CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Acute Stroke Management Evidence Tables

Seventh Edition, Update 2022

Section 8: Acute Stroke Unit Care

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Acute Stroke Management Writing Group and in collaboration with the
Canadian Stroke Consortium

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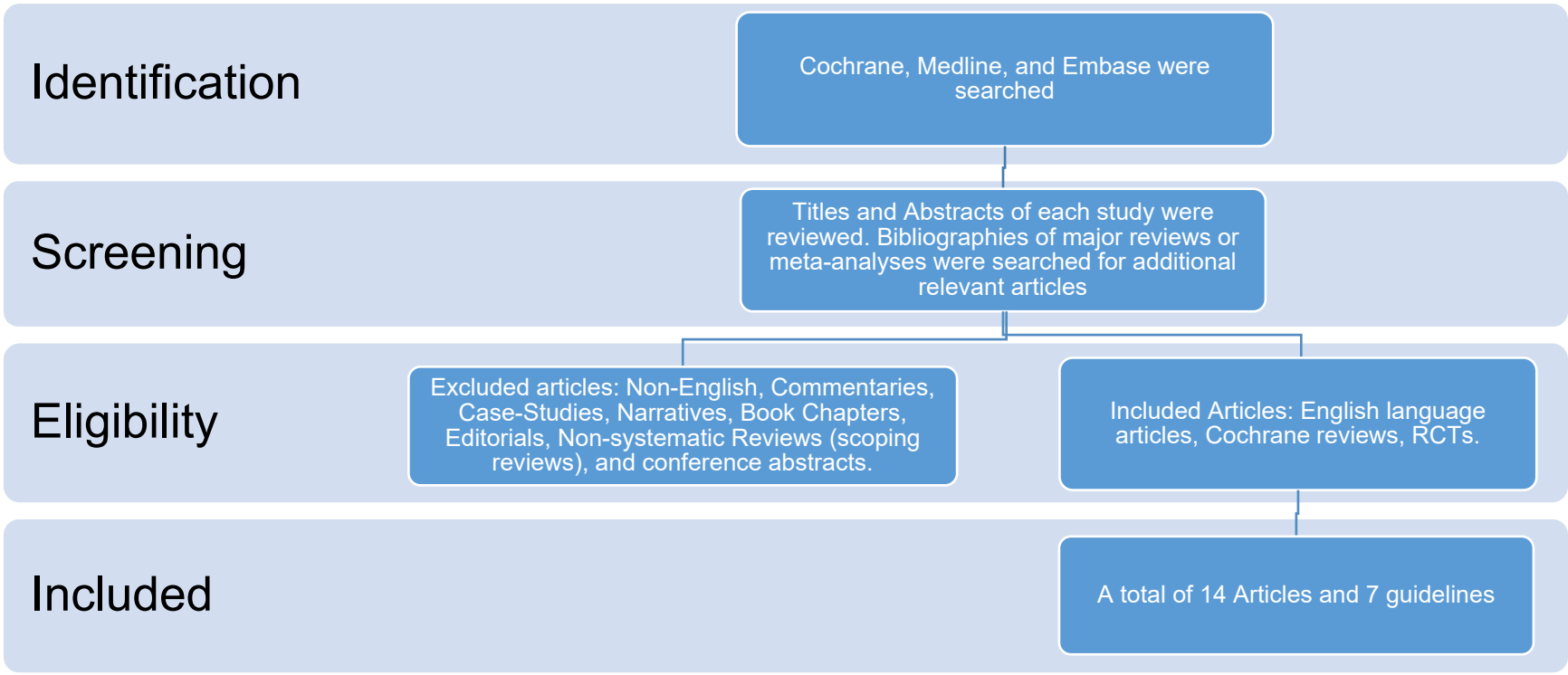
Search Strategy



