CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Stroke Rehabilitation Evidence Tables

Delivery of Inpatient Stroke Rehabilitation

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on Behalf of the Canadian Stroke Best Practice Recommendations
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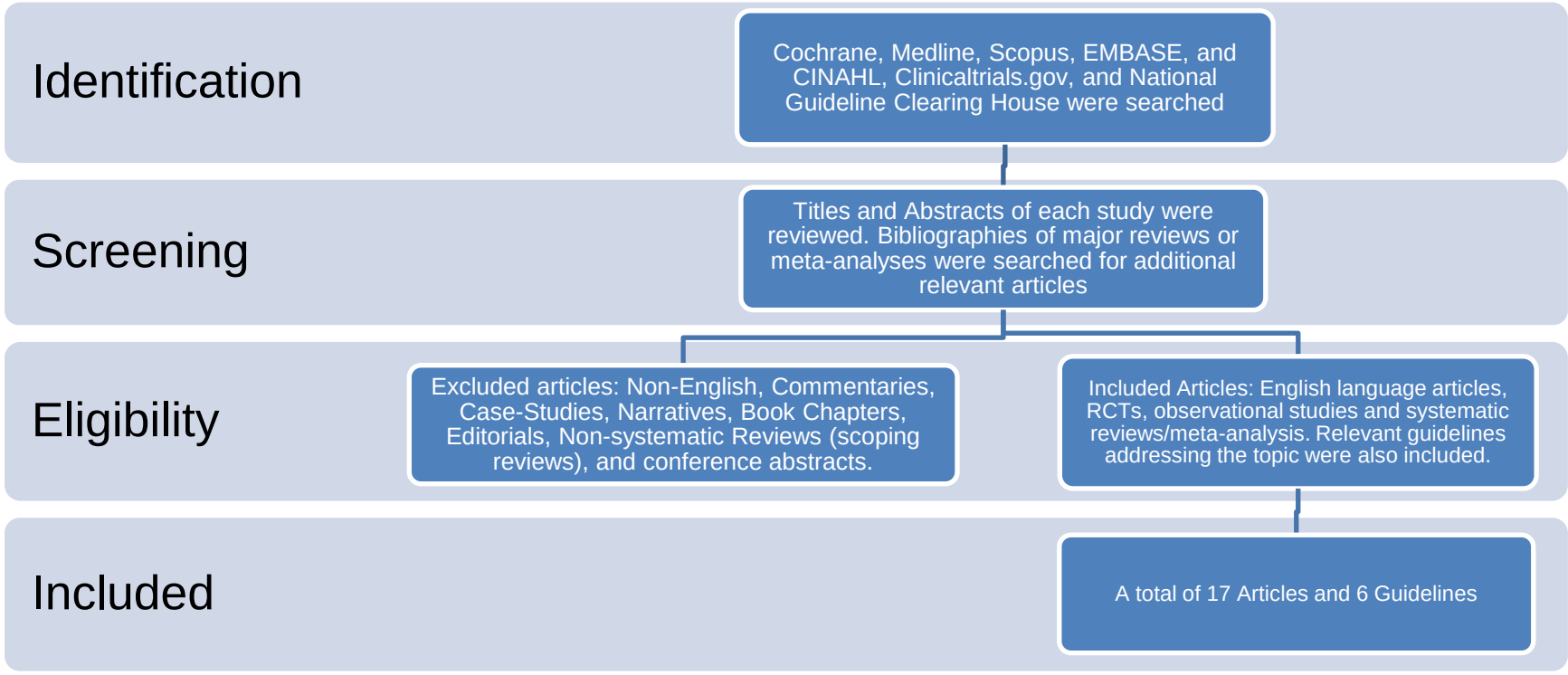
Search Strategy



Cochrane, Medline, and CINAHL, Clinicaltrials.gov, EMBASE, and Scopus were searched using the keywords: Stroke AND Rehabilitation AND Inpatient. The same databases were searched to identify paediatric related evidence using additional keywords: “(pediatric OR pediatrics OR paediatric OR paediatrics OR youth OR child OR children OR young)”. 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, or conference abstracts. Additional searches for relevant best practice guidelines were completed and included in a separate section of the review. A total of 17 articles and 6 guidelines were included.

Published Guidelines

Guideline	Recommendations
Scottish Intercollegiate Guidelines Network (SIGN). Management of patients with stroke: rehabilitation, prevention and management of complications, and discharge planning. A national clinical guideline. Edinburgh (Scotland): Scottish Intercollegiate Guidelines Network (SIGN); 2010 June.	**Organization of Services** • The core multidisciplinary team should include appropriate levels of nursing, medical, physiotherapy, occupational therapy, speech and language therapy, and social work staff [B]. • Patients and carers should have an early active involvement in the rehabilitation process [B]. • Stroke unit teams should conduct at least one formal multidisciplinary meeting per week at which patient problems are identified, rehabilitation goals set, progress monitored and discharge is planned [B]. • Members of the multidisciplinary stroke team should undertake a continuing programme of specialist training and education [B]. **Management and Prevention Strategies** • Stroke patients should be mobilised as early as possible after stroke [B]. • Rehabilitation should include repetitive task training, where it is assessed to be safe and acceptable to the patient, when the aim of treatment is to improve gait speed, walking distance, functional ambulation or sit-to-stand-to-sit [B]. • Where considered safe, every opportunity to increase the intensity of therapy for improving gait should be pursued [B]. **Transfer from Hospital to Home** • Patients with mild/moderate stroke should be able to access stroke specialist early supported discharge services in addition to conventional organised stroke inpatient services [A]. **Roles of the Multidisciplinary Team** • Stroke inpatients should be treated 24 hours a day by nurses specialising in stroke and based in a stroke unit [B].

