EBRSR

HEART & STROKE FOUNDATION
Canadian Partnership for Stroke Recovery

Chapter 7: Outpatient Rehabilitation

Abstract

With the aging of the general population and an increasing number of stroke survivors, there is growing interest in outpatient stroke rehabilitation as a both an extension of and less expensive alternative to inpatient hospital-based programs. In this chapter, we evaluate the effectiveness of three forms of outpatient rehabilitation, which we have defined as: hospital-based, community-based and early supported discharge. Each will be evaluated again standard or traditional care for an outpatient stroke patient.

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Key Points

Early supported discharge may not be efficacious compared to conventional care for outpatient stroke rehabilitation.

Early supported discharge with home therapy may not be more beneficial than early supported discharge with day clinic therapy for ambulation or balance.

Neither home- nor clinic-based therapy appeared to improve outcomes during outpatient rehabilitation.

Neither home- nor clinic-based therapy appeared to improve mental health or quality of life during outpatient rehabilitation.

Neither home- nor clinic-based therapy appeared to improve outcomes during outpatient rehabilitation.

Modified Sackett Scale

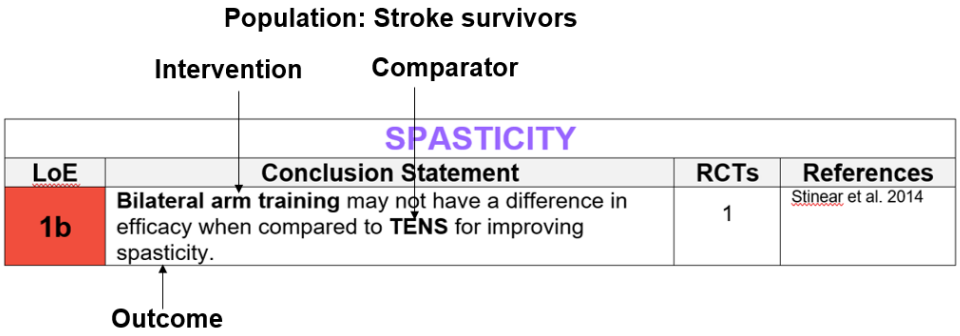
Level of evidence	Study design	Description
Level 1a	Randomized controlled trial (RCT)	More than 1 higher quality RCT (PEDro score ≥6).
Level 1b	RCT	1 higher quality RCT (PEDro score ≥6).
Level 2	RCT	Lower quality RCT (PEDro score <6).
	Prospective controlled trial (PCT)	PCT (not randomized).
	Cohort	Prospective longitudinal study using at least 2 similar groups with one exposed to a particular condition.
Level 3	Case Control	A retrospective study comparing conditions, including historical cohorts.
Level 4	Pre-Post	A prospective trial with a baseline measure, intervention, and a post-test using a single group of subjects.
	Post-test	A prospective post-test with two or more groups (intervention followed by post-test and no re-test or baseline measurement) using a single group of subjects
	Case Series	A retrospective study usually collecting variables from a chart review.
Level 5	Observational	Study using cross-sectional analysis to interpret relations. Expert opinion without explicit critical appraisal, or based on physiology, biomechanics or "first principles".
	Case Report	Pre-post or case series involving one subject.

New to the 19th edition of the Evidence-based Review of Stroke Rehabilitation

1) PICO conclusion statements

This edition of Chapter 13: Neglect rehabilitation interventions synthesizes study results from only randomized controlled trials (RCTs), all levels of evidence (LoE) and conclusion statements are now presented in the Population Intervention Comparator Outcome (PICO) format.

For example:

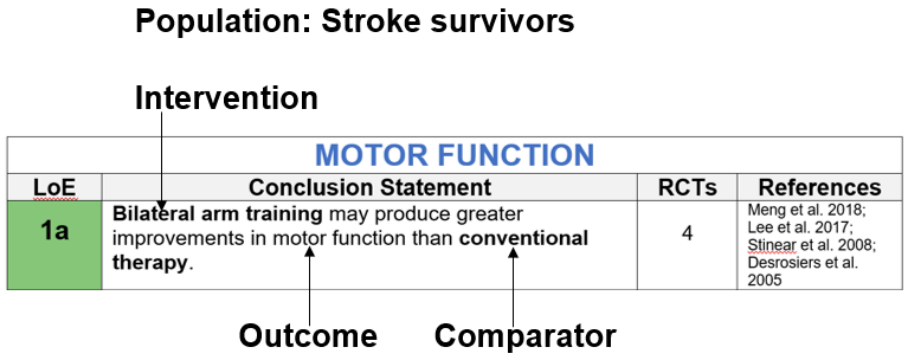


New to these statements is also the use of colours where the levels of evidence are written.

Red statements like above, indicate that the majority of study results when grouped together show no significant differences between intervention and comparator groups.

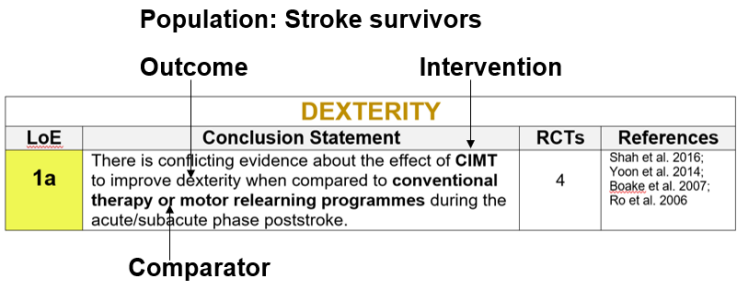
Green statements indicate that the majority of study results when grouped together show a significant between group difference in favour of the intervention group.

For example:



Yellow statements indicate that the study results when grouped together are mixed or conflicting, some studies show benefit in favour of the intervention group, while others show no difference between groups.

For example:



DEXTERITY			
LoE	Conclusion Statement	RCTs	References
1a	There is conflicting evidence about the effect of **CIMT** to improve dexterity when compared to **conventional therapy or motor relearning programmes** during the acute/subacute phase poststroke.	4	Shah et al. 2016; Yoon et al. 2014; Boake et al. 2007; Ro et al. 2006

2) Outpatient rehabilitation outcome measures

Outcome measures were classified into the following broad categories:

Motor function: These outcome measures covered gross motor movements and a series of general impairment measures when using the upper extremities.

