CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Rehabilitation and Recovery following Stroke Evidence Tables

Stroke Rehabilitation Unit Care

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on Behalf of the Canadian Stroke Best Practice Recommendations
Rehabilitation and Recovery following Stroke Writing Group

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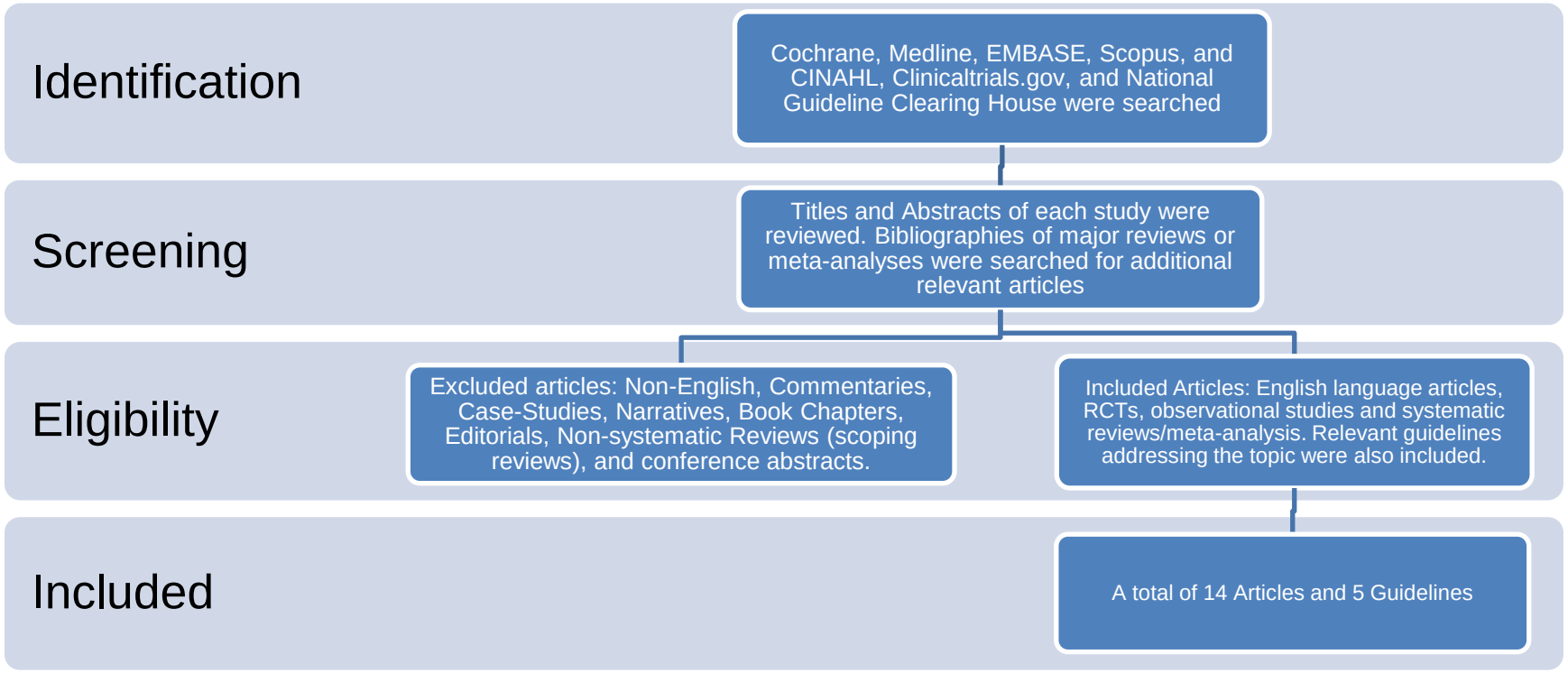
Search Strategy