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	**Determining Setting**
	• Recommend that patients remain in an inpatient setting for their rehabilitation care if they are in need of daily professional nursing services, intensive physician care, and/or multiple therapeutic interventions.
	• Patients should receive as much therapy as they are able to tolerate in order to adapt, recover, and/or reestablish their premorbid or optimal level of functional independence. [B]
	
	Treatment Plan
	• Patients and/or their family members should be educated in order to make informed decisions and become good advocates.
	• The patient/family member's learning style must be assessed (through questioning or observation) and supplemental materials (including handouts) must be available when appropriate.
	• The following list includes topics that (at a minimum) must be addressed during a patient's rehabilitation program:
	  • Etiology of stroke
	  • Patient's diagnosis and any complications/co-morbidities
	  • Prognosis
	  • Expectations for what to expect during recovery and rehabilitation
	  • Secondary prevention
	  • Discharge plan

Guideline	Recommendations
	• Follow-up care including medications. • The clinical team and family/caregiver should reach a shared decision regarding the rehabilitation program. • 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. • The patient's family/caregiver should participate in the rehabilitation sessions, and should be trained to assist patient with functional activities, when needed.
Clinical Guidelines for Stroke Management 2010. Melbourne (Australia): National Stroke Foundation; 2010 Sep. p. 81-82; 97-98.	**Ongoing Inpatient Rehabilitation:** • To ensure all stroke patients receive early, active rehabilitation by a dedicated stroke team, health systems should have comprehensive services which include and link the fundamentals of acute and rehabilitation care. [Grade B]. • Team Meetings: The multidisciplinary stroke team should meet regularly (at least weekly) to discuss assessment of new patients, review patient management and goals, and plan for discharge [Grade C]. **Amount and Intensity of Rehabilitation:** • Rehabilitation should be structured to provide as much practice as possible within the first six months after stroke [Grade A]. • For patients undergoing active rehabilitation, as much physical therapy (physiotherapy and occupational therapy) should be provided as possible with a minimum of one hour active practice per day at least five days a week [Grade GPP]. • Task-specific circuit class training or video self-modelling should be used to increase the amount of practice in rehabilitation [Grade B]. • For patients undergoing active rehabilitation, as much therapy for dysphagia or communication difficulties should be provided as they can tolerate [Grade C]. • Patients should be encouraged by staff members, with the help of their family and/or friends if appropriate, to continue to practice skills they learn in therapy sessions throughout the remainder fo the day [Grade GPP]. **Timing of Rehabilitation:** • Patients should be mobilized as early and as frequently as possible [Grade B]. • Treatment for aphasia should be offered as early as tolerated [Grade B]. • Upper limb training should commence early. CIMT is one approach that may be useful in the first week after stroke [Grade C].
Duncan PW, Zorowitz R, Bates B, Choi JY, Glasberg JJ, Graham GD, Katz RC, Lamberty K, Reker D. Management of adult stroke rehabilitation care: a clinical practice guideline. Stroke, 2005;36:e117 -125	**Organization of Rehabilitation** • Post-acute stroke care should be delivered in a setting in which rehabilitation care is formally coordinated and organized. • Post-acute stroke care should be delivered by a variety of treatment disciplines, experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications. • The multidisciplinary team may consist of a physician, nurse, physical therapist, occupational therapist, kinesiotherapist, speech and language pathologist (SLP), psychologist, recreational therapist, patient, and family/caregivers. **Intensity** • Strongly recommend that rehabilitation therapy start as early as possible, once medical stability is reached. • Recommend that the patient receive as much therapy as “needed” to adapt, recover, and/or reestablish the premorbid or optimal level of functional independence.

Guideline	Recommendations
	Determine Optimal Level of Care • Strongly recommend that rehabilitation services be provided in an environment with organized and coordinated post–acute stroke rehabilitation care.

Intercollegiate Stroke Working Party. *National clinical guideline for stroke,* 4th edition. London: Royal College of Physicians, 2012.	**General Principles of Rehabilitation**
	• Specific treatments should only be undertaken in the context of, and after considering, the overall goals of rehabilitation and any potential interactions with other treatments.
	• The nature and consequences of a patient's impairments should always be explained to the patient and to the carer(s), and if necessary and possible they should be taught strategies or offered treatments to overcome or compensate for any impairment affecting activities or safety, or causing distress.
	
	Evaluating treatment
	• Every patient should have their progress measured against goals set at regular intervals determined by their rate of change, for example using goal attainment scaling.
	• When a patient's goal is not achieved, the reason(s) should be established and:
	  • the goal should be adjusted, *or*
	  • the intervention should be adjusted, *or*
	  • no further intervention should be given towards that goal and a further goal set as appropriate.
	• When a therapist or team is planning to stop giving rehabilitation, the therapist or service should:
	  • discuss the reasons for this decision with the patient and carer
	  • ensure that any continuing support that the patient needs to maintain and/or improve health is provided
	  • teach the patient and, if necessary, carers how to maintain health
	  • provide clear information on how to contact the service for reassessment
	  • outline what specific events or changes should trigger further contact
	  • consider referral to communication support services, if the patient has persistent aphasia, to pursue compensatory strategies to enhance their communication.
	
	Rehabilitation Approach
	• Give as much opportunity as possible for a patient to practise repeatedly and in different settings any tasks or activities that are affected.
	