Functional ambulation: These outcomes measures assessed ambulatory abilities during distance-based or timed walking exercises commonly.

Balance: These outcome measures assessed postural stability, and both static and dynamic balance

Cognition: These outcome measures assessed an individual's overall cognitive processing capability factoring in multiple domains.

Mental Health: These outcome measures assess psychiatric dysfunction in a number of mental health related dimensions.

Stroke severity: These outcome measures assessed the severity of one's stroke through a global assessment of a multitude of deficits a stroke survivor may experience.

Activities of daily living: These outcome measures assessed performance and level of independence in various everyday tasks.

Quality of Life: These outcome measures assessed an individual's overall quality of life and their perception of it, generally compared to their preinjury status.

Community Reintegration: These outcome measures assess an individual's ability to reintegrate into their community and social behaviours.

Caregiver Burden: These outcome measures assess the level of burden for caretakers of stroke survivors.

Outcome measures that fit these categories are described in the next few pages.

Outcome measure definitions

Upper limb motor Function

Nine Hole Peg Test (9HPT): Is a measure of overall manual dexterity in stroke survivors. The measure consists of 1 functional task. Patients are asked to take 9 pegs out of a container and insert them into the pegboard. Once all 9 pegs are inserted, they are then taken out of the pegs as quickly as possible and placed back in the container. Patients are scored on how quickly they can insert and take out the pins, so the faster the time, the better the outcome. This measure has been shown to have good reliability and concurrent validity (da Silva et al. 2017).

Rivermead Mobility Index (RMI): Is a self-reported measure of the ability of a stroke patient to complete functional tasks. This measure consists of 15 functional tasks (e.g. turning over in bed, stairs, walking outside) which are then rated on 2-point scale completed by the patient in the form of a questionnaire (0=cannot complete task, 1=can complete task). This measure is has been shown to have good reliability and validity (Lennon et al. 2000; Colleen et al. 1991).**

Jebsen-Taylor Hand Function Test (JTHFT): Is a measure used to evaluate fine motor skills with weighted and non-weighted hand functions. The test is derived from hand functions required for activities of daily living and is scored as the time taken (in seconds) to complete each subtest, with a maximum of 120 seconds permitted for each subtest. The test is shown to have good test-retest reliability (Allgower et al. 2017; Stern, 1992)

Motor Club Assessment (MCA): Is a measure of functional movement that indicates balance and movement by assessing the range of active movement for shoulder shrugging, arm lifting, forearm supination, wrist cocking, and finger extension. Each movement is rated on a 3-point scale (where 0 = no movement, and 2 = full range of movement). (Sunderland et al. 1989)

Motor Status Scale (MSS): Is a measure of upper limb impairment and disability following stroke. It is divided into 4 sections and assesses shoulder, elbow/forearm, wrist and hand movements on a 6-point scale (maximum score = 82 points). This clinical scale is thought to provide a more complete measurement of upper-limb motor function than the FMA, as it evaluates the complete range of motor function of the upper limb by employing a finer grading of isolated movements. The scale has been shown to have good validity and reliability (Ferraro et al. 2002; Wei et al. 2011).

Rivermead Motor Assessment (RMA): Is a multi-faced measure that assesses gross motor function, leg and trunk movements and arm movements in post-stroke patients. The arm movements section consists of 15 items ranging from specific isolated movements (e.g. protracting shoulder girdle in supine position) to complex tasks (e.g. placing a string around the head and tying a bow at the back). Patients perform all movements actively, and dichotomous scores indicate either success (score 1) or failure (score 0). The measure is shown to have good test-retest reliability, content validity, and construct validity (Dong et al. 2018, Van de Winckel et al. 2007).

Stroke Rehabilitation Assessment of Movement (STREAM): Is a measure of overall gross motor function in stroke survivors. The measure consists of 30 functional tasks (e.g. filling up and drinking from a cup, walking, getting into and out of the bathtub, buttoning a shirt). These tasks are then subdivided into 3 areas: upper limb, lower limb and basic mobility. Each task is then scored on a 3-point scale (0=cannot complete task, 2=completes task as well as the

unaffected side). This measure has been shown to have good reliability and validity (Mateen et al. 2018).

B. Lindmark Motor Assessment: is a measure used to evaluate motor outcomes in patients post-stoke. The measure is based on the Fugl-Meyer assessment. It has seven domains; active selective movement (31 items), rapid movement changes and coordination (4 items), mobility (8 items), balance (7 items), sensation (13 items), joint pain (9 items), and passive range of motion (26 items). The majority of the items are scored from 0-3, with higher numbers indicating better outcomes. The measure has shown good intra- and inter-rater reliability in acute stroke settings (Kierkegaard & Tollback, 2005).

Functional Ambulation

10-Metre Walk Test: Is a measure used to assess walking speed, in which participants are asked to walk a distance of 10m in a straight line at maximum walking speed. The time taken to perform the task is recorded, and maximum walking speed is reported in m/s. The test is shown to have high interrater and intrarater reliability in stroke (Druzbicki et al. 2018).

Functional Ambulation Category: Is a measure of functional mobility in which participants are ranked on their walking ability with categories ranging from zero, indicating the inability to walk or the requirement of two people assisting, to a 5, corresponding to the ability to walk anywhere independently. This measure has demonstrated excellent test-retest reliability, interrater reliability, and excellent concurrent validity in an acute stroke population (Mehrholz et al. 2007).

Dynamic Gait Index: Is a measure of balance and gait in which participant's ability to adapt while walking around various obstacles is assessed. The assessment is performed over a distance of 20 feet and equipment required includes a shoe box, two obstacles, and stairs. The maximum score is 24 points with a higher score indicating less impairment. This measure has demonstrated excellent test/retest reliability, interrater reliability, and validity (Lin et al. 2010; Jonsdottir & Cattaneo, 2007).