Pubmed, EMBASE and the Cochrane Database were searched using the terms “stroke” and “stroke unit” OR “organized stroke care”. The title and abstract of each article were reviewed for relevance. Bibliographies were reviewed to find additional relevant articles. Articles were excluded if they were: non-English, commentaries, case-studies, narrative, book chapters, editorials, non-systematic review, or conference abstracts. Additional searches for relevant best practice guidelines were completed and included in a separate section of the review. A total of 14 articles and 7 guidelines were included and were separated into categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
Stroke Units	
Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Demaerschalk BM, Hoh B, Jauch EC, Kidwell CS, Leslie-Mazwi TM, Ovbiagele B, Scott PA, Sheth KN, Southerland AM, Summers DV, Tirschwell DL; on behalf of the American Heart Association Stroke Council. **Guidelines for the early management of patients with acute ischemic stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association** ***Stroke.* 2019;50:e344–e418.** **(selected)**	Stroke Units 1. The use of comprehensive specialized stroke care (stroke units) that incorporates rehabilitation is recommended. Class I; LOE A. 2. The use of standardized stroke care order sets is recommended to improve general management. Class I; LOE B-NR.
Clinical Guidelines for Stroke Management 2017. Melbourne (Australia): National Stroke Foundation.	Strong recommendation All stroke patients should be admitted to hospital and be treated in a stroke unit with an interdisciplinary team. Strong recommendation New All acute stroke services should implement standardised protocols to manage fever, glucose and swallowing difficulties in stroke patients. Practice points • All stroke patients should be admitted directly to a stroke unit (preferably within three hours of stroke onset). • For patients with suspected stroke presenting to non-stroke unit hospitals, transfer protocols should be developed and used to guide urgent transfers to the nearest stroke unit hospital. • Where transfer is not feasible, smaller isolated hospitals should manage stroke services in a manner that adheres as closely as possible to the criteria for stroke unit care. Where possible, stroke patients should receive care in geographically discrete units.

Guideline	Recommendations
Intercollegiate Stroke Working Party. National clinical guideline for stroke, 5th edition. London: Royal College of Physicians, 2016.	People with suspected acute stroke (including when occurring in people already in hospital) should be admitted directly to a hyperacute stroke unit and be assessed for emergency stroke treatments by a specialist physician without delay.
Bernhardt et al. 2015 **Australian Commission on Safety and Quality in Health Care. Acute Stroke Clinical Care Standard. Sydney: ACSQHC, 2015.**	A patient with stroke is offered treatment in a stroke unit as defined in the Acute stroke services framework.
National Collaborating Centre for Chronic Conditions. Stroke. Diagnosis and initial management of acute stroke and transient ischaemic attack (TIA). London (UK): National Institute for Health and Clinical Excellence (NICE); 2008 Jul. 37 p. (Clinical guideline; no. 68).	Specialist Stroke Units All people with suspected stroke should be admitted directly to a specialist acute stroke unit following initial assessment, either from the community or from the A&E department. (An acute stroke unit is a discrete area in the hospital that is staffed by a specialist stroke multidisciplinary team. It has access to equipment for monitoring and rehabilitating patients. Regular multidisciplinary team meetings occur for goal setting).
In-hospital Stroke	
Nouh A, Amin-Hanjani S, Furie KL, Kernan WN, Olson DM, Testai FD et al. **Identifying best practices to improve evaluation and management of in-hospital stroke: A Scientific Statement from the American Heart Association.** ***Stroke* 2022 Apr;53(4):e165-e175**	5 core elements are proposed to optimize in-hospital stroke care: 1. Deliver stroke training to all hospital staff, including how to activate in-hospital stroke alerts. 2. Create rapid response teams with dedicated stroke training and immediate access to neurological expertise. 3. Standardize the evaluation of patients with potential in-hospital stroke with physical assessment and imaging. 4. Address barriers to treatment potentially, including interfacility transfer to advanced stroke treatment. 5. Establish an in-hospital stroke quality oversight program delivering data-driven performance feedback and driving targeted quality improvement efforts. Additional research is needed to better understand how to reduce the incidence, morbidity, and mortality of in-hospital stroke.