	Intensity
	• Patients with stroke should be offered a minimum of 45 minutes of each appropriate therapy that is required, for a minimum of 5 days per week, at a level that enables the patient to meet their rehabilitation goals for as long as they are continuing to benefit from the therapy and are able to tolerate it.
	• The team should promote the practice of skills gained in therapy in the patient's daily routine in a consistent manner and patients should be enabled and encouraged to practice that activity as much as possible.
	• Therapy assistants and nurses should facilitate practice under the guidance of a qualified therapist.

Stroke Rehabilitation. Long-term rehabilitation after stroke. Issued: June 2013. National Institute for Health and Care Excellence.	**Intensity of stroke rehabilitation** 1.2.16 Offer initially at least 45 minutes of each relevant stroke rehabilitation therapy for a minimum of 5 days per week to people who have the ability to participate, and where functional goals can be achieved. If more rehabilitation is needed at a later stage, tailor the intensity to the person's needs at that time [6]. 1.2.17 Consider more than 45 minutes of each relevant stroke rehabilitation therapy 5 days per week for people who have the ability to participate and continue to make functional gains, and where functional goals can be achieved.

Guideline	Recommendations
	1.2.18 If people with stroke are unable to participate in 45 minutes of each rehabilitation therapy, ensure that therapy is still offered 5 days per week for a shorter time at an intensity that allows them to actively participate.

Evidence Tables

Delivery of Inpatient Stroke Rehabilitation

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Dewan et al., 2014 **United Kingdom** **Post-Test**	N/A	55 patients with a new diagnosis of stroke were included. Mean age: 67.5 years (range=41-88 years). Gender: Male=49%, female=51%. Inclusion criteria: Patients who were ≥18 years old and residents of Camden within the catchment area of the Royal Free Hospital (RFH).	The aim of the study was to assess the use of an innovative structured review process to evaluate stroke patients at approximately 6 weeks after discharge. Joint clinic reviews were held in patients' homes or care homes, consisting of a range of 2-4 patients per session. The reviews were conducted by a Camden stroke navigator and a RFH stroke consultant. Reviews were full assessments focused on each individual patient's medical, health, social, and secondary prevention needs and utilized questionnaires, physical measurements and examinations, medical history reviews, biochemical measurements, and lifestyle risk factor management.	**Outcomes**: Stroke readmission rate, patient experience.	Key Points: This multi-disciplinary review service provides a diverse assessment approach regarding stroke aftercare and stroke patients' individual needs, promoting self-management strategies and community reintegration. The new stroke readmission rate was 0% at 6 weeks and 6 months post stroke. The "did not attend" user rate was also 0%. User satisfaction was very high. The joint clinic review service was viewed as a central point of contact within the stroke community.
Egan et al., 2010 **Canada** **Pre-Post Test**	N/A	41 community-dwelling stroke survivors and 32 care partners received navigation services, of which 35 stroke survivors and 26 care partners	The aim of this study was to evaluate a community stroke navigation service. Following recruitment, participants were	**Outcomes**: Community reintegration, physical and emotional well-being. Assessment time points: Prior to and at 4 months	Key Points: Post-test results yielded a small improvement among stroke patients (p=0.02) in terms of community reintegration, but no change among care partners.

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		participated in both the pre-test and post-test aspect of the study. Mean age of stroke patients: 68.6 years (range=40-97 years). Mean age of care partners: 64.1 years (range=39-86 years. Gender of stroke patients: Males=21, females=20. Gender of care partners: Males=9, females=23. Inclusion criteria: Patients who had experienced one or more strokes and lived in close proximity to Ottawa.	subjected to a pre-test which measures of physical health, depression, emotional health, and participation in valued activities. The stroke navigation service was provided by an occupational therapist, who interviewed each patient and care partner to determine any concerns and ongoing needs. A plan of action was then developed which included case coordination, family support organization, "just in time" education, coaching, and accompaniment. The service was provided 1-8 times within a 4 month period of service provision. Participants participated in a post-test approximately 4 months after receiving the navigation service, which included all pre-test measures as well as an interview.	after receiving the stroke navigation service.	No alterations in terms of physical and emotional health were reported for either stroke patients or care partners.
Shepperd et al., 2013 **United Kingdom** **Cochrane Review**	N/A	24 studies met inclusion criteria consisting of 8039 participants. Exclusion criteria: any RCT in which discharge planning is mentioned but is not the primary focus of the study.	14 trials were included in a meta-analysis (3 new trials identified in 2013 update). All other trials were discussed qualitatively.	Outcomes of interest were divided into three sections: **1. Use of acute care:** length of stay in hospital, readmission rates and discharge destination; **2. Patient and caregiver outcomes**: patient mortality, a variety of outcomes	**1. Use of acute care:** a. A selection of ten trials with older patient populations, found a statistically significant decrease in **length of hospital stay** for patients receiving discharge planning compared to controls (MD -0.91; 95% CI -1.55 to -0.27). Other subgroup analyses found no statistically significant differences.