Cochrane, Medline, Embase, Scopus, CINAHL, and clinicaltrials.gov were searched using the keywords: Stroke AND (rehabilitation OR therapy OR intervention) AND (unit OR ward OR interprofessional OR interdisciplinary OR organized OR coordinated OR specialized team). Titles 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 5 guidelines were included and were separated into separate categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
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. **2018 Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.** ***Stroke.* 2018; Mar;49(3):e46-e110**	4.1 Stroke Units 1. The use of comprehensive specialized stroke care (stroke units) that incorporates rehabilitation is recommended. Class I; LOE A
Clinical Guidelines for Stroke Management 2017. Melbourne (Australia): National Stroke Foundation.	• All stroke patients should be admitted to hospital and be treated in a stroke unit with an interdisciplinary team (strong recommendation) 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.
National Clinical guidelines for stroke" 5th Edition 2016; Intercollegiate Stroke Working Party. Royal College of Physicians	**2.4.1A** People with stroke should be treated on a specialist stroke unit throughout their hospital stay unless their stroke is not the predominant clinical problem. **2.4.1 J** A stroke rehabilitation unit should have a single multi-disciplinary team including specialists in: medicine, nursing, physiotherapy, occupational therapy, speech and language therapy, dietetics, clinical neuropsychology/clinical psychology, social work, orthoptics, with easy access to pharmacy, orthotics, specialist seating, assistive technology and information, advice and support for people with stroke and their family/carers. **2.4.1K** A facility that provides treatment for in-patients with stroke should include: – a geographically-defined unit; – a co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke; – information, advice and support for people with stroke and their family/carers;

Guideline	Recommendations
	– management protocols for common problems, based upon the best available evidence; – close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services; – training for healthcare professionals in the specialty of stroke.
Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, Deruyter F, Eng JJ, Fisher B, Harvey RL, Lang CE, MacKay-Lyons M, Ottenbacher KJ, Pugh S, Reeves MJ, Richards LG, Stiers W, Zorowitz RD; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. **Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.** ***Stroke* 2016;47:e98–e169**	It is recommended that early rehabilitation for hospitalized stroke patients be provided in environments with organized, interprofessional stroke care. Class 1; Level A It is recommended that stroke survivors receive rehabilitation at an intensity commensurate with anticipated benefit and tolerance. Class I; Leve B
Stroke rehabilitation in adults. Issued: June 2013. National Institute for Health and Care Excellence.	**Stroke units** People with disability after stroke should receive rehabilitation in a dedicated stroke inpatient unit and subsequently from a specialist stroke team within the community. **The core multidisciplinary stroke team** A core multidisciplinary stroke rehabilitation team should comprise the following professionals with expertise in stroke rehabilitation: consultant physicians, nurses physiotherapists occupational therapists speech and language therapists clinical psychologists rehabilitation assistants social workers.
Management of Stroke Rehabilitation Working Group. VA/DoD clinical practice guideline for the management of stroke rehabilitation. Washington (DC): Veterans Health Administration, Department of Defense; 2010. p.p.70-72	• Strongly recommend that patients with mild to moderate disability in need of rehabilitation services have access to a setting with a coordinated and organized rehabilitation care team that is experienced in providing stroke services. [A] • Post-acute stroke care should be delivered in a setting where rehabilitation care is formally coordinated and organized. • If an organized rehabilitation team is not available in the facility, patients with moderate or severe disability should be offered a referral to a facility with such a team. Alternately, a physician or rehabilitation specialist with some experience in stroke should be involved in the patient's care. • Post-acute stroke care should be delivered by a variety of treatment disciplines which are experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications.

Guideline	Recommendations
	• The multidisciplinary team may consist of a physician, nurse, physical therapist, occupational therapist, kinesiotherapist, speech and language pathologist, psychologist, recreational therapist, social worker, patient, and family/caregivers. • Inconclusive evidence to recommend the superiority of one type of rehabilitation setting over another. • Patients and/or their family members should be educated in order to make informed decisions and become good advocates. • The rehabilitation program should be guided by specific goals developed in consensus with the patient, family, and rehabilitation team. • Document the detailed treatment plan in the patient's record to provide integrated rehabilitation care.