Evidence Tables

Organization of Care

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Langhorne et al. 2020 **Stroke Unit Trialists' Collaboration** **UK** **Cochrane Review**	The most common source of bias was failure to mask the patient and/or outcome assessor	29 RCTs (n= 5,902), including participants admitted to hospital following acute stroke.	Comparisons between organized stroke unit care with alternative services. Treatment comparisons included acute stroke units that accept patients acutely but discharge early (usually within seven days) and were classified according to intensity of care: i) intensive care with intensive monitoring, ii) semi-intensive care, but with no life support facilities and iii) non-intensive care, and other forms of more organized care such as combined acute and rehabilitation stroke units, mixed rehabilitation ward and mobile stroke teams.	**Primary Outcomes:** Poor outcome, defined as death, dependency (e.g., mRI>3 or BI <18), and institutionalization at the end of scheduled follow-up. **Secondary Outcomes**: Quality of life, patient and carer satisfaction, and length of hospital stay.	**Organized stroke unit vs. alternative service** Stroke units significantly reduced the odds of a poor outcome OR=0.77, 95% CI 0.69 to 0.87. Results from 26 studies included. Stroke units significantly reduced the odds of death at the end of scheduled follow-up. OR=0.76, 95% CI 0.66 to 0.88. Results from 29 studies included. Stroke units significantly reduced the odds of death or institutional care by the end of scheduled follow-up. OR=0.76, 95% CI 0.67 to 0.85. Results from 25 studies included. Stroke units significantly reduced the odds of death or dependency by the end of scheduled follow-up. OR=0.75, 95% CI 0.66 to 0.85. Results from 24 studies included. Hospital LOS was not significantly shorter for stroke unit patients SMD=0.16, 95% CI -0.33 to 0.01. Results from 19 studies included. Quality of evidence was moderate. **Stroke Unit vs. General Medical Ward** Stroke units significantly reduced the odds of a poor outcome OR=0.78, 95% CI 0.68 to 0.91. Results from 14 studies included. Stroke units significantly reduced the odds of death at the end of scheduled follow-up. OR=0.75, 95% CI 0.63 to 0.91. Results from 15 studies included.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					Stroke units significantly reduced the odds of death or institutional care by the end of scheduled follow-up. OR=0.74, 95% CI 0.63 to 0.87). Results from 13 studies included. Stroke units significantly reduced the odds of death or dependency by the end of scheduled follow-up. OR=0.75, 95% CI 0.64 to 0.88). Results from 12 studies included. Hospital LOS was not significantly shorter for stroke unit patients SMD=0.13, 95% CI -0.29 to 0.04. Results from 10 studies included. **Mobile Stroke Team vs General Medical Ward** Only 2 studies were included in pooled analysis. Mobile stroke teams were not associated with significantly better outcomes. **Mixed Rehabilitation Ward vs. GMW** MRWs significantly reduced the odds of a poor outcome OR=0.65, 95% CI 0.47 to 0.90. Results from 6 studies included. MRW did not reduce the odds of death at the end of scheduled follow-up. OR=0.91, 95% CI 0.58 to 1.42. Results from 6 studies included. MRW significantly reduced the odds of death or institutional care by the end of scheduled follow-up. OR=0.71, 95% CI 0.51 to 0.99. Results from 5 studies included. MRW significantly reduced the odds of death or dependency by the end of scheduled follow-up. OR=0.65, 95% CI 0.47 to 0.90. Results from 6 studies included. Hospital LOS was not significantly shorter for MSU patients SMD=0.08, 95% CI -0.21 to 0.37. Results

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					from 3 studies included.
Ronning & Guldvog, 1998 **Stavem and Ronning 2011 (follow-up to 1998)** **Norway** **Quazi-Randomized Trial**	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☑	550 stroke patients, ≥60 years admitted to hospital within 24hrs of stroke onset. Patients with subarachnoid hemorrhage or subdural hematoma were excluded.	Participants were randomized (on the basis of birth date) to receive care on a stroke unit (SU; n=271) or general medical ward (GMW; n=279).	**Primary Outcomes:** Death, institutionalization, and number improved, deteriorated, or dead at 7-month follow-up. **Secondary outcome:** Long-term survival	7-month outcomes: SU patients were hospitalized a median of 7.7 days vs. 9.5 days for GMW patients. Stroke units were not associated with a reduction in the risk of death (OR=0.87, 95% CI 0.59 to 1.28, p>0.05), the need for institutionalization (OR=0.95, 95% CI 0.60 to 1.52, p>0.05), deterioration (OR=0.63, 95% CI 0.30 to 1.33, or death/deterioration (OR=0.79, 95% CI 0.55 to 1.14) at 7-months. Patients treated on the stroke unit had significantly higher Scandinavian Stroke Scale scores and a lower incidence of recurrent stroke compared to patients treated on the general medical ward (p<0.05). *Long-term outcome:* Median follow-up period was 3.7 (range=0 to 13.3) yrs. There was no significant difference in long-term survival between groups (SU=90%, GMW=83%, p=0.15).
Saposnik et al. 2011 **Canada** **Prospective Cohort Study**	NA	6,223 patients with a first-ever ischemic stroke admitted to one of 12 stroke centers participating in a national stroke registry.	Consecutively admitted patients were admitted to either a stroke unit (n=4157) or a non-stroke unit (n=2066): admissions decisions were based primary on bed availability. Patients were categorized according to the following stroke subtypes: cardioembolic, large artery disease, small vessel disease, or other.	**Primary Outcome:** 30-day mortality **Secondary Outcomes:** 7-day mortality, and death/institutionalization at discharge.	For all patients combined, 30-day mortality was 12.2%. Across all stroke types, patients treated in stroke units had significantly reduced 30-day mortality, controlling for age, gender, comorbidity and stroke severity: cardioembolic (OR=0.46, 95% CI 0.36 to 0.59), large artery disease (OR=0.39, 95% CI 0.27 to 0.56), small vessel disease (OR=0.48, 95% CI 0.27 to 0.88), and other (OR=0.45, 95% CI 0.29 to 0.70), all at p<0.01. 7-day mortality and death/ institutionalization were also significantly reduced among patients treated on a stroke unit.
Seenan et al.	NA	25 observational studies	Comparisons of	**Primary Outcome:**	Stroke units were associated with a significant