Walking Speed (WS): Is a measure that simply evaluates how quickly a stroke patient can walk and compares that to an age-matched baseline score. This measure consists of the patient walking a set distance (usually 10-15m) with a trained clinician timing them. The patient's time is then compared to the average age-matched score in nonstroke patients. This measure has been shown to have good reliability and validity (Jordan et al. 2007; Himann et al. 1988)

Balance

Trunk Impairment Scale (TIS): Is a measure of static and dynamic sitting balance as well as trunk coordination while a stroke patient is in a sitting position. This measure consists of 2 distinct subscales: static sitting balance and dynamic sitting balance. The static sitting balance subscale consists of 3 functional tasks (e.g. maintaining a sitting position, maintaining a sitting position with legs passively crossed and maintaining a sitting position with legs actively crossed). The dynamic sitting balance subscale consists of 1 functional task (e.g. rotating upper part of the trunk 6 times and then rotating the lower part of the trunk 6 times). These tasks are then graded on a 4-point ordinal scale (0=cannot complete task, 3=completes the task quickly and with ease). This measure has been shown to have good test-retest reliability and validity (Yu & Park 2013; Verheyden et al. 2004).

Berg Balance Scale: Is a 14-item scale that measures balance ability and control while sitting and standing. Each item is ranked on a 4-point scale for a total score of 56. The measure is shown to have high interrater, intrarater, and test-retest reliability (Reinkensmeyer et al. 2019; Blum et al. 2008).

Activities-Specific Balance Confidence Scale: Is a measure of an individual's confidence, in percent, in performing various ambulatory activities without losing balance. It is a self-reported assessment with 16-items that is proven to have high interrater and test-retest reliability in stroke (Ng et al. 2018).

Functional Reach Test: Is a measure of balance assessing the maximum distance a participant can reach forward while standing in a fixed position. The modified version assesses maximum reach while the participant is sitting. This measure has demonstrated excellent test-retest reliability, intrarater reliability, and high face validity within a stroke population (Katz-Leurer et al. 2009; Outermans et al. 2010).

Postural Assessment Stroke Scale (PASS): Is a measure of how well a stroke patient balances in both static and dynamic positions. This measure consists of 12 functional tasks (e.g. sitting without support, standing without support, sit-to stand etc.). These tasks are then divided into 2 distinct subscales (maintaining a posture and changing a posture). The tasks are scored on a 4-point scale (0=cannot complete task, 3=completes task and can hold position for an extended period of time). This measure has been shown to have good inter-rater reliability and validity (Chien et al. 2007; Benaim et al. 1999).

Timed Up & Go Test (TUG): Is a measure of the ability of a stroke patient to perform sequential motor tasks. This measure consists of 1 functional task which involves the patient standing up from a chair, walking 3 metres, turning around and sitting back down again. This task is then evaluated on a scale from 1 to 5 (1=normal function, 5=severely abnormal function). This measure has been shown to have good reliability and validity (Steffen et al. 2002; Shumway-Cook et al. 2000).

Stair Climb Test (SCT): Is a measure of the amount of dynamic balance a stroke patient possesses, as well as their overall aerobic capacity. This measure is scored by having the patient ascend 4-9 stairs while they are being timed by a trained professional. The lower the time, the better the patient's dynamic balance and aerobic www.ebrsr.com Page 28 capacity. This measure has been shown to have excellent inter-rater and test-retest reliability, as well as good validity (Hesse et al. 2012; Almeida et al. 2010).

Dizziness Handicap Inventory: is questionnaire designed to quantify vestibular dysfunction. It contains 25 items ,which are answered yes (4 points), sometimes (2 points) or no (0 points). The questionnaire is also separated into 3 content categories, which are functional (9 items), emotional (9 items) and physical (7 items). The measure has demonstrated good consistency and reliability (Jacobson & Newman, 1990).

Cognition

The Barrow Neurological Institute Screen for Higher Cerebral Functions: is a measure created to screen for cognitive dysfunction. Administration of the measure begins with a pre-screen, where individuals are assessed on arousal levels (3 points), basic communication (3 points) and cooperation (3 points). There are then 7 additional subscales of speech and language (15 points), orientation (3 points), attention/concentration (3 points), visual and visuospatial problem solving (8 points), memory (7 points), affect (4 points) and awareness (1 point). The 7 subscales and the 3 pre-screen scales are combined for a maximum score of 50, with higher scores indicating less impaired functioning (Redfors et al., 2014; Prigatano & Wong, 1999).

Short Portable Mental Status Questionnaire: is a 10-item questionnaire designed to assess intellectual functioning in elderly individuals. Each item is a question with a correct and incorrect answer, and the measure is scored based on the number of errors made (Smyer, Hofland & Jonas, 1979).

Mini Mental Status Examination (MMSE): Is a brief screening tool and quantitative assessment of cognitive impairment. It is one of the most commonly used instruments for this purpose. The exam consists of 11 questions/tasks in 7 cognitive domains: 1) orientation to time; 2) orientation to place; 3) registration of 3 words; 4) attention and calculation; 5) recall of 3 words; 6) language; and 7) visual construction. The test is scored out of 30 possible points, with a score between18 to24 denoting mild impairment and a score between 0 to17 denoting severe impairment. The test has been found to be valid as a screening tool, and is sensitive for detecting moderate/severe impairment, but not mild impairment. It has good interrater reliability. The MMSE is appropriate for screening for post-stroke cognitive impairment (Bour et al. 2010; Tombaugh & McIntyre, 1992; Dick et al. 1984).

Cognitive Test 50: is a relatively short, simple cognitive test that is scored out of a maximum of 50 points. The test is made up of three subcategories (perceptual-perceptual-motor deficits, memory functions and practical problem solving, each containing a variable number of tasks with variable scoring methods (Engberg, Bentzen & Garde, 1995).

Mental Health

Beck Depression Inventory (BDI): Is a widely used instrument for the detection and assessment of the severity of depression. It can be administered by a trained interviewer or as a questionnaire. The BDI is composed of 21 multiple choice sets, each with 4 self-evaluative statements scored on a scale of 0 (least indicative of depression) to 3 (most indicative of depression). Scores are added to provide a total score from 0-63. Generally, a score >19 is associated with clinically relevant depression. The inventory is simple and easy to administer. It also assesses cognitive symptoms more than somatic, making it ideal for assessing depression in the context of stroke. The BDI is externally valid, is internally consistent and has high testretest reliability (Aben et al. 2002; Beck, Steer & Carbin, 1988).

