Canadian Stroke Best Practices

CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Rehabilitation and Recovery following Stroke Evidence Tables

Delivery of Inpatient Stroke Rehabilitation

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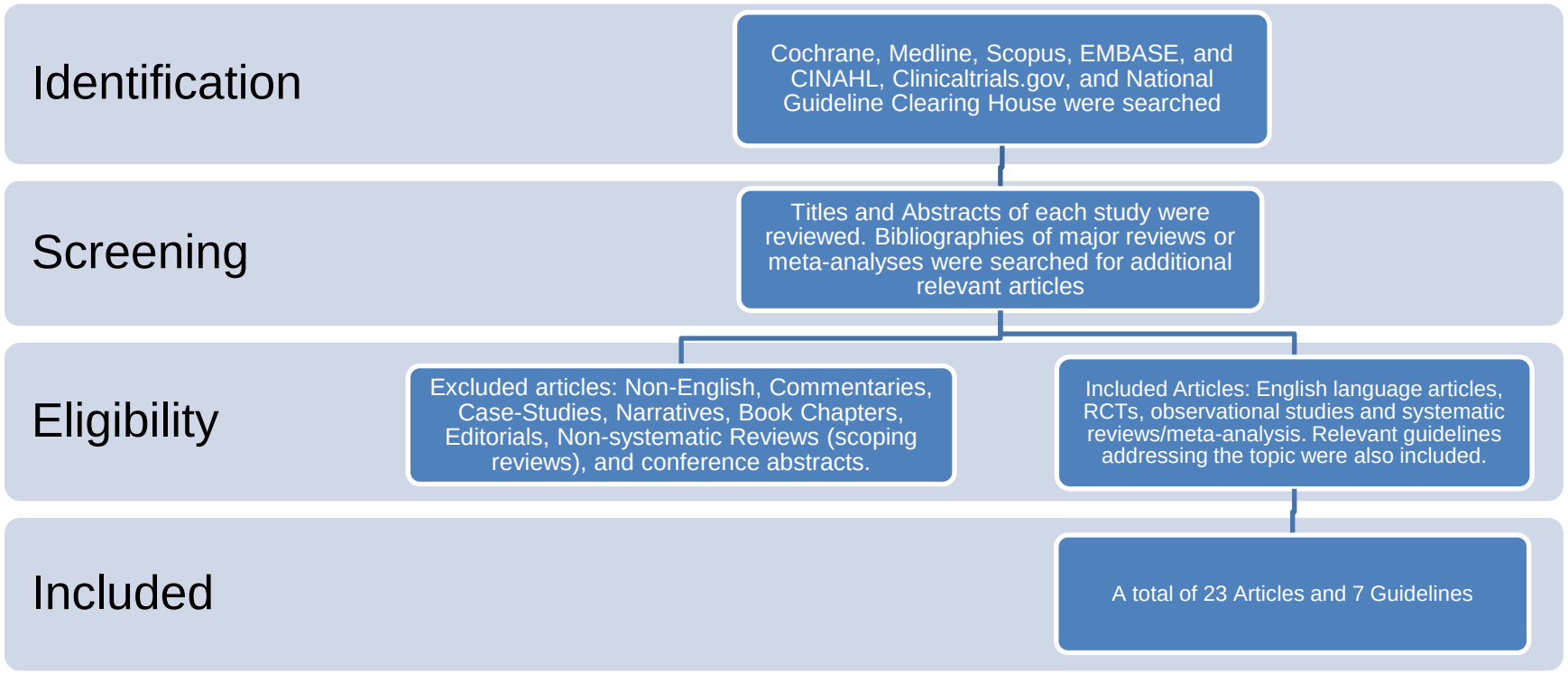
Search Strategy



Cochrane, Medline, and CINAHL, Clinicaltrials.gov, EMBASE, and Scopus were searched using the keywords: Stroke AND (Rehabilitation OR Neurological rehabilitation OR “early mobilization” OR “early rehabilitation”. 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 23 articles and 7 guidelines were included.

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**	**4.11. Rehabilitation** 2.It is recommended that stroke survivors receive rehabilitation at an intensity commensurate with anticipated benefit and tolerance. Class I; LOE B-NR. 3.High-dose, very early mobilization within 24 hours of stroke onset should not be performed because it can reduce the odds of a favorable outcome at 3 months. Class III: Harm: LOE B-R.
Clinical Guidelines for Stroke Management 2017. Melbourne (Australia): National Stroke Foundation.	**Amount and Intensity of Rehabilitation:** For stroke survivors, rehabilitation should be structured to provide as much scheduled therapy (occupational therapy and physiotherapy) as possible. For stroke survivors, group circuit class therapy should be used to increase scheduled therapy time. Strong recommendation A minimum of three hours a day of scheduled therapy (occupational therapy and physiotherapy) is recommended, ensuring at least two hours of active task practice occurs during this time. Weak recommendation **Timing of Rehabilitation:** For stroke patients, starting intensive out-of-bed activities within 24 hours of stroke onset is not recommended. Strong recommendation All stroke patients should commence mobilisation (out-of-bed activity) within 48 hours of stroke onset unless otherwise contraindicated (e.g. receiving end-of-life care). Strong recommendation For patients with mild and moderate stroke, frequent, short sessions of out-of-bed activity should be provided, but the optimal timing within the 48-hour post-stroke time period is unclear. Weak recommendation **Ongoing Inpatient Rehabilitation:**