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2007 **UK** **Systematic Review and Meta-analysis**		comparing stroke unit care to non-stroke unit care (42,236 participants).	outcomes of patients treated in stroke units to those treated in non-stroke units.	12-month mortality. **Secondary Outcome:** Poor outcome (death, discharge location other than home, dependence in daily activities).	reduction in the risk of death (OR=0.79, 95% CI 0.73 to 0.86, p<0.001). Results from 17 trials included. Using the results from 8 multi-centred trials only, stroke units were associated with a significant reduced risk of death (OR=0.82, 95% CI 0.77 to 0.87, p<0.001). Stroke units were associated with a significant reduction in the risk of a poor outcome (OR=0.87, 95% CI 0.80 to 0.95, p<0.01). Results from 15 trials included.

Systems of Care

Study/Type	Main Findings
Langhorne P, Audebert HJ, Cadilhac DA, Kim J, Lindsay P. **Stroke systems of care in high-income countries: what is optimal?** ***Lancet*. 2020 Oct 31;396(10260):1433-1442** **(Series review)**	Interventions currently available within high-income health systems to facilitate the delivery of timely access to stroke care are summarized. *Education and training campaigns* • 4 factors responsible for delays for reperfusion therapies include i) patient-related factors; ii) training and related health system factors; iii) resources; and iv) inadequate coordination between different parts of the service • Strategies directed at the public and emergency medical services appear to improve stroke recognition, time to presentation, and treatment • Public awareness campaigns do not appear effective for improving response times after stroke onset. • Educational interventions for emergency medical services can improve access to thrombolysis. • The use of validated prehospital stroke screening tools used by paramedics can improve the accuracy of paramedic diagnosis. *Mobile stroke units* • MSUs can expedite the diagnosis, triage, and treatment of stroke. • MSUs can also provide other prehospital treatments, including early reversal of warfarin, dabigatran, or other anticoagulants after intracerebral haemorrhage or before thrombolysis. *Stroke centres* • Both comprehensive stroke centres (CSCs) and primary stroke centres (PSCs) approaches have been associated with improvements in the quality and outcome of care, compared with non-specialist care in general hospitals, although CSCs are required for the most complex stroke interventions. • In regions without PSCs or CSCs, thrombolysis can be started before transportation to specialized facilities, to avoid critical delays.