Geriatric Depression Scale (GDS): Is a self-rating screening test for depression in the elderly. A long form of the scale consists of 30 yes/no questions relating to how the examinee felt over the preceding week, while the short form consists of 15 questions. One point is given for each response indicating depression symptoms. Depression severity can be categorized into mild (11-20 long form; 5-9 short form) or moderate-severe (21-30 long form; 10-15 short form). Both versions of the test have been extensively validated. They both have high internal consistency, test-retest reliability, sensitivity and specificity. The test has also been validated for use with elderly stroke patients and found to have a high predictive value (McDowel, 2006; Agrell & Dehlin, 1989; Sheikh & Yesavage, 1986).

Hospital Anxiety and Depression Scale (HADS): Is a measure of depression and anxiety symptomatology designed to detect these disorders among physically ill patients. The scale is divided into an anxiety portion (HADS-A) and a depression portion (HADS-D), each scored out of 21 points. The total test consists of 14 items (7 in each subscale), each evaluated on a 4-point scale. The HADS has been found to be sensitive, specific, have moderate-excellent internal consistency and be a valid and appropriate test for screening post-stroke depression (Aben et al. 2002; Zigmond & Snaith, 1983).

Montgomery-Asberg Depression Rating Scale: is a 10-item questionnaire meant to assess depressive symptoms. Each item is rated on a 6-point Likert scale. Higher scores are indicative of greater levels of depression. The scale has shown good psychometric properties in multiple patient groups and in multiple languages (Kang et al. 2013).

General Health Questionnaire: has many different versions of various sizes, but the 28-item one is the most popular. The tool is meant to identify minor psychiatric disorders and mental health problems. The 28-item version consists of 4 subclasses (somatic symptoms, anxiety/insomnia, social dysfunction and severe depression) each with 7 items. It has been validated and found reliable in 38 different languages (Jackson, 2007).

Aphasia

Reinvang's Aphasia Test: Based on the Boston Diagnostic Aphasia Examination, this assessment is a neuropsychological battery used to assess the presence of aphasia. This test consists of 4 subtests which are: fluency, comprehension, naming and repetition (Reinvang & Graves 1975).

Frenchay Aphasia Screening Test: is a screening measure designed to identify individuals suffering from communication deficits. The screen has 4 subscales (comprehension, verbal expression, reading and writing) for a total score out of 30. The lower the score, the more severe the deficits. This measure has shown good reliability and internal consistency in psychometric evaluations (Enderby et al., 1986).

Stroke Severity

Canadian Neurological Scale (CNS): Is a measure used to assess neurological status of acute phase stroke patients. Ten clinical domains including ,motor rehabilitations, both weakness and response of arm, face and legs are measured along with mentation (speech, orientation and level of consciousness). The scale has demonstrated reliability and concurrent validity (Bushnell et al. 2001).

National Institutes of Health Stroke Scale (NIHSS): Is a measure of somatosensory function in stroke patients during the acute phase of stroke. This measure contains 11 items and 2 of the 11 items are passive range of motion (PROM) assessments delivered by a clinician to the upper and lower extremity of the patient. The other 9 items are visual exams conducted by the clinician (e.g. gaze, facial palsy dysarthria, level of consciousness). Each item is then scored on a 3-point scale (0=normal, 2=minimal function/awareness). This measure has been shown to have good reliability and validity (Heldner et al. 2013; Weimar et al. 2004).

Modified Rankin Scale (MRS): Is a measure of functional independence for stroke survivors. The measure contains 1 item. This item is an interview that lasts approximately 30-45 minutes and is done by a trained clinician. The clinician asks the patient questions about their overall health, their ease in carrying out ADLs (cooking, eating, dressing) and other factors about their life. At the end of the interview the patient is assessed on a 6-point scale (0=bedridden, needs assistance with basic ADLs, 5=functioning at the same level as prior to stroke). This measure has been shown to have good reliability and validity (Quinn et al. 2009; Wilson et al. 2002).

Scandinavian Stroke Scale (SSS): Is a measure of somatosensory function in acute/subacute phase stroke patients. This measure consists of 10 functional tasks (e.g. speech, orientation in space, eye movement) which are rated on a 7-point (0=paralysis/no movement, 6=fully conscious/ as normal as unaffected side). This measure has been shown to have good reliability and validity (Askim et al. 2016; Christensen et al. 2005).

Oxford Handicap Scale: Is a clinician-evaluated assessment that measures the severity of a patient's handicap. This assessment requires specific questions being asked by said clinician about the patient's physical state. These results are then compiled and evaluated on a 6-point scale (0=none/no handicap, 5=severe handicap). This measure has been shown to have good reliability and validity (Perel et al. 2008).

Activities of Daily Living

Adelaide Activities Profile: is measurement of the ability and frequency with which elderly individuals engage in activities of daily living. The measure contains 4 subscales (domestic chores, household maintenance, service to others and social activities). The measure asks elderly individuals to describe their performance of 21 different activities within a three-month period. Each activity is rated from 0-3 to indicate frequency. Larger scores indicate greater frequency. This measure has been shown to have good construct validity and has been translate into multiple languages (Kanashiro & Yassuda, 2011; Bond & Clark, 1998).

Barthel Index (BI): Is a measure of one's ability to perform activities of daily living. The scale consists of 10 items: personal hygiene, bathing, feeding, toilet use, stair climbing, dressing, bowel control, bladder control, ambulation or wheelchair mobility and chair/bed transfers. Each item has a five-stage scoring system and a maximum score of 100 points, where higher scores indicate better performance. The scale is suitable for monitoring on the phone, and is shown to have a high inter-rater reliability (Park, 2018).

Katz Index of Independence in Activities of Daily Living: is a short questionnaire that consists of 6 different activities of daily living. Each activity is scored either 1 (independent) or 0 (dependent), and the points are summed to provide a number between 0-6 which would indicate an individual's overall independence everyday tasks. It has shown good reliability and validity measures (Wallace & Shelkey, 2008).