Guideline	Recommendations
	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].
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 1, Level B High-dose, very early mobilization within 24 hours of stroke onset can reduce the odds of a favorable outcome at 3 months and is not recommended. Class III, Level A
National Clinical guidelines for stroke" 5th Edition 2016; Intercollegiate Stroke Working Party. Royal College of Physicians	2.11 People with stroke should accumulate at least 45 minutes of each appropriate therapy every day, at a frequency that enables them to meet their rehabilitation goals, and for as long as they are willing and capable of participating and showing measurable benefit from treatment. In the first two weeks after stroke, therapy targeted at the recovery of mobility should consist of frequent, short interventions every day, typically beginning between 24 and 48 hours after stroke onset. Multi-disciplinary stroke teams should incorporate the practising of functional skills gained in therapy into the person's daily routine in a consistent manner, and the care environment should support people with stroke to practise their activities as much as possible. Healthcare staff who support people with stroke to practise their activities should do so under the guidance of a qualified therapist. 3.12.1Patients with difficulty moving after stroke should be assessed as soon as possible within the first 24 hours of onset by an

Guideline	Recommendations
	appropriately trained healthcare professional to determine the most appropriate and safe methods of transfer and mobilisation. Patients with difficulty moving early after stroke who are medically stable should be offered frequent, short daily mobilisations (sitting out of bed, standing or walking) by appropriately trained staff with access to appropriate equipment, typically beginning between 24 and 48 hours of stroke onset. Mobilisation within 24 hours of onset should only be for patients who require little or no assistance to mobilise.
Stroke Rehabilitation. Long-term rehabilitation after stroke. Issued: June 2013. National Institute for Health and Care Excellence.	**Intensity of stroke rehabilitation** 3.1.6 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].
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]. Stroke patients should be mobilised as early as possible after stroke [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	Strongly recommend that rehabilitation therapy should start as early as possible, once medical stability is reached. [A] 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]

Evidence Tables

Early Initiation of Rehabilitation Therapies

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Early Mobilization					
Langhorne et al. 2018 **UK** **Cochrane review**	3 trials were deemed to be at low risk of bias. The remainder were at high or unclear risk of bias.	9 RCTs (n= 2,958), including participants who had sustained an acute stroke and could be mobilized within 48 hours. Median age was 68 years, 52% were men. Baseline stroke severity was moderate in most trials. A median of 12% had ICH.	Trials that started out-of-bed mobilization within 48 hours of stroke, and aimed to reduce time-to-first mobilization, with or without an increase in the amount or frequency (or both) of mobilization activities (VEM group), were compared with usual care, where time-to-first mobilization was commenced later. Trials included SEVEL, AVERT (phases II and III), Langhorne 2010, Chippala & Sharma 2016, Morreale et al. 2016, Poletto 2015, and AKEMIS et al. 2014	**Primary outcome:** Death of poor outcome (dependency or institutionalization) at the end of follow up. **Secondary outcomes:** Death, dependency, institutionalization, activities of daily living (ADL), extended ADL, quality of life, walking ability, complications (e.g. deep vein thrombosis), patient mood, and length of hospital stay	The median delay to starting mobilization after stroke onset was 18.5 hours in the VEM group and 33.3 hours in the usual care group. The median difference within trials was 12.7 hours. There were no significant differences in the odds of primary outcome at 3 months between groups (51% vs. 49%; OR= 1.08, 95% CI 0.92 to 1.26, p = 0.36), or the odds of death (7% vs. 8.5%; OR=1.27, 95% CI 0.95 to 1.70; p = 0.11). Mean 20-point Barthel Index) was significantly higher in the VEM group (MD= 1.94, 95% CI 0.75 to 3.13, p = 0.001). Mean length of stay was significantly shorter in the VEM group (MD= -1.44, 95% CI -2.28 to - 0.60, p = 0.0008).
Li et al. 2018 **China** **Systematic review & meta-analysis**	NA	6 RCTs including patients admitted to hospital following acute ischemic or hemorrhagic stroke	Trials compared early mobilization (within 24 hours of stroke) vs. usual care. Trials included SEVEL, AVERT (phases II and III), Chippala & Sharma 2016, and AKEMIS et al. 2014, all described below)	**Primary outcomes:** mRS (0-2), mortality at 3 months **Secondary outcomes:** BI scores at 3 months, LOS	There was no significant difference between groups in the proportion of patients with mRS score of 0-2 at 3 months (RR=0.80, 95% CI 0.58-1.02). The results from 5 trials were included (n=1,646). Early mobilization was not associated with an increased risk of mortality (RR=1.21, 95% CI 0.76-1.75). The results from 4 trials were included. Early mobilization was associated with higher BI scores at 3 months (SMD=0.66, 95% CI 0.0-1.31). The results from 4 trials were included (n=285). Early mobilization was associated with a significantly reduced LOS (WMD=-1.97, 95% CI -