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				including (functional, psychosocial, quality of life and health status) and patient and caregiver satisfaction; **3. Health care costs:** hospital, community, medication, and overall costs.	b. A selection of 12 trials consisting of older patients with a medical condition, found a statistically significant decrease in **readmission to hospital** at 3 months post discharge (RR 0.82; 95% CI 0.73 to 0.92). Findings on readmission rates were variable depending on assessment time point (e.g. four weeks, nine months, one year etc.) c. Trials reporting on **discharge destination** were limited. Trials (2 studies) comparing home to residential care found no significant differences between groups (RR 1.03; 95% CI 0.93 to 1.14). One trial consisting of a variety of patients found that patients in the intervention group were more likely to be discharged home compared to a nursing home, deceased or other (Difference 6%; 95% CI 0.4% to 12%). **2. Patient and caregiver outcomes:** a. **Mortality**: No statistically significant differences in mortality between intervention and control groups. b. **Health outcomes**: One trial assessing functional outcomes of patients recovering from stroke using the Barthel Index found a statistically significant improvement in the intervention group compared to controls (Median difference of 6 points; P<0.01). In the same study, there were significant differences in quality or life between the groups using the EuroQol (Difference of 9 points; P<0.005), but no differences in Rankin score or anxiety and depression (HADS). 3. **Health care costs:** There were no comparisons between studies for hospital, community or medication costs. **Note**: This study found no trials assessing the effectiveness of communication between health care providers associated with discharge planning. <u>Key Points:</u> Some evidence to suggest that discharge planning is effective in reducing patient length of stay in hospital and hospital readmission rates. Only one study was specific to patients

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					recovering from stroke; patient population types were quite variable between studies.
Stoke Unit Trialists' Collaboration 2013 **United Kingdom** **Systematic Review and Meta-Analysis (Cochrane Review)**	N/A	28 RCTs and quasi-randomized trials (5,855 participants). Inclusion criteria: patients with a diagnosis of stroke.	Comparing organized stroke unit care with an alternative, less organized service. Heterogeneity was assessed using the I^2 statistic. Analyses used fixed effects models except where important heterogeneity was observed, in which case random effects models were employed.	Primary Outcomes: death, dependency, and institutionalization. Secondary Outcomes: Quality of life, patient and carer satisfaction, and length of hospital stay.	Death 1) 6 - 52 week follow-up: OR of 0.76 (95% CI 0.66 to 0.88; P = 0.0001). 28 trials. 2) 5 - yr follow-up: 0.74 (95% CI 0.59 to 0.94; P = 0.01). 3 trials. 3) 10 - yr follow-up: 0.67 (95% CI 0.43 to 1.03; P = 0.07). 3 trials. Death/institutional care: 1) 6 - 52 week follow-up: OR 0.76, (95% CI 0.67 to 0.86; P = 0.0001). 23 trials. 2) 5 - yr follow-up: 0.59 (95% CI 0.33 to 1.05; P = 0.07) 3 trials. 3) 10 - yr follow-up: 0.57 (95% CI 0.37 to 0.88; P = 0.01). 3 trials. Death/Dependency 1) 6 - 52 week follow-up: OR 0.80 (95% CI 0.67 to 0.97; P < 0.00001). 23 trials. 2) 5 - yr follow-up: 0.54 (95% CI 0.22 to 1.34; P = 0.18) 3 trials. 3) 10 - yr follow-up: 0.70 (95% CI 0.27 to 1.80; P = 0.45). 3 trials. Length of stay in hospital and/or institution: (SMD -0.15, 95% CI -0.32 to 0.02; P = 0.09). 18 trials. Key Points: Stroke patients who receive organised inpatient care in a stroke unit are more likely to be alive, independent, and living at home one year after the stroke. The benefits were most apparent in units based in a discrete ward.
Craig et al., 2010 **United Kingdom** **Systematic Review and Meta-Analysis**	N/A	Two studies with 103 (AVERT n=71, VERITAS n=32) patients were included. Age Range: Overall, participants were between 27-97 years old.	Both studies involved interventions to mobilize patients within 24 hours after stroke at frequent intervals. The AVERT study implemented the intervention for 14 days,	**Primary Outcome:** Independence at 3 months (Measured by a mRS of 0-2, and a Barthel index of 18-20). **Secondary Outcome:** Early complications of immobility and activities of	VEM patients had significantly greater odds of independence at 3 months (adjusted OR 3.11; 95% CI: 1.03-9.33), controlling for age, baseline NIHSS score, pre stroke mRS. Findings remained significant when controlling for automated monitoring and history of coronary heart disease. VEM patients were more likely to be independent in activities of daily living at 3 months (adjusted OR

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		Median time to mobilization: AVERT 18.1 hours (IQR 12.8-21.5), VERITAS 27.3 hours (IQR 26.0-29.0) for the early mobilization group. Inclusion criteria: patients with first or recurrent stroke. Exclusion criteria: Participants with a severe pre stroke disability were excluded from both studies.	whereas the VERITAS trials lasted 7 days. Both studies compared early mobilization treatment groups (VEM) to a standard care control group (SC).	daily living at 3 months (stroke-related, immobility-related, comorbidity-related, or other causes).	4.41; 95% CI 1.36-14.32), controlling for age, baseline NIHSS score, pre stroke mRS. Findings remained significant when controlling for automated monitoring and history of coronary heart disease. More standard care patients experienced at least one complication (51%) compared with the treatment group (35.3%). The risk of experiencing immobility related complications was significantly lower in VEM patients (adjusted OR 0.20; 95%CI 0.10-0.70). Key Points: Early mobilization of patients following stroke resulted in a greater odds of being independent at 3 months after stroke.
Kwakkel et al., 1997 **Netherlands** **Systematic Review and Meta-analysis**	N/A	9 studies were included consisting of 1051 patients. Mean age: 66.2 years. Mean daily minutes of Physiotherapy: 48.4 min in experimental group; 23.4 min in the control group. Mean daily minutes of Occupational Therapy: 44.0 min in the experimental group; 18.5 min in the control group.	Random effects model. Hedge's g was used for the effect size estimate for each study. For the overall effect size, weights were applied to each estimate based on sample size.	**Outcomes:** ADL (as measured by, for example, the barthel index), functioning (as measured by, for example, walking), and neuromuscular (as measured by, for example, muscle strength).	**Activities of Daily Living (ADL):** A higher level of treatment intensity resulted in increases in ADL scores (ES 0.34; 95% CI 0.21 to 0.48; P<0.001) after controlling for confounding and applying appropriate weights. **Functional**: A higher level of treatment intensity resulted in increases in functional outcomes (ES 0.36; 95% CI 0.13 to 0.59; P<0.01) after controlling for confounding and applying appropriate weights. **Neuromuscular**: A higher level of treatment intensity resulted in increases in functional outcomes (ES 0.32; 95% CI 0.07 to 0.56; P<0.01) after controlling for confounding and applying appropriate weights. Key Points: Effect sizes were influenced by rehabilitation setting, type of outcome and the extent of the difference between amounts of therapies received. There were statistically significant increases in ADL, functional and neuromuscular outcomes with increased treatment intensity.
Avert Trail Collaboration Group 2015	N/A	Patients were randomized to either the very early mobilization	Following randomization, patients in the usual care group received care at	Primary Outcome: Favourable outcomes at 3 months (Measured by a	There were significantly fewer patients in the very early mobilization group with favourable outcomes compared to patients in the usual care group