Study/Type	Main Findings
	• In some cases, when hospitals provide thrombectomy and do not have neurosurgery or neurointensive care services, transfer to the appropriate specialized service may be required. *Stroke Units* • Compared with care in general medical or neurology wards, admission to a stroke unit can result in more patients surviving, returning home, and regaining independence. • The core features of stroke unit care include: a discrete ward area; specialist medical, nursing, and therapy staff with stroke expertise; a multidisciplinary team working together through regular meetings; and standard protocols to address common challenges and reduce the risk of complications. *Transfer from hospital to community* • To facilitate successful transfer, provision of adequate information and training, home assessments before discharge, and training and education for carers and family have been used commonly, but often fail to meet patients/carer needs. • Early supported discharge (ESD) programs have enabled patients to return home earlier with an increased chance of remaining at home and regaining independence in daily activities. *Continuing rehabilitation and reintegration into regular living* • There is much diversity in terms of both service delivery and research models *Telemedicine networks* • The use of telemedicine has been used most commonly in the delivery of thrombolysis. • Telemedicine poses unique challenges in terms of technological and organizational quality standards, including remote control and broadband streaming for videoconferencing, data protection, standard operating procedures, accreditation for service providers, and clinical quality management and reviews. • Telestroke is used in different forms, ranging from exclusive remote consultation (eg, for indicating thrombolytic treatment) to comprehensive networks enabling smaller hospitals to run local stroke units, using telestroke as required. • The use of telemedicine for remote neurological assessment and imaging reading have been reported to be as reliable and valid as onsite examinations. The safety and efficacy of thrombolysis administration by telemedicine in smaller hospitals were equivalent to thrombolysis done in larger experienced stroke centres. • Telestroke networks are cost-effective. • Physical rehabilitation, speech and language therapy, and occupational therapy can be provided by telerehabilitation platforms, although the evidence base to support its widespread use is lacking. *Coordination and monitoring of services for stroke* • Agreements with emergency medical services should be in place to ensure that patients with symptoms suspicious of acute stroke are delivered to stroke-ready hospitals. • Concerns about both variation in practice among hospitals and inequity of access to best-practice management for acute stroke, highlight the need for monitoring the quality of care. • Regular stroke care quality monitoring should include the proportions of patients receiving (or experiencing delays in receiving) stroke unit care, intravenous thrombolysis, and mechanical thrombectomy. Continuity of care should also be evaluated, from prehospital emergency care and triage to the optimal facility, to in-hospital care management by a multidisciplinary team, and stroke aftercare tailored to individual patient needs. • Standardized data collection via national audits or statewide registries is to be encouraged.
Adeoye O, Nyström KV,	1. Stroke centers should use organized approaches (eg, stroke teams, stroke units, and written protocols) to ensure that all patients receive

Study/Type	Main Findings
Yavagal DR, Luciano J, Nogueira RG, Zorowitz RD, Khalessi AA, Bushnell C, Barsan WG, Panagos P, et al. **Recommendations for the establishment of stroke systems of care: A 2019 update.** ***Stroke* 2019;50:e187–e210.**	appropriate subacute care (revised from 2005). 2. Stroke centers should adopt approaches to secondary prevention that address all major modifiable risk factors and that are consistent with the national guidelines for all patients with a history or a suspected history of stroke or transient ischemic attack. The focus of postacute care should be on reducing mortality, maximizing recovery, and preventing recurrent stroke and cardiovascular events (revised from 2005). 3. A stroke system should establish support systems to ensure that all patients discharged from hospitals and other facilities to their homes have appropriate follow-up with specialized stroke services when needed and primary care arranged on discharge. These efforts should include education and training for the patient and his or her family members. Clear, comprehensive, and timely communication across the inpatient and outpatient poststroke continuum of care is essential to ensure appropriate medical and rehabilitation care (new). 4. To standardize postacute care after stroke discharge, stroke centers should comprehensively screen for postacute complications, provide individualized care plans for patients during the transition of care, provide referrals to community services, and reinforce secondary prevention and self-management of stroke risk factors and lifestyle changes to decrease the risk of recurrent stroke. Trained stroke nurses, nurse practitioners, social workers, community health workers, and others should play a pivotal role (new).

In-Hospital Stroke

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Akbik et al. 2020 **USA** **Retrospective study**	NA	267,956 patients who underwent reperfusion therapy for acute ischemic stroke who were included in the Get with the Guidelines-Stroke registry from January 2008 to September 2018. Mean age was 72 years, 53.2% were women.	The outcomes of patients who experienced a stroke with in-hospital or out-of-hospital onset, were compared.	**Primary outcomes:** Time to cranial imaging, to intravenous thrombolysis (IVT), and to endovascular therapy (EVT), discharge destination, in-hospital mortality	Of 2,237,793 patients discharged with acute ischemic stroke at 1,355 sites during the study period, 67,493 patients (3.0%) had an in-hospital stroke *IVT* Overall, 224,826 patients received IVT, of which 10,481 were in-hospital strokes and 214,345 were out of hospital strokes. The median time to CT and from CT to treatment was significantly longer in the in-hospital stoke group (33 vs. 16 minutes, p<0.001 and 61 vs. 43 minutes, p<0.001 respectively). Fewer patients in the in-hospital group were discharged home (40.2% vs. 47.1%). Patients with in-hospital stroke were significantly