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					2.63 to -1.32). The results from 3 trials were included (n=236).
Chippala & Sharma 2016 **India** **RCT**	CA: ☑ Blinding: Patient:☒ assessor ☑ ITT:☒	86 patients ≥18 years with acute onset of ischemic stroke who were able to react to verbal commands, had SBP 120-180 mm Hg, oxygen saturation >92%, a heart rate of 40-100 bpm and temperature <38.5°C. Mean age was 60 years, 53% were male. 52% of patients had moderately disabling strokes (NIHSS 8-16).	Within 24 hours of stroke onset, patients were randomized 1:1 to either the Very Early Mobilization group or a standard care group for 7 days or until discharge. The treatment protocol for the Early mobilization group was similar to the AVERT protocol. Patients were out of bed within 24 hours and received passive and active mobilization. Patients in the standard care groups received routine stroke unit care.	**Primary outcome:** Barthel Index at day 7 and 3 months **Secondary outcomes:** LOS	The were 6 losses to follow-up (3 in each group). Median BI scores at baseline, discharge and 3 months were: 50, 85 and 90 (intervention) and 52.5, 70 and 75 (control). There was significantly greater improvement in median BI scores from admission to discharge ($p<0.001$) and from admission to 3-months in the intervention group ($p<0.001$) Median LOS was significantly shorter in the early mobilization group (8 vs. 10, $p<0.001$).
Herisson et al. 2016 **France** **RCT** ***Stroke and Early VErticaL positioning (SEVEL)***	CA: ☑ Blinding: Patient:☒ assessor ☒ ITT: ☒	167 patients ≥18 years with acute onset of ischemic stroke were recruited from 11 centres. Patients with severe stroke (NIHSS ≥22 were excluded). Mean ages were 68.1 (early group), 71.2 years (progressive group). Mean NIHSS scores were 7.2 (early) and 7.8 (progressive).	Patients were randomized 1:1 to early and progressive sitting arms. Patients in the early sitting arm were seated out of bed as soon as possible, within the first day of stroke. Patients in the progressive group sat in bed for days 1-2 post stroke, and then seating out of bed on day 3. For both protocols, minimal duration of the first sitting was 15 minutes in both groups; maximum duration was 60 minutes. Duration of treatment was 7 days, or until discharge.	**Primary outcome:** Favourable outcome (mRS 0-2) at 3 months **Secondary outcomes:** Medical complications, LOS, tolerance at 7 days and 3 months	The study was terminated early due to slow enrollment. There were 24 losses to follow-up (17 early group, 7 progressive group). The percentage of patients with mRS scores of 0-2 at 3 months was similar (76.2% vs. 77.3%, $p=0.52$). There were no significant differences between groups on any of the secondary outcomes (medical infections: pulmonary infection, UTI, dysphagia, DVT, pressure ulcer). Mean LOS was 9.8 (early) vs. 10.5 (progressive) days, $p=0.27$. The procedure was well-tolerated in both groups. There were no significant changes in SBP, DBP or heart rate immediately after the procedure, or 5 minutes later.
Bernhardt et al.	CA: ☑	2,104 patients ≥18 years,	Patients were randomized to	**Primary outcome:**	**Main Results (2015)**

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
2015, 2016 **Australia** **RCT** ***A Very Early Rehabilitation Trial for stroke (AVERT)***	Blinding: Patient:☒ assessor ☑ ITT: ☑	recruited from 56 stroke units, located in 5 countries, within 24 hours of ischemic or hemorrhagic stroke without pre-morbid disability. Mean age was 72 years, 55% of patients were admitted with mild stroke (NIHSS score 1-7)	receive usual care (n=1,050) or early mobilization (n=1,054), a task-specific intervention focused on sitting, standing, and walking activity, initiated within 24 hrs. of stroke onset. Four pre-specified levels of out-of-bed activity were used, depending on functional recovery. The duration of treatment was 14 days, or until discharge from the stroke unit.	Favourable outcome (mRS 0-2) at 3 months **Secondary outcomes:** Shift in distribution of mRS, time to achieve assisted- free walking over 50m, proportion of patients able to walk unassisted at 3 months, death, and serious adverse events	Significantly fewer patients in the very early mobilization group had a favourable outcome (46% vs. 50%; adjusted OR=0.73, 95% CI 0.59-0.90, p=0.004). There was no significant shift in the distribution of mRS between groups (adjusted OR=0.94, 95% CI 0.85-1.03, p=0.193). Significantly more patients in the very early mobilization group were mobilized within 12 and 24 hrs (23% vs. 14% and 92% vs. 59%, respectively). The median time to first mobilization was significant sooner in the early mobilization group (18.5 vs. 22.4 hrs, p<0.0001). Patients in the early mobilization group received significantly more out of bed sessions (median of 6.5 vs. 3, p<0.0001) and more daily therapy (31 vs. 10 min, p<0.0001). The odds of walking for 50 m independently were not significantly increased in the early mobilization group (adjusted OR=1.04, 95% CI 0.94-1.15, p=0.46). The odds of death non-serious adverse events and neurological serious adverse events were not significantly increased in the early mobilization group. **Subgroup analysis (2016)** Regardless of group assignment, keeping time to first mobilization and frequency constant, every extra 5 minutes of out-of-bed activity per day reduced the odds of a favorable outcome (OR=0.94, 95% CI 0.91-0.97, p<0.001) and reduced the odds of walking unassisted for 50 m (OR=0.85, 95% CI 0.81-0.89, p<0.001), after controlling for age and stroke severity. Regardless of group assignment, increasing the frequency of out-of-bed sessions improved the