Rivermead Activities of Daily Living: is a an assessment of independence in activities of daily living. It contains two subscales (domestic and community activities) that each contain 6 items. Each item is scored on a scale from 0-3, with higher scores indicating greater independence. It has shown good reliability and sensitivity (Rossier, Wade & Murphy, 2001).

Frenchay Arm Test (FAT): Is a measure of upper extremity motor control that a stroke survivor possesses. The measure consists of 5 common tasks that require use of the upper extremity (e.g. stabilize a ruler/draw a line with a pencil, comb hair, clip a clothespin onto the edge of a table, grasp a cylinder, drink from a glass of water and then set it down). Each task is then scored on a 2-point scale wherein each task receives either a 0 (unsuccessful completion) or a 1 (successful completion). This measure has been shown to have good reliability and validity in its full form. (Heller et al. 1987; Parker et al. 1986)

Frenchay Activities Index (FAI): Is a measure of activities that stroke survivors have participated in recently. The measure consists of 15 items that are in turn split up into 3 subscales (domestic chores, leisure/work and outdoor activities). These items include: preparing meals, washing clothes, light/heavy housework, social outings etc. Each task is then scored on a 4-point scale with 1 being the lowest score. This measure has been shown to have good reliability and concurrent validity in its full form (Schuling et al. 1993).

Functional Independence Measure (FIM): Is an 18-item outcome measure composed of both cognitive (5-items) and motor (13-items) subscales. Each item assesses the level of assistance required to complete an activity of daily living on a 7-point scale. The summation of all the item scores ranges from 18 to 126, with higher scores being indicative of greater functional independence. This measure has been shown to have excellent reliability and concurrent validity in its full form (Stineman et al. 1996).

Older Adults Resources and Services – Activities of Daily Living Scale: examines how much assistance an individual would need to perform tasks of everyday living. This measure is subscale of a larger assessment but is often used independently. It has two subscales, personal and instrumental ADLs, each containing 7 items. Each item is rated on a 3 point scale from 0-2, with higher scores indicating greater levels of independence (Doble & Fisher, 1998).

London Handicap Scale: is a self-reported questionnaire intended to assess an individual's functional ability and activities of daily living. The questionnaire contains 6 domains; mobility, physical independence, occupation, social integration, social orientation and economic selfsufficiency. Each domain is rated on a 6-point Likert scale, from 'no disadvantage' to 'most severe disadvantage' on that domain. The test is scored between 0 and 1, with lower scores corresponding to a greater disadvantage (Harwood et al. 1994).

Nottingham Extended Activities of Daily Living: is a measure of activities of daily living specifically designed to assess stroke survivors. It consists of 22 questions, each with a 4-point Likert scale assessing varying levels of dependence on the task described in the item. There are four subscales (mobility, kitchen, domestic, leisure), with higher scores indicating greater independence in each area, and overall. Conclusions on its reliability and validity have been mixed (Green & Young, 2001).

Nottingham Leisure Questionnaire: is a self-rated questionnaire meant to assess leisure activity in individuals suffering from disabilities. It contains 30-items, and responses are rated on a 3-point scale based on the frequency with which they complete the activity. Total scores are from 0-60, with higher scores indicating more frequent participation in leisure activities. It has shown an acceptable test-retest reliability and validity (Drummond et al. 2001).

Canadian Occupational Performance Measure (COPM): Is a measure of how well a stroke survivor engages in self-care, productivity and leisure. The measure consists of 25 functional items/tasks (e.g. bathing, ability to work at least part-time, activities involved in). Each task is then scored on a single 10-point rating scale primarily measuring proficiency in each of the 3 sub-categories (self-care, productivity and leisure). This measure has been shown to have good reliability and validity in its full form. (Yang et al. 2017).

Nottingham Stroke Dressing Assessment (NSDA): Is a measure of a stroke survivor's ability to successfully dress themselves. The measure consists of 25 functional dressing tasks (e.g. buttoning up a shirt, buckling a belt/watch, putting on pants). These tasks are then measured on a 4-point scale (0=cannot complete task, 3=completes task as well as the unaffected side). This measure has been shown to have good reliability and validity (Walker et al. 2012).

Assessment of Motor and Process Skills (AMPS): Is a measure of processing skills and overall independence for stroke survivors in performing activities of daily living (ADL) (Ahn et al. 2016). The measure consists of 16 motor tasks (e.g. picking up/setting down a mug, donning/doffing a piece of clothing, turning doorknobs) and 20 process tasks (e.g.memory testing, matching shapes, word recall) (Ahn et al. 2016) Each task is scored on 10 item tool assessing functional ability and the accuracy/speed at which the skill(s) are completed (Lam et al. 2018). This measure has been shown to have good reliability and validity in both its full and abbreviated form (Lam et al. 2018; Ahn et al. 2016).

Lawton Instrumental Activities of Daily Life Scale: Is a measure of functional impairment in more complex daily living skills (in comparison to basic activities of daily living). The scale examines 8 domains of function: ability to use the telephone, shopping, food preparation, housekeeping, laundry, transportation, responsibility for medications, and finances. 1 point is given if the patient is independent and capable in each domain, for a total possible score ranging from 0 (low function and dependent) to 8 points (high function and independent). The scale is a valid and accepted test of functional status and has good interrater reliability (Graf, 2008; Lawton & Brody, 1969).

Instrumental Activity Measure: is a measure designed to assess dependence and perceived difficulty in instrumental activities of daily living. The measure consists of seven items (eg. Meals, cleaning etc…). Items were rated by a therapist during a semi-structured interview on a 7 point Likert scale for dependence, and by the participant on a 4 point likert scale for perceived difficulty. The interview takes a total of roughly three hours (Grimby et al., 1996).