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Australia **RCT**		group (N=1054) or the usual care group (N=1050). Mean Age: The mean age of patients was 72.3y and 72.7y in the very early mobilization group and the usual care group respectively. Median time to mobilization: Very early mobilisation 18.5 hours (IQR 12.8-22.3), Usual care 22.4 hours (IQR 16.5-29.3). Inclusion criteria: Patients >18y old, had their first stroke and were admitted <24h within stroke onset. Exclusion criteria: Patients who were directly admitted to the intensive-care unit, had significant pre-morbid disability, early deterioration, received palliative treatment or immediate surgery, had any other serious medical condition or an unstable coronary condition, were unresponsive to voice, had a systolic blood pressure <110mm Hg or >200mm Hg, had an oxygen saturation of 92%, a resting heat beat <40bpm or >100bpm, temperature >38.5°C or	the discretion of their participating stroke unit. Patients in the very early mobilization group received intervention within 24h of stroke onset lasting for 14 days or until discharge from stroke unit.	modified Rankin Scale score of 0-2). Secondary Outcome: Time to achieve unassisted walking over 50 meters, proportion of patients who can walk unassisted at 3 months and deaths or the number of non-fatal adverse events at 3 months.	(N=480, 46% vs N=525, 50%, CI: 0.59-0.90, p=0.004). Overall, 8% of patients perished (95% CI: 6.5-8.8), 7% of the usual care group and 8% of the very early mobilization group (p=0.113). No significant differences were observed between groups for the number of non-fatal adverse events at 3 months (p=0.194). There were no significant differences for time to walking unassisted (p=0.459) or proportion of patients able to walk at 3 months (p=0.153). Key Points: Very early mobilization of patients following stroke resulted in poorer outcomes when compared to the usual care group at 3 months.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		with a subarachnoid haemorrhage.			
Hayward et al. 2014 **Australia** **Observational**	N/A	239 patients with stroke admitted to inpatient rehabilitation (70 ± 13 years, 69% male). Inclusion Criteria: medically stable patients with a primary diagnosis of stroke, who were receiving physiotherapy and were able to understand instructions and provide written informed consent.	Patients were assessed within 72 hours of admission to and discharge from the unit. Demographic and clinical information was collected for all participants and included age, gender, time from stroke onset to rehabilitation admission and total hospital length of stay.	**Outcomes:** Motor function of FIM (m-FIM) & Minimally clinically important difference (MCID). Assessment time points: Admission & Discharge.	Severe motor disability (m-FIM ≤40) change from admission score of 27 ± 8 to a discharge score of 59 ±18, (p< 0.001). MCID 83% achieve a MCID and 85% shift out of 'severe' to either moderate or mild motor disability on discharge from inpatient rehabilitation.
Chan et al. 2013 **United States** **Prospective Cohort Study**	N/A	222 patients admitted to hospital with hemorrhagic or ischemic stroke. Mean Age: 67 years (Home, no treatment), 69 years (home health care), 67 years (inpatient rehabilitation), 79 years (skilled nursing facility). 16% of patients were lost to follow-up.	Patients were classified according to post-acute care groups: Group 1 - Home, No Treatment (n = 79); Group 2 – Home health care and/or outpatient therapy (n=48); Group 3 – Inpatient rehabilitation facility (INF; n=66); Group 4 – Skilled nursing facility (SNF) without inpatient rehabilitation (n=29).	**Primary Outcome:** Activity Measure for Post-Acute Care (AM-PAC). Patient functioning in each of the 3 domains of the AM-PAC (mobility, self-care, and cognition) was compared across post-acute care groups. Outcome was administered at discharge from acute care and at 6 month follow-up.	**Adjusted Analysis:** **IRF vs. SNF without IRF:** Patients attending a SNF had statistically significantly lower mobility scores at 6 months (β -10.1 SD 2.5, p<0.0001), lower self-care scores (β -8.8 SD 3.2, p=0.007) and cognition scores (β -8.7 SD 2.2, p<0.0001) compared to the IRF. **IRF vs. Home Health Care/Outpatient Therapy:** Patients receiving home health care or outpatient therapy had statistically significantly lower cognition scores (β -5.6 SD 2.4, p=0.02) compared to the IRF. There were no statistically significant differences in mobility and self-care outcomes. **IRF vs. Home, No Treatment:** There were no statistically significant differences in mobility, self-care or cognition scores (p=0.2, p=0.91, p=0.08, respectively) between patients who went home and received no care compared to those that attended the IRF.
Reistetter et al. 2014 **USA**		143,036 patients discharged from inpatient rehabilitation facility (IRF).	Patient data was obtained from the Uniform Data System for Medical Rehabilitation (UDSMR).	**Outcomes:** Community discharge, length of stay (LOS), and discharge functional status ratings (motor, cognitive using FIM).	Regression Analysis: Race: Persons who were Hispanic had shorter LOS (b=−1.03; 95% CI, −1.21 to −.85). Persons in the black and Hispanic race/ethnic groups