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					odds of favorable outcome by 13% (OR for each additional session =1.13, 95% CI 1.09-1.18, p <0.001) and improved the odds of walking 50 meters unassisted by 66% (OR for each additional session =1.66, 95% CI 1.53–1.80, p< 0.001), after controlling for age and stroke severity. Increased frequency of out-of-bed sessions also reduced the odds of death and fatal and nonfatal neurological serious adverse events.
Sundseth et al. 2012 **Norway** **RCT** ***Akerhus Early Mobilization in Stroke Study (AKEMIS)***	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	56 patients admitted to a single stroke unit with ischemic stroke or ICH within 24 hours of onset of symptoms. Mean age was 77 years, 45% male.	Patients were randomized to a very early mobilization (VEM) group (n=32) or to a control group (n=33). Patients in both groups received standard stroke unit care. Patients in the VEM group were mobilized as soon as possible (within 24 hours post stroke). The control group were mobilized between 24 and 48 hours.	**Primary Outcome:** Poor outcome at 3 months (mRS score of 3-6). **Secondary Outcomes:** Independence (BI score of ≥18), death and number of complications at 3 months.	The median time to first mobilization from stroke onset was significantly shorter for patients in the VEM group (13.1 vs. 33.3 hrs, p<0.001). More patients in the VEM group had poorer outcomes compared with control participants, although this difference was not statistically significant (OR= 2.70, 95% CI: 0.78-9.34; p=0.12). The odds of death or dependency, or dependency at 3 months were not significantly reduced in the VEM group (OR= 5.26, 95% CI: 0.84-32.88; p=0.08; OR= 1.25; 95% CI: 0.36-4.34; p=0.73, respectively). The improvement in mean NIHSS scores from baseline to 3 months was significantly greater for patients in the VEM group (7.2-3.9 vs. 7.5-5.5, p=0.02). The proportion of patients with at least 1 complication within 3 months was similar between groups (67% vs. 66%, p=0.93).
Craig et al. 2010 **UK** **Systematic Review & Meta-Analysis**	N/A	103 patients included in the AVERT (n=71) and VERITAS (n=32) trials, who had been admitted to hospital following acute first or recurrent stroke. The baseline characteristics of patients in both trials were similar.	Both trials examined interventions to mobilize patients within 24 hours after stroke at frequent intervals. The AVERT study implemented the intervention for 14 days, VERITAS trial lasted 7 days. Both studies	**Primary Outcome:** Independence at 3 months (mRS of 0-2, and Barthel index of 18-20). **Secondary Outcome:** Early complications of immobility and activities	In pooled analysis, median time to first mobilization was significantly shorter in VEM group (21 vs. 31 hours, p<0.05). The odds of independence, adjusting for age, baseline NIHSS score and premorbid mRS score, were significantly higher for VEM patients using both mRS and BI criteria (OR= 3.11, 95% CI 1.03-9.33 and OR= 4.41, 95% CI 1.36-14.32,

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		Participants with severe pre-stroke disability were excluded from both studies.	compared early mobilization treatment groups (VEM) to a standard care control group (SC).	of daily living at 3 months (stroke-related, immobility-related, comorbidity-related, or other causes).	respectively). The risk of experiencing immobility related complications was significantly lower in VEM patients (adjusted OR= 0.20, 95%CI 0.10-0.70).
Earlier Admission to Inpatient Rehabilitation					
Lynch et al. 2014 **Australia** **Systematic review & meta-analysis**	NA	5 RCTs and 38 non-RCTs including patients who had received inpatient rehabilitation following acute stroke.	Data from identified studies were used to answer 2 questions 1) What are the effects of commencing physical rehabilitation within 7 days of stroke? 2) What are the effects of earlier transfer to the rehabilitation service?	**Primary outcome:** Mortality and good outcome (mRS 0-2), at 3 months	3 RCTs compared mobilization within 24 and 48 hours of admission (n=159). Earlier mobilization was associated with a trend towards higher mortality (OR=2.58, 95% CI 0.98 to 6.79, p=0. 06). There was no significant difference between groups in mean change in BI scores at 3 months (MD=1.20, 95% CI -0.77-3.18, p=0.23), or in the odds of a good outcome (OR=1.16, 95% CI 0.61-2.18, p=0.66). Both outcomes were in the direction of benefit for the usual care group. Pooled analyses were not possible for an examination of rehabilitation initiated within 7 days. Pooled analyses were not possible for Q2, although among 26/32 observational studies, early transfer to rehabilitation was associated with better functional outcome.
Liu et al. 2014 **China** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	243 patients presenting within 48 hours after first-ever ICH, with no contraindications to being mobilized within 48 hours of stroke onset and a Fugl–Meyer stroke deficit score of 27-90. Mean age was 59 years, 56% were men.	Patients were randomized 1:1 to a standard care or very early rehabilitation (VER) groups. Patients in both groups underwent similar rehabilitation, which was performed by the patient's relatives under the guidance of medical staff and included ADL and stretching exercises, and neuromuscular electric stimulation and repetitive task-specific training. Rehabilitation was initiated at	**Primary outcome:** Death within 6 months of stroke **Secondary outcomes:** SF-36, BI and Zung Self-Rated Anxiety Scale, assessed at 3- and 6-months post stroke	Mean LOS was significantly shorter for patients in the VER group (24 vs. 34 days, p<0.001). There were significantly more deaths at 6 months in the standard care group (3 vs. 12). Patients in the VER group were more likely to be alive (HR= 4.44, 95% CI 1.24–15.87). There were no significant differences between groups in any of the secondary outcomes at 3 months, but significant differences favouring the VER group at 6 months. Mean Physical Component Summary SF-36 scores 43.8 vs. 37.4, p<0.05; mean BI scores were 73.8 vs. 61.3,