Evidence Table

Stroke Unit Care

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Systematic reviews and meta-analyses					
Stroke Unit Trialists' Collaboration (SUTC) 2013 **UK** **Cochrane Review**	N/A	28 RCTs including 5,855 participants with a confirmed diagnosis of stroke.	Organized stroke unit care was compared with alternative, less organized levels of service. Core features of more organized forms of care included multidisciplinary staffing and co-ordinated multidisciplinary team care, incorporating meetings at least once per week. Less organized forms of care included general medical wards or mixed rehabilitation wards	**Primary Outcomes:** Death, dependency, and institutionalization **Secondary Outcomes:** Quality of life, patient and carer satisfaction, and length of hospital stay (LOS)	After a median of 12 months of follow-up, case fatality was significantly lower in the specialized services group (OR=0.76, 95% CI 0.66 to 0.88; p=0.0001). Data from 28 trials included. After a median of 12 months of follow-up, specialized services were associated with significantly reduced odds of death or the need for institutionalized care (OR=0.76, 95% CI 0.67 to 0.86; p=0.0001). Data from 23 trials were included. At the end of follow-up, the odds of death or dependency were significantly reduced in the specialized services group (OR= 0.80,95% CI 0.67 to 0.97; p<0.00001). Data from 23 trials were included. Specialized services were not associated with a significantly longer LOS (SMD -0.15, 95% CI -0.32 to 0.02; p=0.09). Data from 18 trials included.
Sun et al. 2013 **Belgium**	NA	7 RCTs and 3 controlled trials, which included patients with stroke or 'stroke-like' symptoms who were admitted to hospital within 7 days of symptoms onset, were included. Mean ages ranged from 62-80 years. The proportion of women varied from 39-66%.	The outcomes of patients admitted to acute stroke units (SU), defined as "a geographic location within the hospital designated for stroke or stroke-like patients, staffed by a multidisciplinary team with a special interest and expertise in stroke care", were compared with patients admitted to any less-organized forms of care, including internal medicine, neurology, cardiology, or geriatric wards. Units that	**Primary outcome:** Mortality at end of follow-up **Secondary outcomes:** independence, institutionalization	The odds of mortality associated with SU case were of borderline significance (OR=0.84, 0.70-1.00, p=0.05). Duration of follow-up ranged from 6 months to 10 years. The results from 8 trials were included. SU care was associated with increased odds of independence (OR=1.23, 95% CI 1.04 to 1.45); decreased odds of death or institutional care (OR=0.70, 95% CI 0.60 to 0.83), institutional care (OR=0.61, 95% CI 0.47 to 0.79), and death or dependency (OR=0.81, 95% CI 0.69 to 0.96).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			provided post-acute rehabilitation only, were excluded.		
Foley et al. 2007 **Canada**	N/A	14 RCTs and quasi-RCTs including participants with a diagnosis of stroke. Studies in which the intervention was provided to a mixed population (stroke and non-stroke) or outside of a discrete physical unit (e.g., mobile units) were excluded.	Trials compared stroke unit care to conventional care and were organized into one of 3 groups depending on the model of care provided: 1) Acute care (randomization within 36 hours of stroke onset and less than 2-week length of stay); 2) Combined (acute and rehabilitation); 3) Rehabilitation (admitted within 2 weeks of stroke onset following transfer from another facility).	**Primary Outcomes:** Mortality, death or dependency, and length of hospital stay (LOS)	Stroke unit care compared with alternative **Mortality:** Acute Care: OR=0.80, 95% CI 0.61–1.03 Combined: OR=0.71, 95% CI 0.54–0.94 Rehabilitation: OR=0.60, 95% CI 0.44–0.81 Overall: OR=0.71, 95% CI 0.60–0.83 **Death/Dependency:** Acute Care: OR=0.70, 95% CI 0.56–0.86 Combined: OR=0.50, 95% CI 0.39–0.65 Rehabilitation: OR=0.63, 95% CI 0.48–0.83 Overall: OR=0.62, 95% CI 0.53–0.71 **LOS (days):** Acute Care: WMD=12.9, 95% CI -10.0–4.3 Combined: WMD=-14.4, 95% CI -27.1–-1.7 Rehabilitation: WMD=-13.2, 95% CI -48.3–21.9 Overall: WMD=-9.9, 95% CI -16.6–-3.1
Seenan et al. 2007 **UK**	N/A	25 observational studies (n=42,236) including participants with a clinical diagnosis of a stroke. In studies that included a mixed sample, ≥80% of persons had to have sustained a stroke.	The outcomes of patients treated on a stroke unit were compared to those treated in non-stroke units.	**Primary Outcome:** 12-month mortality **Secondary Outcome:** Poor outcome (death, discharge location other than home, dependence in daily activities)	Stroke unit care was associated with significantly better outcomes Death: OR=0.79, 95% CI 0.73–0.86, p<0.001. Results from 17 trials included. Death (multi-centered trials only): OR=0.82, 95% CI 0.77–0.87, p<0.001. Results from 8 trials included. Poor outcome: OR=0.87, 95% CI 0.80–0.95, p<0.01. Results from 15 trials included.
Clinical Trials					
Juby et al. 1996 **Lincoln et al. 2000; Drummond et al. 2005 (long-term follow-up)** **UK**	CA: ☒ Blinding: Patient ☒ Assessor☑ ITT: ☒	315 stroke patients who were candidates for inpatient rehabilitation. Patients who were unconscious at admission, had other medical problems requiring treatment during acute care, or were expected to be	Participants were randomized to receive inpatient rehabilitation on a stroke unit (n=176) or a general medical or geriatric unit (n=139).	**Outcomes:** Barthel Index (BI), Rivermead Motor Assessment and ADL Scale, Nottingham Extended ADL, General Health Questionnaire GHQ), Cognitive and Instrumental Readjustment Scale, and non-specified mood rating	Stroke unit care was associated with significantly longer mean LOS (81±41.7 vs. 63.2±46.9 days, p<0.01). 12-month mortality did not differ significantly between the two groups (OR=0.72, 95% CI 0.39–1.31, p>0.05). At both 3 and 6 months, participants treated in the stroke unit were more independent in ADLs and