Quality of Life

EuroQol Quality of Life (EQ-5D): Is a widely-used measure of quality of life. It is a brief, selfreported scale covering 5 dimensions: 1) mobility; 2) self-care; 3) usual activities; 4) pain/discomfort; and 5) anxiety/depression. There are two different versions of the scale, one with 3 levels (EQ-5D-3L) and one with 5 levels (EQ-5D-5L) in which subjects rate each dimension from 1 to 3 or 1 to 5, respectively. A "health state" is generated from the score on each dimension, generating a state of 11111 to 33333 in the EQ-5D-3L or 11111 to 55555 in the EQ-5D-5L, with lower numbers representing better health-related quality of life. A summary value can be calculated from each health state to generate a value from 0 to 1. In the second part of the test, subjects rate their current state of health from 0 (worst imaginable) to 100 (best possible) on a visual analogue scale (EQ VAS). The EuroQol scale has been extensively validated in many populations, including stroke survivors. The scale has also been shown to have good reliability (Golicki et al. 2015; Janssen et al. 2013).

Dartmouth co-op charts: is a measure of quality of life and health status. It consists of 9 domains (physical function, emotional function, daily activities, social activities, social support, change in health, overall health, pain and quality of life). (Mant et al. 2000).

Pearlman's Quality of Life Scale: is a single 6-point self-rated Likert scale (1-6) that ranges from 1 – "about as good as it can possibly be", to 6 – "Terrible, my quality of life is very bad" (Pearlman & Uhlmann, 1991).

Life Satisfaction Index: is a semi structured interview rated assessment of an individual's well-being. The measure is scored on 5 subscales (zest vs apathy, resolution and fortitude, congruence between desired and achieved goals, positive self-concept and mood/tone) each scored from 1-5, with higher scores indicating a better outcome (Neugarten, Havighurst & Tobin, 1961).

Medical Outcome Trusts' Short Form Health Survey (SF-36 or SF-12): Is a commonly used measure of health-related quality of life and overall health status. The test contains 36 items (or 12) encompassing 8 subscales: 1) physical functioning; 2) role limitations – physical; 3) bodily pain; 4) general health; 5) vitality; 6) social functioning; 7) role limitations – emotional; and 8) mental health. The result of each subscale is transformed to a score from 0-100 representing the lowest and highest possible scores, respectively. Two summary measures, physical and mental health, are generated by weighting the relevant subscales. The test has been validated in a wide range of populations, including stroke and traumatic brain injury patients. (Guilfoyle et al. 2010; Hagen, Bugge & Alexander, 2003).

Nottingham Health Profile: is an assessment about an individual's perceived health status and quality of life. It contains 38 questions in 6 subdomains (energy, pain, emotional reaction, sleep, social isolation and physical abilities) that are all weighted so that the sum of their score is equal to 100. It also contains a second part, which assesses whether their health is causing problems in certain areas of life (eg. Work, vacations). It has shown good consistency and reliability, as well as sensitivity (Wann-Hansson et al. 2004).

Sickness Impact Profile: is an assessment of quality of life. It is divided into 12 subdomains, covering 3 major domains (physical, psychological, and social). There are 136 items total, each one a 'yes' or 'no' question. The measure has shown good psychometric properties (Stummer et al. 2015).

Community Reintegration

McMaster Family Assessment Device: is a questionnaire developed as a screening instrument to assess family functioning and identify problem areas. It contains 7 different subscales (problem solving, communication, roles, affective responsiveness, affective involvement, behavior control and general functioning) which are based off of the McMaster Model of Family Functioning. The questionnaire contains a total of 53 items that are rated on a 4 point scale from 'strongly disagree' to 'strongly agree'. It has been shown to be both reliable and valid in a number of clinically and culturally different populations (Shek, 2001; Kabacoff et al., 1990; Epstein, Baldwin & Bishop, 1983).

Reintegration to Normal Living Index (RNLI): Assesses the degree to which individuals who had experienced traumatic or incapacitating illness achieve reintegration into normal social activities. It consists of 11 items with domains of: daily functioning, recreational and social activities, family roles, personal relationships and perception of self. Each statement is rate on a visual analogue scale (1-minimal reintegration, 10-maximum reintegration). The tool has been validated for self-administration in stroke survivors (McKellar et al. 2015).

Subjective Index of Physical and Social Outcome: is a 10-item measure that was developed for stroke survivors to assess social integration and community participation. Each item is scored on a 5 point scale (0-4) with lower scores indicating poor integration. The measure has shown good reliability and validity in psychometric evaluations (Trigg & Wood, 2003).

Brief Assessment of Social Engagement: is a measure designed to assess both actual and symbolic participation in social settings of elderly individuals. It contains 20 dichotomously rated items, with higher scores indicating greater participation (Bennett, 2002).

Caregiver Burden

Caregiver Strain Index: is a measure designed to assess caregiver burden. It consists of 13 items in the form of a statement, which is answered with a binary yes or no. Yes answers are counted as one point, and the total score is the number of yes'. Higher scores indicate greater levels of burden, with scores of seven or greater considered 'high burden'. It is one of the most widely used measures for assessing caregiver burden (Post et al., 2007).

Early Supported Discharge

Adapted from: https://www.gethealthystayhealthy.com/articles/preparing-for-hospital-discharge

With the aging of the general population and an increasing number of stroke survivors, there is growing interest in outpatient stroke rehabilitation as both an extension to and a less expensive alternative to in-patient hospital-based programs. Debate continues as to which setting provides the best opportunity for continued improvement following discharge from inpatient rehabilitation. Arguments in favour of hospital, community, and home-based outpatient programs have all been made. There is also debate as to whether early-supported discharge programs may, in fact, be superior to inpatient rehabilitation for a select group of patients which is later addressed in this chapter.

Early supported discharge (ESD) programs arose from a recognition that many patients preferred being home following a stroke and that inpatient interdisciplinary stroke rehabilitation may not be necessary for some stroke patients in need of rehabilitation or even be associated with the best outcomes. Since the goal of therapy is to establish skills that are applicable to the home environment, where better to learn but in one's home? Critics of ESD argue that most patients are already discharged as soon as it is feasible and with increasing pressures on rehabilitation length of stay that is becoming increasingly the case; however, not all have immediate access to outpatient stroke rehabilitation.

A Cochrane Review assessing the efficacy of ESD for acute stroke patients, conducted by the Early Supported Discharge Trialists, was first published in 2001 and most recently updated in 2017 (Langhorne & Baylan, 2017). The purpose of this review was to determine whether ESD, with appropriate community support, could be as effective as conventional inpatient rehabilitation and reduce the length of hospital stay. ESD interventions in these studies were designed to accelerate the transition from hospital to home. The review included the results from 17 trials (2,422 patients).