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			one-week post stroke for patients in the standard care group and within 48 hours of stroke onset in the VER group.		p<0.05; and mean Zung scores were 48.9 vs. 55.2, p<0.05.
Wang et al. 2011 **USA** **Retrospective Study**	N/A	1,908 patients admitted to a regional inpatient rehabilitation hospital with moderate or severely-disabling stroke. Mean age was 63.6 years, 45.7% were women.	Patients were classified by Case Mix Group (CMG) as moderately impaired (CMG =0104- 0107, n=614), and severely impaired (CMG=0108-0114, n=1,294). All patients received a minimum of 3 hours of therapy/day. The association between time from stroke onset to rehabilitation admission and FIM gain, controlling for demographics, co-morbid conditions, and other measures (eg, pre-IRH setting, IRH length of stay), was examined. Separate analyses were performed for moderate and severe stroke groups	**Primary Outcomes:** FIM change from inpatient rehabilitation admission to discharge	Mean time to admission to inpatient rehabilitation was 27.3 days. Patients with moderate disability were admitted significantly sooner (19.8 vs. 30.9 days). Mean admission and discharge FIM scores were 52.2 and 77.4, respectively, and were significantly lower for patients with severe disability. **Patients with moderate stroke severity**: Decreasing time (days) 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). **Patients with severe stroke severity**: Decreasing time (days) to inpatient rehabilitation admission was a significant predictor of total FIM gain, motor FIM gain, and cognition FIM gain (p<0.0001). Significant predictors of FIM gain for both groups were: decreasing age, decreasing time to rehabilitation, previous stroke (none), and lower admission FIM scores. Ideal time from stroke onset to admission to rehabilitation for patients with moderate stroke severity was within 21 days, and 30 days for patients with a severe stroke.
Salter et al. 2006 **Canada** **Retrospective study**	NA	435 patients admitted to a single regional specialized stroke rehabilitation unit within 150 days of first-ever, unilateral stroke. Mean age was 69 years, 75%	Two groups of patients were formed: those admitted for rehabilitation within 30 days of stroke onset (early) and those admitted from 31-150 days (late).	**Primary outcomes:** FIM change from admission to discharge, LOS	Patients in the earlier admission group had significantly higher admission and discharge FIM scores (76.8 to 101.5 vs. 55.4 to 77.3, p<0.01). After adjusting for admission FIM scores, the mean FIM change was significantly higher in the early admission group (26.8 vs. 17.9, p<0.01).

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		were women.	Differences between groups (early vs delayed) were examined for the outcomes of admission and discharge FIM scores, change in FIM scores, FIM efficiency and LOS		Mean LOS was significantly shorter in the earlier admission group (42.7 vs. 71.4 days, p<0.01).