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
RCT		discharge within 2 weeks were excluded. 18% of those assessed met inclusion criteria.		scales	extended ADLs (BI, Rivermead ADL Scale, and the Nottingham Extended ADL Scale), ($p<0.05$); however, at 12 months, only mean Nottingham Extended ADL Scale scores differed significantly between groups, favouring stroke units ($p<0.05$). There were no significant differences between groups at 3, 6, or 12 months in mean Rivermead Motor Assessment or any of the mood and adjustment measures, with the exception that patients treated in the SU reported significantly better scores on the GHQ at the 12-month follow-up ($p<0.05$). Loses to follow-up (3, 6, 12-month follow-up): Stroke Unit = 10.2%, 14.8%, 18.2% Conventional Unit = 15.8%, 21.6%, 30.2% **5-year follow-up (Lincoln et al. 2000)** Data from 87% of randomized patients were available Fewer patients treated in the stroke unit had died (45% vs. 55%, RR=0.80, 95% CI 0.65–1.01) while a greater percentage were disabled (34% vs. 27%) or institutionalized (12% vs. 8%), Survival analyses significantly favoured stroke unit care (log rank test=4.36, $p<0.05$). The risk of death/dependency was significantly lower in the stroke unit group (RR=0.91, 95% CI 0.83–0.99). The relative risk of death/institutionalization associated with stroke unit care was 0.90 (95% CI 0.75–1.08). **10-year follow-up (Drummond et al. 2005)** Data from 87% of randomized patients were available Significantly fewer patients treated in the stroke unit had died (69% vs. 80%; RR=0.87, 95% CI 0.78-0.97) while a greater percentage were disabled (67% vs. 43%) or institutionalized (20% vs. 10%). Survival analyses significantly favoured stroke unit care (log rank test=6.63, $p<0.05$).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					The risk of death/dependency was not significantly lower in the stroke unit care group (RR=0.99, 95% CI 0.94–1.05). The relative risk (RR) of death/Institutionalization was 0.91, 95% CI 0.83–1.00. RRs were calculated assuming worst case scenario for those who could not be traced (SU=8, CW=7) or refused to participate (SU=4, CW=4).
Kalra et al. 1993 **UK** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor☒ ITT: ☒	245 patients, 2-weeks post stroke onset, following acute care treatment in a general medical ward. Patients discharged from acute care within 2-weeks of onset were excluded.	Participants were stratified into 3 groups based on their stroke severity using the Orpington Prognostic Scale: 1) mild-moderate (Prognostic score=<3), 2) moderate-severe (Prognostic score=3-5), and 3) severe-very severe (Prognostic score=>5) and then randomized to a stroke rehabilitation unit (n=126) or a general medical unit (n=126).	**Primary outcomes:** In-hospital mortality, discharge home, discharge to long-term care, and length of hospital stay, Barthel Index.	Among patients with the best prognoses, no significant differences were found between those treated on a stroke unit vs. a general medical unit. Among patients group with moderate-severe stroke severity, those treated in the stroke unit were significantly more likely to be discharged home (75% vs. 52%, p<0.001), less likely to be discharged to long-term care (22% vs. 44%, p<0.001), and experienced a greater median change in Barthel Index score (12 vs. 8, p<0.05) during a shorter length of stay (48.7±17.2 vs. 104.6±28.6, p<0.001), compared to those treated in the general medical ward; however, no differences were found with respect to mortality (3% vs. 4%, p>0.05). Among patients with the worst prognoses, those treated on the stroke unit had significantly lower mortality (37% vs. 67%, p<0.05) and a significantly shorter length of stay (52.3±19.8 vs. 123.2±48.2 days, p<0.001), compared to those treated in the general medical ward; however, no significant differences were found with respect to discharge destination or change in Barthel Index score (both at p>0.05).
Observational studies					
Turner et al. 2015 **UK** **Scottish Stroke Care Audit**	NA	41,692 patients admitted to 36 hospitals from 2005-2011 with index stroke events, who survived for at least 3 days, were included. Mean age was 73.4 years, 48.4% were	The outcomes of patients admitted to stroke units (SU, 79%) were compared with patients admitted to general medical wards (21%), using national registry data.	**Primary outcome:** Survival **Secondary outcomes:** Discharge destination	The adjusted odds of survival were significantly higher for patients admitted to a SU at 7, 30, 60,90 and 365 days, ranging from OR of 3.11 (95% CI 2.71 to 3.56) at day 7, to 1.43 (95% CI 1.34 to 1.54) at day 365. The adjusted odds for being discharged home/usual place of residence at 6 months for those admitted to