A variety of outcomes were assessed comparing early supported discharge with conventional care at the end of scheduled follow up, which ranged from 3 to 5 years. The results are presented in Table 1.

Table 1. Results of a Cochrane review on ESD

Outcome	Significant Result (Y/N)	OR and 95% CI or * Weighted Mean Difference and 95% CI
Death	No	1.04 (0.77 to 1.40)
Death or need for institutionalization	Yes	0.75 (0.59 to 0.96)
Death or dependency	Yes	0.80 (0.67 to 0.95)
ADL Barthel Index scores	No	0.03 (-0.07 to 0.13) *
Length of initial hospital stay (days)	Yes	-5.54 (-8.81 to –2.91)*
Subjective Health status	No	-0.01 (-0.12 to 0.10) *
Mood Status	No	-0.06 (-0.19 to 0.07)*
Satisfaction with services	Yes	1.60 (1.08 to 2.38) *
Number of readmissions to hospital	No	1.09 (0.79 to 1.51)

In a further breakdown of the meta-analysis, there were three types of ESD service organization identified in the review:

1. ESD team with coordination and delivery: a multidisciplinary team, which coordinated discharge from hospital and post discharge care, and provided rehabilitation therapies in the home.
2. ESD team coordination: discharge and immediate post discharge plans were coordinated by a multidisciplinary care team, but rehabilitation therapies were provided by community-based agencies.
3. No ESD team coordination: therapies were provided by uncoordinated community services or by health-care volunteers.

As hypothesized by the authors, the increasing coordination of services was associated with an improved outcome (see Table 2).

Table 2. Outcome At End Of Scheduled Follow-Up (ESD Vs. Conventional Care) Stratified By Level Of Service Provision (More Coordinated To Less Coordinated) (Langhorne & Baylan, 2017)

Death or dependency	Significant Result (Y/N)	Odds Ratio (OR) and 95% CI
Overall result	Yes	0.80 (0.67 to 0.95)
ESD team with coordination and delivery	Yes	0.67 (0.52 to 0.87)
ESD team coordination	Yes	0.82 (0.61 to 1.10)
no ESD team coordination	No	1.11 (0.75 to 1.62)

Potential for Cost Savings of ESD

Several of the RCTs included in the above review included an economic component in their study in an attempt to establish if ESD was associated with cost savings. Although Beech et al.

(1999) found that the cost of ESD was 8% less compared with conventional inpatient rehabilitation; the authors concluded that early community discharge was *"unlikely to lead to financial savings"* and its primary benefit was increasing the capacity of limited hospital beds. The relatively small cost savings from early discharge would be offset by increased financial costs of community-based rehabilitation services. The community-based rehabilitation costs, *"would depend on (1) whether the community rehabilitation was introduced by reorganizing existing staffing establishments and (2) whether the increased demands on community health and social services could be absorbed within existing staffing structures."* Teng et al. (2003) in a follow-up study of Mayo et al. (2000), found that the total costs associated with the home care group after three months was significantly less compared to the usual care group ($7,784 vs. $11,065 Canadian, p<0.0001)(Figure 7.2). Fjaertoft et al. (2005) reported that although there was a significant reduction in inpatients days after 52 weeks (66 days for ESUS vs. 85 days for OSUS, p=0.012), this was not associated with a corresponding statistically significant reduction in mean total cost (18,937 EUR for ESUS vs. 21,824 EUR for OSUS).

Several systematic reviews have also been conducted on this topic. Brady et al. (2005) published an economic evaluation of ESD services including the results from 8 RCTs that included costing data. Using the data from the 6 studies with higher methodological quality, ESD was associated with cost-savings of 4 to 30 percent; however, the savings reached statistical significance in only a single study (Teng et al., 2003). The authors noted that it was difficult to generalize these findings since there were large variations in service delivery. For example, the duration of home rehabilitation varied from 4 weeks to 4 months. However, they did conclude that ESD could be provided at a modestly lower cost compared with inpatient rehabilitation for patients suffering from mild or moderate disability.

Larsen et al. (2006) conducted a systematic review of ESD including an examination of the costs compared with the alternative intervention, usually inpatient stroke rehabilitation. Using the results from 5 previously published RCTs, the average cost of home rehabilitation, which included an average of 11 home therapy sessions, was $1,340 USD per person. Although the authors do not provide the cost associated with inpatient rehabilitation they did report the cost average cost savings in bed days and nursing home stays, amounting to $140 USD per person. These authors concluded that ESD was the dominant intervention, since it was associated with both a cost savings and improved outcome, in the form of a reduction in the odds of death or institutionalization (OR: 0.75, 95% CI 0.46 to 0.95).

Saka et al. (2009) also examined the cost-effectiveness of stroke unit care combined with ESD using data on outcome from a previous trial (Rudd et al., 1997). The authors reported that at the end of 10 years, the combination of ESD and SU care was more cost-effective than a SU without ESD. The incremental cost-effectiveness ratio was £17,721 (increased incremental cost of £1,400/ increase of 2.23 quality adjusted life year gained per patient), which was below the willingness to pay threshold of £30,000 in the UK. The authors of this study converted Barthel Index scores to a measure of health-related quality of life using an unconventional method. For this reason the results should be interpreted cautiously.

Included as part of systematic review assessing the economic evidence for all integrated care provided to patients recovering from stroke across the spectrum of inpatient programs to the community, Tummers et al. (2012) reported on six ESD studies that met inclusion criteria. The studies included were all RCTs reporting no evidence for adverse effects on patient outcomes with ESD programs relative to the comparator group. Cost savings with ESD services were

reported for all studies (4%-30% cost reduction); however only one study by Teng et al. (2003) was statistically significant; these results were similar to those found in Brady et al. (2005).

Potential cost savings associated with the implementation of ESD programs, when part of larger package of interventions including increased use of thrombolytic agents and stroke units was recently examined in a model including stroke admissions over a 3-year period in Canada. Cost avoidance associated specifically with increased use of ESD programs was estimated to be $133 million and $25.1 million, in direct and indirect costs, respectively (Krueger et al., 2012).