Intensity of Rehabilitation Therapy Provision

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Schneider et al. 2016 **Australia** **Systematic review & meta-analysis**	NA	14 studies (954 participants) including samples that were composed of >80% of persons recovering from stroke. Mean age ranged from 49 to 75 years. Time after stroke ranged from a few weeks to > 6 months, with 86% of the studies carried out < 6 months after stroke.	Outcomes of trials comparing additional dose of rehabilitation interventions vs. standard amount of the same rehabilitation interventions, aimed at improving upper or lower activity, or both, were pooled. Subgroup analyses were carried out examining the degree of the increase of additional therapy: ≤100% of standard dose and >100% of standard dose	**Primary outcome:** Standardized measures of upper and lower extremity activity	The immediate effect of additional rehabilitation (i.e post intervention scores-pre-intervention scores) was significantly improved activity (SMD=0.39, 95% CI 0.07-0.71, p=0.02). Small increases in additional therapy were not associated with significant improvement in activity (SMD=0.0, 95% CI -0.4-0.4, p=0.99. Results from 3 trials included). Large increases in additional therapy were associated with significant improvements in activity (SMD=0.59, 95% CI 0.23-0.94, p=0.001. Results from 8 trials included). Results from ROC indicated that an increase of ≥240% of standard dose of therapy would be required to ensure true benefit.
Wang et al. 2013 **USA** **Retrospective study**	N/A	360 patients ≥18 years, admitted to an inpatient rehabilitation unit following a stroke, with a minimum LOS of 3 days. Mean age was 64.8 years, 57.4% were men.	Data related to type and duration of therapies (OT, PT and SLP) were obtained by chart review. The association between therapy duration/day and FIM gain was analyzed. Total therapy time provided per day was analyzed as a continuous	**Primary outcome**: Gains in FIM (mobility, cognition sub scores and total gain).	Mean total therapy time received per day was 190.3 ±29.3 minutes. Mean LOS was 20.2 days. Mean admission, discharge and FIM gains achieved during rehabilitation were 45.8, 71.7 and 26.0, respectively. Percentage of patients who received varying duration of total therapy per day was: <3 hours 29.4%

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			and a categorical variable (<3.0 hours vs. ≥3.0 to <3.5 hours vs. ≥3.5 hours).		≥3.0 to <3.5 hours 46.9% ≥3.5 hours 23.6% Controlling for age, sex, comorbidities, and total baseline motor and cognition scores, patients who received a total therapy time of <3.0 hours per day had significantly lower total FIM gains compared with those treated for ≥3.0 hours per day. No significant difference in total FIM gain was found between patients treated for ≥3.0 but <3.5 hours and ≥3.5 hours per day. Independent predictors of total FIM gain included hemorrhagic stroke, left brain injury, earlier admission to rehabilitation, a longer rehabilitation stay and longer duration of therapy provision (both ≥3.0 to <3.5 and ≥3.5 hours, compared with <3.0 hours).
Foley et al. 2012 **Canada** **Retrospective study**	N/A	123 patients admitted to an inpatient rehabilitation unit following a first-ever, or recurrent stroke. Mean age was 67 years.	Independent predictors of FIM gain were identified using data from the medical chart and workload measurement data for therapy provision (OT, PT and SLP).	**Primary outcome**: FIM gain during rehabilitation	Mean time from stroke onset to rehabilitation admission was 33 days. Mean admission and discharge FIM scores were 77 and 103, respectively. Mean active LOS on the rehabilitation unit was 25.3 days. Mean therapy time: Physiotherapy 37 min/day Occupational Therapy 37.8 min/day Speech Language Pathology 13.3 min/day Total OT time and total FIM at admission were significant independent 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.
Hu et al. 2010 **Taiwan** **Retrospective**	NA	154 patients ≥18 years, admitted to an acute stroke unit, who required rehabilitation. Mean age was 63.1 years, 63.4%	Clinical data were obtained from the medical chart and multivariable models were developed to identify predictors of independence in	**Primary outcomes:** Walking function and BI score at discharge from rehabilitation	Mean total LOS (acute + rehabilitation) was 48 days. Mean time from stroke onset to commencement of rehabilitation was 6.7 days.

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study		were men. At baseline, 11% of patients had mild strokes (NIHSS 0-6), 44% had moderate strokes (NIHSS 7-15) and 45% had severe strokes (NIHSS 16-42).	walking (score of 10 or 15 points on locomotion item of BI) and total BI discharge score		Mean admission and discharge BI scores were 17.8 and 50.3, respectively. Mean intensity of rehabilitation (sessions per day, 30-45 minutes/session) was 0.6. At admission and discharge, 19% and 87% of patients were able to walk independently. Significant, independent predictors of discharge BI scores were younger age, increased rehabilitation intensity, higher admission BI scores and earlier admission to rehabilitation. Significant, independent predictors of independence in walking at discharge from rehabilitation were age, increased rehabilitation intensity, higher admission BI scores and earlier admission to rehabilitation In subgroup analysis, rehabilitation intensity was a significant independent predictors of discharge BI scores for patients with mild/moderate strokes, but not for independence in walking. Rehabilitation intensity was a significant independent predictor of both discharge BI score and independence in walking for patients with severe strokes.
The Glasgow Augmented Physiotherapy Study (GAPS) group 2004 **UK** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	70 patients admitted to one of 3 rehabilitation hospitals following stroke which had occurred within the previous 6 weeks. Mean age was 68 years, 41% were women. Mean BI score was 11.0	Patients were randomized 1:1 to receive either conventional inpatient stroke services with provision of physiotherapy input for 30-40 minutes direct contact per day, five days per week, or conventional stroke services plus additional physiotherapy input, aiming to provide double the total daily physiotherapy time to 60-80 minutes per day, five days per	**Primary outcome:** Motricity Index (MI) **Secondary outcomes:** Time to achieve mobility milestones, Rivermead Mobility Index, Barthel Index and Nottingham EADL, EuroQoL	Patients in the augmented group received more PT (34 vs. 21 hours). The mean proportion of time spent standing was significantly greater in the augmented group (8.0% vs. 4.8%, p=0.002) There were no significant differences in mean MI scores between groups at baseline, 4 weeks, 3 or 6 months. There were no significant differences between