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					less likely than those with out-of-hospital onset to be treated with IVT within 60 minutes of onset (adjusted OR=0.45, 95% CI, 0.42-0.48; P < .001), were less likely to be independent ambulators at discharge (aOR= 0.78; 95% CI, 0.74-0.82; P < .001) or to be discharged home (aOR= 0.69; 95% CI, 0.66-0.73; P < .001), with an increased likelihood of in-hospital mortality or discharge to hospice (aOR= 1.39; 95% CI, 1.29-1.50; P < .001). *EVT* Patients with in-hospital stroke who received EVT had longer median times from presentation to cranial imaging (38 vs 15 minutes; p < .001) while median times from CT to treatment were similar (120 vs. 126 minutes). Patients with in-hospital stroke onset were less likely to be treated within 120 minutes of symptom recognition or emergency department arrival (aOR= 0.65; 95% CI, 0.57-0.75; P < .001). The odds of symptomatic intracranial hemorrhage were significantly lower among the in-hospital stroke group (aOR= 0.75; 95% CI, 0.61-0.92; p = .005). The odds of ambulating independently at discharge or being discharged home were significantly lower in the in-hospital stroke group (aOR= 0.77; 95% CI, 0.68-0.86; P < .001 and aOR= 0.68; 95% CI, 0.61-0.77; P < .001, respectively). Patients who received EVT for stroke with in-hospital onset were more likely to die or be discharged to hospice (aOR=1.58; 95% CI, 1.43-1.75; P < .001).
Saltman et al. 2015 **Canada** **Retrospective study**	NA	973 adult patients with in-hospital stroke and 28 837 persons with community-onset stroke seen in an emergency department, recruited between July 1, 2003, and March 31, 2012 from	The processes of stroke care delivery and outcomes were compared between those with in-hospital vs. community-onset stroke	**Primary outcome:** Time to neuroimaging **Secondary outcomes:** Use of thrombolysis, stroke unit care, dysphagia screening, carotid imaging, medications for secondary	Patients with in-hospital stroke had significantly longer waiting times from symptom recognition to neuroimaging (median, 4.5 vs 1.2 hours; *P* < .001; for <2 hours, 32% vs 63%; adj OR=0.21; 95% CI, 0.18-0.24), compared with those with community-onset stroke. Use of t-PA: The use of thrombolysis was

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		participating stroke centres in Ontario. Median age was 73 years, 47% were women.		stroke prevention, length of stay (LOS), mRS at discharge, discharge destination, and mortality at 7 days, 30 days, and 1 year following stroke.	significantly lower among those with in-hospital stroke (12% vs. 19%; adjOR = 0.54; 95%CI, 0.43-0.67; *P* < .001), and longer time from stroke recognition to administration of thrombolysis (median, 2.0 vs 1.2 hours; *P* < .001). Fewer in-hospital stroke patients received thrombolysis within 90 minutes of diagnosis (29% vs 72%, *P* <0.001). Those with in-hospital stroke were less likely to be cared for on a stroke unit (28% vs 61%, p<0.001), had a significantly longer median hospital LOS (17 vs. 4 days, p<0.001) and were more likely to be dead or disabled at discharge (OR=1.64, 95% CI 1.38-1.96). After adjustment, there were no significant differences between groups in the 7-day, 30-day or 1-year mortality. Those with in-hospital stroke were more likely to be discharge for inpatient rehabilitation (OR=1.42, 95% CI 1.22-1.66)
Cumbler et al. 2014 **USA** **Controlled study**	NA	21,349 patients who experienced an in-hospital ischemic stroke who were admitted to 1,280 hospitals participating in the Get with the Guideline Stroke registry from 2006-2012 and 928,885 patients admitted to hospitals from the community during the same time frame. The median age of patients in both groups was 73 years. Women experienced in-hospital stroke more frequently (54.3% vs. 51.9%, p<0.0001)	Comparison of risk factor profile, processes of care and outcomes between groups using univariate and multivariable methods.	**Primary outcome:** In-hospital mortality, discharge home, independent ambulation at discharge. For patients who received t-PA, symptomatic ICH, other serious complications	Patients who experienced in-hospital stroke were significantly more likely to have atrial fibrillation, prosthetic heart valve, heart failure, CHD/MI, diabetes, dyslipidemia and peripheral vascular disease and to be taking antihypertensive agents and cholesterol-lowering and diabetic medication. They were also more likely to have suffered a more severe stroke. Patients who experienced stroke onset in the community were significantly more likely to have experienced a previous stroke, HTN and to be a smoker. In-hospital stroke patients were significantly less likely to meet 7 achievement standards (t-PA within 3 hours, early antithrombotics, DVT prophylaxis, antithrombotics/anticoagulants on discharge, statin meds), and were less likely to receive a dysphagia screen or receive t-PA within 3.5-4.5 hours but were more likely to receive a rehab referral and