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Observational		Mean age: 70.6±13.5 years (49.4% male). Inclusion criteria: Adults between 18 and 100 years, living at home before acute stroke, and were discharged from IRF.	Demographic factors (including age, sex, race/ethnicity, marital status, and insurance status), Clinical factors (including stroke type, comorbidities, and admission functional status) and 10 geographic regions were used as covariates in analysis.	Assessment time points: Within 3 days of admission and 3 days of discharge.	demonstrated significantly less change in function compared with non-Hispanic whites. Clinical: Higher admission motor ratings were associated with shorter LOS (b=−.39; 95% CI, −.40 to −.39). Clinical: Higher FIM instrument motor and cognitive ratings at admission significantly increased the likelihood of community discharge (motor OR=1.08 [95% CI, 1.08–1.08]; cognitive OR=1.03 [95% CI, 1.03–1.03]).
Wang et al., 2013 **USA** **Observational (retrospective cohort)**	N/A	360 patients admitted to inpatient rehabilitation were included. Mean age: 64.8 years. Mean total therapy time: 190.3 min/day (SD 29.3). Inclusion criteria: Patients must have been in inpatient rehabilitation for at least 3 days, age greater than 18 years with a diagnosis of stroke.	Cohort and associated information was identified from an administrative database and chart review. The aim of the study was to assess the association between times in therapy with functional outcome. The study also sought to assess the ideal length of therapy time for greatest FIM gains. Total therapy time was analyzed as a continuous and a categorical variable. Categorical variable of >3 hours or ≥3 hours for total therapy time was identified from clinical practice guidelines and used as the cut point to assess the effect of thresholds for therapy.	**Outcomes**: Functional gain (FIM – Activities of daily living (ADL), mobility, cognition and total gain). Assessment time points: Admission and discharge to calculate FIM gain.	Correlations: **Gain in FIM ADL**: Gain in FIM ADL was significantly correlated with number of minutes spent with the PT, OT, SLT, and total therapy time (P<0.05). **Gain in FIM Mobility**: Gain in FIM Mobility was significantly correlated with PT and total therapy time (P<0.05) but not OT or SLT time. **Gain in FIM Cognition:** Gain in FIM ADL was significantly correlated with number of minutes spent with the PT, OT, SLT, and total therapy time (P<0.05). **Gain in FIM total:** Gain in FIM Mobility was significantly correlated with PT, SLT and total therapy time (P<0.05) but not OT time. Regression Analysis: Controlling for age, sex, comorbidities, and total baseline motor and cognition scores, greater than 3.5 hours was significantly associated with total FIM gain compared to less than 3 hours (P=0.0032)/ Between 3.0 and 3.5 hours per/day is also significantly associated with total FIM gain compared to less than 3 hours (P=0.0211). Other significant predictors of functional gains include stroke type, side of lesion, time since stroke, and inpatient rehabilitation length of stay.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					Key Points: More than 3 hours of total therapy time from a PT, OT, and SLT combined offers significantly improved functional outcomes for patients in inpatient rehabilitation. Types of FIM gains are variable between disciplines, but all clinicians provided functional gains in at least 2 categories (ADL, motor, cognitive or total).
Foley et al., 2012 **Canada** **Observational (retrospective cohort)**	N/A	123 patients admitted to inpatient rehabilitation were included. Mean age: 67 years (SD 15). Mean therapy time: Physiotherapy (37 min/day (SD 18.1)); Occupational Therapy (37.8 min/day (SD 16.0)); Speech language pathology (13.3 min/day (SD 15.1)). Inclusion criteria: confirmed diagnosis of stroke.	Cohort and associated information were identified from administrative databases. The aim of the study was to assess the effect of total therapy time on patient outcomes and to determine the predictors of FIM gain. Bivariate correlations to inform a multivariate model were used to identify the significant predictors of FIM gain.	**Outcomes**: Functional independence measure (FIM) gain. Assessment time points: Admission and discharge to calculate FIM gain.	Correlations: **Gain in FIM**: Length of stay, Admission motor and total FIM scores, total and daily average PT and OT therapy time were significantly correlated with total FIM gain. Regression Analysis: Total OT time and total FIM at admission were significant predictors of FIM gain. With total PT time and length of stay in inpatient rehabilitation, the model explained 35% of the variance in FIM gain. Key Points: Findings indicate that total therapy time received in inpatient rehabilitation at this hospital site for this population of patients did not meet the standard of care dictated in guidelines. The amount of therapy provided by an occupational therapist during inpatient rehabilitation did appear to influence a patient's functional gain during their stay.
Bayley et al., 2012 **Canada** **Observational Study**	N/A	79 rehabilitation professionals across 5 hospital centers with inpatient rehabilitation units participated in the study, including: 23 occupational therapists, 17 physical therapists, 23 nurses and 16 directors/managers.	The aim of the study was to assess and describe the barriers to implementation of evidence based recommendations for stroke rehabilitation by experienced rehabilitation professionals. A rehabilitation professional at each site was identified as the "local facilitator" responsible for promoting	**Outcomes:** Barriers to implementation.	Key Points: 6 key themes regarding barriers to implementation of recommendations were identified, including: lack of time, staffing issues, training/education, therapy selection and prioritization, equipment and team functioning/communication. Inadequate staffing was a particularly common theme among nurses.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			a 6-month implementation of the recommendations. The rehabilitation professionals participated in 21 focus groups (each consisting of 3-6 participants) which were held within 2-4 weeks of implementation completion. The focus group sessions were audio recorded after which key emerging themes were identified by 2 researchers.		
Wang et al., 2011 **USA** **Observational Study (retrospective cohort)**	N/A	1908 patients admitted to inpatient rehabilitation were included. Mean Age: Overall 63.6 years (SD 13.5) Moderately impaired group (61.3 years (SD 13.6)), Severely impaired group (64.6 years (SD 13.3)). Time to admission to inpatient rehabilitation: Overall 27.3 days (SD 34.3). Moderately impaired group (19.8 days (SD 34.3)), Severely impaired group (30.9 days (SD 37.4)). Inclusion Criteria: admitted to inpatient rehabilitation for first stroke and a confirmed diagnosis of stroke.	Cohort and associated information was identified from an administrative database and supplemented with Census data from the USA. Analyses were performed separately for moderate and severe strokes (severity based on case-mix groups (CMGs)). Time to admission to inpatient rehabilitation was analyzed as a continuous and a categorical variable. Categorical variable of 0-7 days, 8-14 days, 15-21 days, 22-30 days, 31-60 days and 61-365 days was used to determine optimal arrival times to inpatient rehabilitation.	**Outcomes:** Functional change (FIM – Activities of daily living (ADL), mobility, cognition and total change). Assessment time points: Admission and discharge to calculate change in FIM.	Correlations: **Patients with moderate stroke severity**: There was a significant correlation between total FIM change, and motor FIM change and number of days from stroke onset to admission to inpatient rehabilitation (P<0.0001). There was non-statistically significant correlation between cognition FIM change and days to inpatient rehabilitation admission (P=0.08). **Patients with severe stroke severity**: There was a significant correlation between total FIM change (P<0.0001), motor FIM change (P<0.0001) and cognition FIM change (P<0.001) and number of days from stroke onset to admission to inpatient rehabilitation. There was a non-statistically significant correlation between cognition FIM change and days to inpatient rehabilitation admission (P=0.08). Regression Analysis: **Patients with moderate stroke severity**: Time to inpatient rehabilitation admission was a significant predictor of total FIM gain and motor FIM gain (P<0.0001), but not cognition FIM gain (P=0.2328) for patients with moderately severe strokes. **Patients with severe stroke severity**: Time to