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			week.		groups in the proportions of patients who achieved a mobility milestone (time to first stand, time to walk 10 paces or time to walk 10 metres). There were no significant differences between groups for any of the secondary outcomes at any of the assessment points.
Horn et al. 2005 **USA** **Prospective study**	N/A	830 patients ≥18 years, with a first-time admission to an inpatient stroke rehabilitation unit, 389 with moderately-sever stroke and 441 with severe stroke. Mean ages were 66.2 years (moderate group) and 67.9 years (severe group).	Data used for this study was from the Post-Stroke Rehabilitation Outcomes Project. The relationship between days from symptom onset to rehabilitation admission, medications, nutritional support, and minutes of PT, OT, and SLP activity per patient per day and discharge total FIM score, was examined, controlling for patent characteristics, stroke symptoms, neurobehavioral impairment, and rehabilitation LOS. Analyses were performed separately for moderate and severe strokes (severity based on case-mix groups (CMGs)). A secondary analysis included patient outcomes according to therapy received during 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), to assess the effect of early intensive therapy. Analysis controlled	**Primary outcomes**: Discharge FIM scores and discharge destination	Mean admission and discharge FIM scores for moderate group were and 71.6 and 97.7. 93.3% of patients were discharged home Mean admission and discharge FIM scores for severe group were 43.1 and 72.3. 67.1% of patients were discharged home. Mean duration of therapy received per day (minutes) for patients with moderate stroke was 43.5 (PT); 40.9 (OT) and 25.6 (SLP). **Patients with Moderate Stroke Severity:** 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 discharge cognitive FIM or some combination of the three. **Patients with Severe Stroke Severity:** 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.

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			for patient characteristics, symptoms, neurobehavioral impairments and length of stay in inpatient rehabilitation.		Similar findings for patients with both moderate and severe strokes.
Kwakkel et al.1997 **Netherlands** **Systematic Review & meta-analysis**	N/A	9 trials (n=1,051) including patients who had sustained a stroke. Mean age was 66.2 years.	Trials examining the effect of different intensities (enhanced or augmented vs. control or usual care) of PT and/or OT. Duration of treatment ranged from one to 8 months	**Primary outcomes:** Measures of ADL, functional outcome (eg., dexterity, walking performance, and walking velocity) and neuromuscular outcome (eg., muscle strength)	Patients in the intervention groups received more daily PT and OT compared with patients in the control groups (48.4 vs. 23.4 minutes and 44.0 vs. 18.5 minutes, respectively) Greater treatment intensity was associated with significantly higher ADL scores (ES=0.28, 95% CI 0.16-0.41; 9 studies), and better neuromuscular outcomes (ES=0.37, 95% CI 0.13-0.62; 5 studies), but not better functional outcome (ES=0.10, 95% CI -0.10 to 0.30, 4 studies).

Transition from Inpatient Rehabilitation & Discharge Planning

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Shepperd et al. 2013 **UK** **Cochrane Review**	NA	24 studies (n=8,039) that included all patients who had been admitted to any type of hospital (acute, rehabilitation or community) with any medical or surgical condition. In 16 RCTs patients were admitted with medical conditions, 2 trials admitted patients ≥65 years following a fall, 4 trials recruited patients with a mix of medical and surgical conditions, and two trials recruited participants from an	Trials evaluated a discharge plan either as a stand-alone intervention, or as a component of a broader intervention vs. usual care in most cases (n=19)	**Primary Outcomes:** Hospital LOS, readmission rates and discharge destination **Secondary outcomes:** Patient mortality, functional, psychosocial, quality of life and health status and patient and caregiver satisfaction and health care costs	The use of discharge plans was associated with a significantly reduced LOS: (MD -0.91; 95% CI -1.55 to -0.27). The results from 10 studies were included. At 3 months following discharge, the use of discharge planning was associated with a significant reduction in readmissions (RR= 0.82; 95% CI 0.73 to 0.92). The results from 12 trials were included. Only 2 trials reported discharge destination as an outcome. In one, patients in the discharge planning group were no more likely to return home, while another reported that patients were more likely to return home. (Difference= 6%; 95% CI 0.4% to 12%). At 6-9 months following discharge, patients in the