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					receive intensive statin therapy. When quality/achievement measures were combined, in-hospital stroke patients were less likely to receive investigations/care for which they were eligible (82.6% vs. 92.8%, p<0.0001). In-hospital stroke patients were less likely to be independent in ambulation at discharge (adj OR=0.42, 95% CI 0.39-0.45, p<0.001), and to be discharged home (adj OR=0.37, 95% CI 0.35-0.39, p<0.001). The odds of mortality were higher (adj OR=2.72, 95% CI 2.57-2.88, p<0.001). More in-hospital stroke patients were treated with t-PA (11% vs. 6.6%). Among patients who received t-PA, the odds of symptomatic ICH were not increased significantly compared with community-onset patients (adj OR=0.84, 95% CI 0.66-1.08). The odds of being an independent ambulator at discharge, or being discharged home were significantly lower, while the odds of in-hospital mortality remained significantly higher.
Manawadu et al. 2014 **UK** **Controlled study**	NA	1,836 patients admitted to a single academic hospital from 2009-2010. 95% of patients experienced onset of stroke symptoms while living in the (n=1,752). 5% (n=84) of cases were in-hospital strokes of which 63% were early referrals (n-53) to a stroke specialist (within 3 hours of symptom onset) and 37% (n=31) were late referrals. The mean age of in-hospital stroke patients was 74 years,	Comparisons of outcomes of in-hospital stroke patients who were referred early vs. later to a stroke specialist.	**Primary outcome:** Excellent (mRS score 0-1) or favourable (mRS score 0-2) outcome at 90 days. **Secondary outcomes:** Symptomatic ICH in thrombolyzed patients, all-cause and stroke-related mortality at 90 days and medical complications.	Of the 84 in-hospital strokes, 78 were ischemic and 6 were hemorrhagic. Of these, 29 patients (34.5%) were treated with t-PA. Of the eligible in-hospital stroke patients, 49% early-referral were thrombolyzed compared with 10% of late referrals. A greater proportion of early-referral patients treated with t-PA experienced a favourable outcome (40% vs. 7%, p=0.001), but not an excellent outcome (17% vs. 3%, p=0.60). There were no differences in the proportion of early vs. late referral patients who were dead at 90 days. Independent predictors of an excellent or favourable outcome at 90 days among 78 patients

