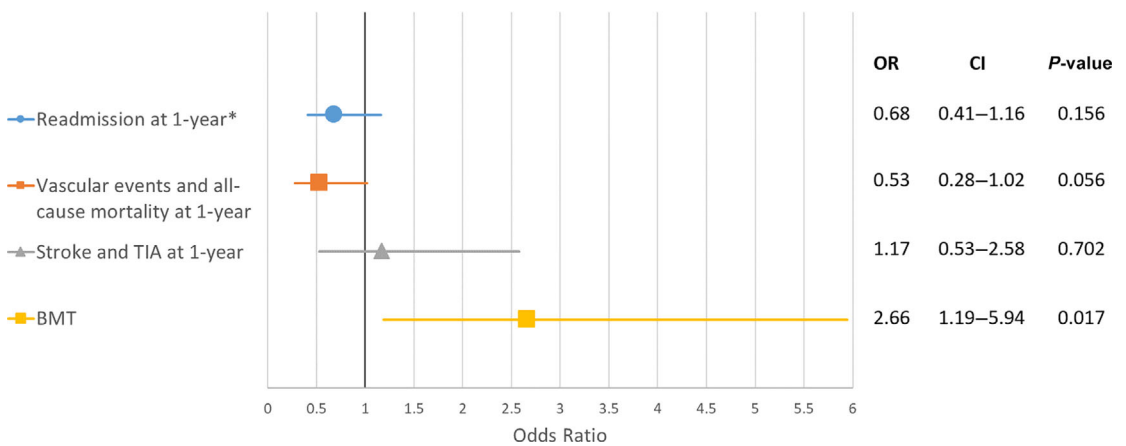

Figure 2 Multivariate outcomes with odds ratio of association of clinic attendance with patient outcomes. *Adjusted using the same variables to optimise model fit as described in Table 1.

This highlights an important difference in our study that likely affected our results. We did not review our 30- or 90-day readmission rates as the median follow-up time was 85 days (IQR 63–98.5). It may well be the case that this delay is too long to reap the degree of proposed benefits. Shortening our follow-up time may allow us to identify issues earlier such as ongoing dysphagia to prevent an aspiration pneumonia. This may potentially reduce the likelihood of a hospital readmission and long-term disability.

Clearly, some benefit is gained from these visits in light of the demonstrated improvement in the best medical therapy guideline adherence and the number of medication changes. This highlights that our current model and study methodology may require some adjustment to achieve the desired benefits as regards actual patient outcomes. A longer follow-up study period to monitor for adverse patient outcomes may also be warranted.

There are some limitations to our study. The study groups had important differences in baseline characteristics, which impacted the statistical analysis and may have overshadowed a positive effect of the study period. The observational design means some confounders may be missed. For example, there are multiple non-vascular comorbidities that could influence the chances of a readmission. Finally, as this is a single-centre study generalisability may be limited. Only a multi-centre randomised controlled trial will be able conclusively to address these issues.

Strengths of our study include the before and after design that helps to address hidden confounders, the relatively large sample size and low number of missing data. Our study's pragmatic methodology is easily reproducible, allows for repeated evaluation of our clinic's efficacy and effectively highlights areas for development to inform continuous service improvement.

Since the completion of this evaluation, we have implemented more consistent early CNS phone calls within 1–2 weeks of discharge followed by face-to-face follow up at 6–12 weeks for people who are found to require ongoing care during the phone contact. We plan to reassess the impact of this new model using similar methodology; however, we plan to include a patient survey to assess impact on quality of life as well as considering more time points when assessing readmission rate (30 and 90 days) and potentially longer follow-up period especially to assess the impact on vascular events (2 years).

We feel that our CNS also plays an extremely valuable role with regards to stroke education. Although it was not within the scope of study to investigate this, anecdotally our CNS have provided important psychosocial benefit and support to patients who are adjusting to life with disability following a stroke that accentuates the value of a structured follow-up clinic.

Conclusion

In summary, we did not identify a significant reduction in the 1-year hospital readmission rate for patients with stroke following the establishment of the CNS-led stroke follow-up clinic. Guideline adherence, however, was improved for those patients actually attending the clinic, and there is a suggestion of reduced serious health outcomes for clinic attenders as well. Additional benefits that are offered from a psychosocial, health economic and health burden perspective with earlier timed follow up requires further evaluation to help optimise outpatient care post-stroke.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Appendix S1 Electronic template for clinical nurse specialist-led stroke follow-up clinic.