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		acute psychiatric ward			control group were no more likely to be dead (OR=1.00, 95% CI 0.79-1.26, p=0.99). Results from 6 trials were included. The results from too few studies were available for pooled analysis of the remaining secondary outcomes. No studies included data reporting costs.
Allen et al. 2009 **USA** **RCT**	CA: ☑ Blinding: Patient☒ Assessor☑ ITT: ☑	380 patients admitted to the stroke unit of an acute care hospital with ischemic stroke, discharged home directly, or within 8 weeks of discharge from hospital following a short stay in a skilled nursing facility	Patients were randomized to receive enhanced post discharge care (n=190) or standard care (n=190). An advanced practice nurse (APN) performed an in-home assessment within 1 week of discharge, the results of which were used to by the multidisciplinary team to form a care plan that was provided to the patient's GP. Follow-up by the APN continued for 6 months (including home visits and telephone calls) in collaboration with the GP to ensure that all aspects of care were coordinated and delivered. Patients in the standard care group received care by their MD.	**Outcomes:** NIHSS, Timed Up & Go test, mortality and institutionalization, QoL, recurrent stroke, blood pressure, depression (CES-D scale), Hgb A_{1c}, cholesterol, self-reported fall, incontinence, stroke knowledge and lifestyle modification (assessed using an investigator-generated questionnaire). All assessments were conducted at baseline and at 6 months	There were no significant differences between groups on any of the outcomes of interest except for significantly increased percentage of patients in the intervention group who could correctly identify stroke symptoms (79% vs. 76%) and risk knowledge (53% vs. 48%). Informal tests for potential interactions revealed that persons with a prior history of stroke, TIA or atrial fibrillation, benefited more from the intervention in terms of improved neuromotor function. Most of the APN time was spent on issues related to self-management and medical management issues.
Mayo et al. 2008 **Canada** **RCT**	CA: ☑ Blinding: Patient☒ Assessor☑ ITT: ☑	190 stroke patients discharged home from 1 of 5 acute care hospitals who were identified as having a specific need for health care supervision following discharge, such as living	Participants were randomized to receive either a case management intervention (n=96) or care as usual (n=94). The intervention involved coordination with the patient's personal physician through telephone contact and home visits with the	**Primary Outcome:** The Physical Component Summary of the Short-Form-36 (SF-36). **Secondary Outcome:** Health Care Utilization, the Medical Component of the SF-36, the	The mean number of nurse visits was 4.8 and the mean number of telephone contacts was 7.4. 60% of the patients had suffered moderately-disabling strokes. Patients were discharged home an average of 12 days following admission.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		alone or having a medical comorbidity. 65% of those screened for eligibility were randomized.	patient over 6 weeks. Persons in the usual care group were instructed to make an appointment with the patient's personal physician as soon as possible	EuroQuol EQ-5D, the Preference-Based Stroke Index, the Reintegration to Normal Living Index, the Barthel Index, the Geriatric Depression Scale, Gait Speed, and the Timed Up and Go Test, healthcare utilization. Assessments were conducted at discharge, following the intervention, and 6-months post stroke.	There were no significant differences between groups on any of the primary or secondary outcomes at any of the assessment points. From the 6-week to 6-month follow-up, patients in case management group had attended fewer mean specialist outpatient visits (2.2 vs. 3.4, p<0.01). Lost to Follow-up: Intervention group=15 (16%); Control group=18 (19%).

Repetitive Task-Specific Therapy

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
French et al. 2016 **UK** **Cochrane Review**	NA	33 RCTs (1,853 participants), which included individuals ≥18 years recovering from a stroke. In 14 trials, only patients who had sustained a first-ever stroke were included, in 6 trials, patients with either a first or recurrent stroke were included. In 10 trials, the mean age was <60 years, and in 7 trials, the mean age was >70 years. Mean time since stroke was within one month (n=10 trials), 1-3 months in 5 trials and ≥3 months in the	Trials evaluated studies in which an intervention of any intensity or duration included an active motor sequence, which was performed repetitively within a single training session, and where the practice was aimed towards a clear functional goal. The control condition varied across trials. Usual care provided in 18 trials. In 11 trials, an attention control was used. The intervention was delivered exclusively	**Primary Outcomes:** Arm function, hand function, change in walking distance, walking speed, functional ambulation, and lower-limb functional measures, assessed at the end of the treatment period **Secondary outcomes:** ADL and global motor function	Repetitive task training was associated with small, but significantly greater improvements in arm function (SMD=0.25, 95% CI 0.01-0.49; results from 11 trials), hand function (SMD= 0.25, 95% CI 0.00- 0.51; results from 8 trials) and sitting balance or reach (SMD=0.28, 95% CI 0.01-0.55; results from 6 trials). Repetitive task training was associated with significantly greater distance walked in 6 minutes (MD=34.80 m, 95% CI 18.19- 51.41; results from 9 trials), significantly higher functional ambulation scores (SMD= 0.35, 95% CI 0.04-0.66; results from 8 trials), significantly higher measures of lower-limb function (SMD= 0.29, 95% CI 0.10- 0.48; results from 5 trials) and significantly higher measures of global motor function (SMD=0.38, 95% CI 0.11-0.65; results from 5 trials).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		remaining trials.	during inpatient rehabilitation in 11 trials and in both inpatient and outpatient settings in 3 trials. 16 trials provided 10- 21 total hours of training; 4 trials provided 30-40 hours and 4 trials provided ≥40 hours.		Repetitive task training was associated with significantly higher measures of ADL (SMD=0.28, 95% CI 0.10-0.45; results from 9 trials). Effects were not modified by intervention type, dosage of task practice or time since stroke for upper or lower limb outcomes, but treatments delivered within 6 months of stroke onset were more effective.

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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