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		51% were male. The median NIHSS score was 10.			with ischemic stroke included younger age, index diagnosis (admission for TIA or cardiac procedures vs. surgical procedures), higher baseline NIHSS score, and early specialist management (adj OR=1.04, 95%CI 1.01-1.46, p=0.007). Thrombolysis was not an independent predictor of a favourable outcome. Early referral to a stroke specialist was also an independent predictor of a favourable outcome among the whole cohort of in-hospital strokes (i.e., including ICH admissions) adj OR=1.13, 95% CI 1.10-1.27, p=0.002).
Cumbler et al. 2011 **USA** **Controlled study**	NA	116 patients who experienced an in-hospital ischemic stroke and 4,946 out of hospital stroke patients admitted to 16 hospitals in a single state participating in the Get with the Guideline (GWTG) Stroke registry, from 2005-2009. Mean age did not differ between groups (70.8 vs. 71.5) years.	Comparisons of GWTG quality of care indicators of in-hospital vs. community-onset stroke patients (excluding thrombolysis)	**Primary outcome:** Adherence to 9/10 GWTG measures of quality of care measures **Secondary outcomes:** Adherence to individual GWTG measures	Mean NIHSS score was significantly higher among in-hospital stroke patients (9.5 vs. 7.0, p=0.01). A significantly greater proportion of in-hospital stroke patients received stroke education and stroke rehabilitation services. There were no differences between groups in the percentage of patients who received smoking cessation counseling, antithrombotic treatment by day 2, anticoagulation therapy, DVT prophylaxis, cholesterol-lowering therapy or a dysphagia screen. A higher percentage of in-hospital patients received deficit-free care (a composite measure of all GTWT measures) 52.8% vs. 23.3%, p<0.0001.
Farooq et al. 2008 **USA** **Controlled study**	NA	2,743 patients included in an acute, state-wide stroke registry over a 6-month period in 2002 admitted to 15 hospitals. Of these, 177 patients experienced an in-hospital stroke and 2,566 were admitted with community onset.	Comparison of interventions, complications and outcomes between in-hospital stroke and community-onset stroke patients	**Primary outcomes:** In-hospital case fatality, mRS scores at discharge	There were no differences between groups in the distribution of ages, sex, race, stroke subtypes (ischemic vs. ICH), or initial imaging results, or in the number of stroke risk factors (previous stroke, atrial fibrillation, diabetes, HTN, dyslipidemia and current smokers). Significantly more in-hospital stroke patients had a history of MI/CHD and CHF. There were no differences between groups in the number of patients who received initial imaging within 25 minutes of stroke recognition or arrival to

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					hospital (3.1% vs. 3.5%, p=0.27), treatment with t-PA (8.6% vs. 2.6%, p=0.28), cardiac monitoring, cerebral angiography, echocardiography, dysphagia screen or DVT prophylaxis. Fewer in-hospital stroke patients were discharged home (22.9% vs. 52.2%, p<0.01). Significantly fewer in-hospital stroke patients received cerebral vasculature investigations (55.2% vs. 75.6%, p<0.01), or lipid profile (23.6% vs. 38.0%, p=0.01). Significantly more in-hospital patients had a documented DVT/PE (6.4% vs. 1.0%, p=0.01) and pneumonia (15.9% vs. 5.2%, p<0.01). There were no differences in the number of patients receiving discharge treatment (anticoagulants/antithrombotics, lipid-lowering, diabetes or antihypertensive medications) or smoking cessation counseling. In-hospital case fatality was significantly higher among in-hospital patients (14.6% vs. 6.9%, p=0.04). The distribution of mRS scores was shifter towards poorer outcomes for the in-hospital group (p<0.001).
Kimura et al. 2006 **Japan** **Controlled study**	NA	15,815 consecutive patients included in the J-MUSIC registry. 694 (4.4%) experienced an in-hospital ischemic stroke and 15,121 (95.6%) were admitted with an acute ischemic stroke. All participants were admitted to 156 hospitals from 1999-2000.	Comparison of characteristics, risk factors and outcomes between in-hospital stroke and community-onset stroke patients	Case fatality rate, mRS score at discharge	In-hospital stroke patients were significantly older (73.4 vs. 70.4 years, p<0.0001) and there as a greater proportion of females (49.1% vs. 38.1%, p<0.0001). A higher percentage of in-hospital stroke patients had a history of stroke (42.6% vs. 30.1%, p<0.0001) and atrial fibrillation (34.6% vs. 20.4%, p<0.0001). There were no differences between groups in the percentage of patients with HTN or diabetes.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					The mean admission NIHSS score was significantly higher for patients with in-hospital stroke (14.6 vs. 8.1, p<0.0001). In-hospital stroke was an independent predictor of severe stroke defined as NIHSS score ≥11 (OR=3.27, 95% CI 2.7-3.88, p<0.0001). Significantly more in-hospital stroke patients died in hospital (19.2% vs. 6.8%, p<0.0001) and within 28 days (12.1% vs. 4.8%, p<0.0001). The distribution of mRS scores was shifted towards poorer outcomes for the in-hospital group (p<0.0001). In-hospital stroke was an independent predictor of death at discharge (OR=1.44, 95% CI 1.11-1.84, p=0.003).

Abbreviations

ARR: absolute risk reduction	CA: concealed allocation	CI: confidence interval
HR: hazard ratio	ITT: intention-to-treat	NNTB: number needed to benefit
NNTH: number needed to harm	OR: odds ratio	RCT: randomized controlled trial
RR: relative risk	RRR: relative risk reduction	

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