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		women. 86% were ischemic stroke. 70% of patients were admitted within a day of symptom onset.	Analyses were adjusted for age in years at time of admission, living alone, independent in activities of daily living, able to lift both arms at first assessment, able to talk, and able to walk		SU were significantly higher (OR=1.19, 95% CI 1.11 to 1.28)
Tamm et al. 2014 **Canada** **Retrospective Study**	N/A	805 patients admitted to 2 community hospitals from 2003 to 2009 with a diagnosis of stroke. Patients were treated on general medical wards by an internist. A 10-bed stroke unit, providing both acute and rehabilitation services, provided by a multidisciplinary team that included stroke neurologists, was established at one of the hospitals in 2007.	At the hospital that established the stroke unit, the outcomes of patients treated from 2007-2009 were compared with those of patients treated before its implementation (2003-2006). At the control hospital, the outcomes of patients treated from 2007-2009 were compared with those of patients treated from 2003-2006, during which time there were no changes in the model of service provision.	**Primary Outcomes:** Mortality, LOS, Discharge disposition	At the hospital that established a stroke unit, there was a significant reduction in mortality after its implementation (8.3% vs. 17.1%, p<0.001, adjusted OR= 0.54; 95% CI 0.31–0.95; p=0.035), a significant reduction in median LOS (8 vs.12 days, p=0.027) and a significant increase in the number of patients discharged home (43.8% vs. 25.7%, p<0.001). Stroke unit care was also associated with fewer cases of pneumonia (10.2% vs. 5.3%, p=0.037). There were no significant differences in any of the outcomes at the control hospital between 2003-2006 and 2007-2009.
Foley et al. 2013 **Canada** **Retrospective Study**	N/A	6,709 patients identified from a national database, who were admitted for inpatient rehabilitation at 57 facilities in the province of Ontario, from 2006-2008.	Two types of service delivery models were identified: a Stroke Rehabilitation Units (SRU), based on the presence of a collection of geographically distinct, stroke-dedicated beds and dedicated therapists (n=1,725, 25.7%), and non-dedicated SRUs (Non-SRU (n=4,984, 74.3%).	**Primary Outcomes:** LOS, FIM gain, FIM efficiency (FIM gain/LOS), Discharge Home	Patients admitted to a SRU took significantly longer to arrive from acute care (37.2 vs. 22.8 days, p< 0·001) and were admitted with higher mean FIM scores (77.5 vs. 74.8, p<0.001). Mean LOS was significantly longer for SRU patients (42.1 vs. 35.4 days, p<0.001). There was no significant difference between groups in mean FIM gain (SRU: 22.3 vs. non-SRU: 22.1 days, p=0.748). Mean FIM efficiency was significantly higher in non-SRUs (0.88 vs. 0.62, p<0.001) Persons admitted to a SRU were no more likely to