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		Exclusion criteria: Patients with a mild stroke or diagnosed with an ischemic stroke with no cerebral infarction.			inpatient rehabilitation admission was a significant predictor of total FIM gain, motor FIM gain, and cognition FIM gain (P<0.0001) for patients with severe strokes. Significant predictors of time to admission to rehabilitation included: Age (P=0.0026), stroke type, previous stroke, total FIM on admission (P<0.0001), and admission year. These predictors explained 12% of the variance in time to rehabilitation admission. Ideal time from stroke onset to admission to rehabilitation: For patients with moderate stroke severity, ideal admission time is within 21 days. For patients with a severe stroke, ideal admission time is within 30 days of stroke. Key Points: Patients with both moderate and severe stroke benefit from early admission to inpatient rehabilitation. Those with severe stroke in this population were found to benefit from inpatient rehabilitation up to 30 days post stroke.
Christie et al., 2011 **Australia** **Pre-post intervention study**	N/A	119 patients were included in the study. Mean age: 74.3 years (SD 12.3). Inclusion criteria: confirmed diagnosis of stroke, medically stable, experiencing difficulty in dressing tasks.	No control group. Analysis involved paired t-tests to assess change in outcomes before and after the intervention. Intervention involved group dressing therapy for one hour, 2 times per week in addition to the regular occupational therapy offered at the unit. Patients could receive upper dressing therapy, lower body dressing therapy or both upper and lower body dressing therapy.	**Primary outcome:** Change in FIM score (for the upper and lower body dressing items). Assessment time points: At the start of the intervention and at the end of the intervention.	**FIM total change (upper and lower body dressing):** Patients (n=71) receiving the intervention achieved a statistically significant increase of 5.2 points on the FIM for both upper and lower body dressing (Mean difference 5.2; 95% CI 4.5 to 6.0; P=0.0001). **FIM change (upper body dressing):** Patients (n=108) receiving the intervention achieved a statistically significant increase of 2.2 points on the FIM for upper body dressing (Mean difference 2.2; 95% CI 1.9 to 2.5; P=0.0001). **FIM change (lower body dressing):** Patients (n=82) receiving the intervention achieved a statistically significant increase of 2.7 points on the FIM for lower body dressing (Mean difference 2.7; 95% CI 2.3 to 3.1; P=0.0001). Key Points: Patients experienced gains in the upper and lower body dressing components of the

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					FIM. However, this therapy was offered in addition to regular occupational therapy and therefore it is unknown if a control group would have received similar gains in dressing scores.
Woo et al., 2008 **China** **Observational study (retrospective cohort)**	N/A	2210 patients from three inpatient rehabilitation sites were included. Median Age: Overall 75 years (IQR 68-81). Hospital A: 76 years; Hospital B 75 years; Hospital C 75 years. Length of Stay: Overall 25 days (IQR 16-37) Hospital A: 22 days (IQR 15-32); Hospital B 25 days (IQR 17-36); Hospital C 26 days (IQR 15-39).	Three hospital sites with different processes of care were compared according to patient outcomes using analysis of covariance (ANCOVA).	**Outcomes**: Functional independence measure (FIM) efficiency gain (Gain in FIM from admission to discharge divided by length of stay). Assessment time points: Admission and discharge to calculate FIM gain.	Controlling for age and motor and cognitive FIM score at admission, patients receiving care from Hospital A experienced statistically significantly greater FIM efficiency gains compared to Hospitals B or C: Hospital A vs. B: (0.735 vs. 0.503; P<0.001) Hospital A vs. C: (0.735 vs. 0.550; P<0.001) Hospital B vs. C: (0.503 vs. 0.550; P=0.488) Hospital A had a very different process of care compared to Hospital B and C. Two key areas were highlighted in the study: the multidisciplinary nature of the care provided (variety of care providers, weekly team meetings) and an organized transition process between hospital and the community. Key Points: Controlling for patient demographics and initial functioning on admission to rehabilitation, patients receiving care from Hospital A, which offered multidisciplinary services and discharge planning and support received greater functional improvements per day compared to the other two comparison hospitals who did not have these services available.
Horn et al., 2005 **USA** **Observational Study (Prospective cohort)**	N/A	830 patients (389 with moderate stroke severity; 441 with severe stroke) admitted to inpatient rehabilitation. Mean age: Moderate stroke (66.2 years) Severe stroke (67.9 years). Inclusion criteria: Patients with moderate or severe strokes, over 18 years of age and first	Patient data derived from the Post-Stroke Rehabilitation Outcomes Project. Analyses were performed separately for moderate and severe strokes (severity based on case-mix groups (CMGs)). A secondary analysis looked at patient outcomes according to therapy received during	**Outcomes**: Patient functioning (using the Functional independence measure – FIM – cognitive, motor and total scores) and discharge destination. Assessment time point: At discharge from inpatient rehabilitation.	Regression analysis controlled for patient characteristics, symptoms, neurobehavioral impairments and length of stay in inpatient rehabilitation. **Patients with Moderate Stroke Severity:** Significant increases in discharge FIM (P<0.001) and discharge motor FIM (P=0.002) scores with earlier admission to inpatient rehabilitation. The number of minutes a patient spent on various activities (gait, transfers, speech etc.) with PTs, OTs and SLPs had at least one significant association with either increased discharge FIM, increased discharge motor FIM or increased

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		admission to rehabilitation after stroke.	only the first block of rehabilitation (i.e. number of minutes within the first 3 hour session for each of the PT, OT and SLP). This analysis was done to assess the effect of early intensive therapy on outcomes.		discharge cognitive FIM or some combination of the three. **Patients with Severe Stroke Severity:** Significant increases in discharge FIM (P<0.001) and discharge motor FIM (P<0.001) scores with earlier admission to inpatient rehabilitation. Amount of time spent with PTs, OTs, SLPs had similar increases in FIM scores as seen in patients with moderate stroke severity. In the secondary analysis with the regression analysis only including time spent with the patient during the first 3 hour block of therapy provided by the PT, OT or SLP, there were similar findings. Greater FIM scores with decreased time between stroke and admission to rehabilitation and greater FIM scores with increased time spent with patient during the first 3 hour block of therapy provided. Similar findings for patients with both moderate and severe strokes. Key Points: Greater discharge FIM score and greater discharge motor FIM score is associated with a shorter time between stroke onset and admission to rehabilitation. Additionally, more intensive therapy (based on number of minutes) and more intensive therapy in the early stages (first therapy session) are associated with greater discharge FIM scores. These findings apply to patients with both moderate and severe strokes.
Badriah et al. 2013 **Japan** **Observational**	N/A	205 patients admitted to inpatient rehabilitation. Mean age: 76.49 ± 13.76. Mean LOS: 112.99 ± 60.48. Mean Total Hours: 140.69 ± 103.04.	No control group. There were eight independent variables, including an interaction term, and one dependent variable. Age, sex, and previous history of disability. Each patient's functional level was measured three times by the PTs or OTs in charge: at the beginning	**Outcomes:** Functional gain (FIM – Activities of daily living (ADL). Assessment time points: Admission, discharge and discharge after 3 months to calculate FIM gain.	Correlations: Age, previous history of disability, and FIM score at the beginning of therapy were related to the FIM score, indicating that FIM score was lower in older than in younger stroke patients ($p < 0.001$). The FIM score was lower in patients with a previous history of disability compared with those without ($p < 0.03$) and in patients with low FIM scores at the beginning of therapy compared with patients with high FIM scores at the beginning of

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		FIM at Admission: 67.63 ± 32.84. FIM at Discharge: 74.39 ± 35.61.	of the rehabilitation program, at hospital discharge, and 3 mo after hospital discharge. Functional independence was assessed using the FIM.		therapy ($p < 0.001$). The intensity of total therapy and effectiveness of therapy were related to an increase in the FIM score (both $p < 0.001$).

Glossary
RCT= Randomized Controlled Trial
N/A = Not Applicable
CA = Concealed Allocation
ITT = Intention to treat
OR = Odds Ratio
CI = Confidence Interval
IQR = Interquartile Range
FIM = Functional Independence Measure

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