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					be discharged home (70.5% vs. 68.8%, p=0.21).
Di Carlo et al. 2011 **Italy** ***European Registers of Stroke (EROS) Project***	N/A	355 consecutively-admitted patients with a first-ever stroke were included. Patients with subarachnoid hemorrhage were excluded. Mean age was 7.3 years, 54.1% were men. 44% of patients had a baseline Barthel Index score of 0-9	Patients were admitted to either an acute stroke unit (n=140) or to a general medical ward (n=215) at the same institution, according to bed availability. Stroke unit care was provided in an 8-bed, semi-intensive, multidisciplinary care unit. Patients admitted to the general medical ward were referred for physiotherapy or SLP services, as required.	**Primary Outcomes**: Frequency of investigations and treatments, death, death/dependency and death/institutionalization.	Patients admitted to the general ward were significantly older (mean age 77.2 vs. 67.7 years, p<0.001) and had higher mean NIHSS scores (10.3 vs. 9.7). MRI, carotid duplex scan, and transcranial Doppler were performed significantly more often in SU patients (all p values < 0.001). A significantly higher proportion of SU patients were treated with thrombolysis (18.6% vs. 0.5%, p<0.001). At discharge, SU patients were more likely to be referred to a rehabilitation hospital (38.6% vs. 21.3%, p=0.001). Adjusted for age, sex, baseline risk factors, pre-stroke dependency, acute-phase severity, pathological type, and clinical syndromes, SU care was associated with lower odds of: death at one year (OR=0.4, 95% CI 0.19–0.87), death or dependency at 3 months and one year (OR=0.31, 95% CI 0.14–0.71 and OR=0.45, 95% CI 0.21–0.97) and death or institutionalization at 3 months and one year (OR=0.25 ,95% CI 0.11–0.58 and OR= 0.36, 95% CI 0.17–0.77, respectively).
Terent et al. 2009 **Sweden Riks-Stroke, (Swedish Stroke Register)**	NA	105,043 patients admitted to 86 hospitals following acute stroke from 2001-2005. Mean age was 76 years, 51% were men. 20.6% of patients were discharged for additional rehabilitation.	The outcomes of patients admitted to an acute stroke unit (SU 76%) were compared with those admitted to other units or wards (24%), based on subgroups, including age, sex, stroke type and level of consciousness (LOC) at admission.	**Primary outcomes:** Death or institutional living, death or dependency after 3 months and death during follow-up period	**Death at the end of follow-up (mean of 2.4 years):** SU care was associated with a significantly reduced risk of mortality across all age groups (18-64 yrs, 65-74 yrs, 75-84 yrs and ≥85 yrs), both sexes, all stroke sub types (ischemic, hemorrhagic and unspecified) and LOC on admission (conscious, unconscious and reduced consciousness). **Death or institutionalization at 3 months:** SU care was associated with significantly reduced odds of the outcome across all age categories, both sexes, and LOCs, and among patients with ischemic or hemorrhagic strokes. **Death or dependency at 3 months:**

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					SU care was associated with significantly reduced odds of the outcome among the youngest and oldest age cohorts, among both sexes, in patients with hemorrhagic stroke and in patients with reduced LOC or who were unconscious at admission.

Abbreviations

ADL: Activities of Daily living	CA: Concealed allocation
CI: Confidence interval	FIM: Functional Independence Measure
ITT: Intention-to-treat analysis	LOS: Length of stay
NA: Not assessed	OR: Odds ratio

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