Effective Elements of an ESD Program

The results from a consensus panel including 10 of the authors whose RCTs had been included in a Cochrane ESD review, using a modified Delphi process to determine who should be included in an ESD team and what features it should include (Fisher et al., 2011). There was strong agreement (i.e. 100%) that the members of the team should have specialized stroke care knowledge and that the team should be multidisciplinary, including: a physiotherapist, occupational therapist and a nurse. There was also strong agreement that an ESD team should be hospital-based, organised by a team coordinator and each patient be assigned a key person to coordinate their care. There was also strong agreement that ESD teams should meet on a weekly basis.

An additional consensus process was undertaken including 26 participants from the U.K., to build on the ESD work, for community based rehabilitation services in general (Fisher et al., 2013). Participants agreed (73%) that community stroke rehabilitation teams are distinct from ESD programs, but offer complimentary services. If patients are eligible for ESD and have ongoing rehabilitation needs, 96% of participants agreed that they should also have access to community rehabilitation services. Participants strongly agreed (92%) that ESD services could be provided by a community rehabilitation team given they are sufficiently and appropriately resourced, somewhat contradicting the authors consensus panel's recommendation of a hospital-based approach. Additionally, 92% of participants strongly agreed that those patients who are not eligible for ESD should have access to community rehabilitation if necessary when discharged, and if a stroke survivor has complex needs related to the stroke, they should only be transferred to the community when the appropriate supports are in place (Fisher et al., 2013).

A review of evidence for ESD implementation highlighted that ESD services should be composed of a multidisciplinary team with stroke specialists, the team should work cohesively, and specific patient eligibility criteria should be in place (Mas & Inzitari, 2012).

17 RCTs were found evaluating early supported discharge for outpatient rehabilitation. All 17 RCTs compared early supported discharge to conventional care (Sanatana et al., 2017; Gjelsvik et al., 2014; Hofstad et al., 2014; Torp et al., 2006; Askim et al., 2004; Donnely et al., 2004; Bautz-Holter et al., 2002; Suwanwela et al., 2002; Anderson et al., 2000; Indredavik et al., 2000; Kalra et al., 2000; Mayo et al., 2000; Duncan et al., 1998; Holmqvist et al., 1998; Ricauda et al., 1998; Rodgers et al., 1997; Rudd et al., 1997). One RCT also compared early supported discharge home to early supported discharge to a day clinic (Gjelsvik et al., 2014).

The methodological details and results of all 17 RCTs are presented in table 3.

Table 3. RCTs evaluating early supported discharge for outpatient therapy

Authors (Year) Study Design (PEDro Score) Sample Size$_{start}$ Sample Size$_{end}$ Time post stroke category	Interventions Duration: Session length, frequency per week for total number of weeks	Outcome Measures Result (direction of effect)
Santana et al. (2017) RCT (6) N_{Start}=190 N_{End}=148 TPS=Acute	E: Early Supported Discharge with home-based rehabilitation (8 sessions, 1mo) C: Conventional Care Duration: 6mo	• Functional Independence Measure (-) • Frenchay Activities Index (-)
Gjelsvik et al. (2014) RCT (6) N_{Start}=167 N_{End}=105 TPS=Acute	E1: Early supported discharge with treatment in a community day unit (out) E2: ESD with treatment at home (via home visits from the community health team), C: Received treatment as usual care without any intervention Duration: 3mo	E1 vs E2 • Postural Assessment Scale for Stroke (-) • Trunk Impairment Scale (+exp2) • Self-report on Walking (-) • Barthel Index (-) • Timed Up and Go (-) • 5m Timed Walk (-) E1 vs C • Postural Assessment Scale for Stroke (-) • Trunk Impairment Scale (-) • Self-report on Walking (+exp1) • Barthel Index (+exp1) • Timed Up and Go (-) • 5m Timed Walk (-) E2 vs C • Postural Assessment Scale for Stroke (-) • Trunk Impairment Scale (+exp2) • Self-report on Walking (-) • Barthel Index (+exp2) • Timed Up and Go (-) • 5m Timed Walk (-)
Hofstad et al. (2014) RCT (6) N_{Start}=306 N_{End}=229	E1: Early supported discharge (ESD) with treatment in a community day unit E2: ESD with treatment at home (via home visits from the community health team) C: Received treatment as usual care Duration: 3mo	E1 + E2 vs C • Modified Rankin Scale (-) • Barthel Index (-) • National Institutes of Health Stroke Scale (-)
Torp et al. (2006) RCT (6) N_{Start}=373 N_{End}=178 TPS=Acute	E: Received care from an interdisciplinary stroke team C: Received standard care Duration: 6mo	• Barthel Index (-) • Mini Mental State Exam (-) • Short Form 36 – Physical Component (-) • Short Form 36 – Mental Component (-) • Social network (-)
Askim et al. (2004) Askim et al. (2006) RCT (7) N_{Start}=62 N_{End}=60 TPS=Acute	E: Extended stroke unit with early supported discharge C: Ordinary stroke unit service Duration: 26wks	• Barthel Index (-) • Modified Rankin (-) • Berg Balance Scale (-) • Walking Speed (-) • Mortality (-) • Nottingham Health Profile – all subscales (-) • Except: Social (+exp) • Caregiver Strain Index (-)
Donnelly et al (2004) RCT (7) N_{Start}=113	E: Community-based rehabilitation with early discharge C: Conventional care	• Barthel Index (-) • Nottingham ADL (-) • 10m timed walk (-)

N_{End}=97 TPS=Acute	Duration: 12mo	• EuroQoL (-) • SF-36 (-) • Patient satisfaction (+exp) • Carer Strain Index (-)
Bautz-Holter et al. (2002) RCT (8) N_{Start}=82 N_{End}=66 TPS=Acute	E: Early supported discharge with home rehabilitation C: Conventional rehabilitation Duration: 3mo	• Nottingham EADL – all subscales (-) • General Health Questionnaire (+exp) • Montgomery Asberg Depression Rating Scale (-)
Suwanwela et al. (2002) RCT (5) N_{Start}=102 N_{End}=102 TPS=Acute	E1: Receive hospitalization for 3 days followed by home rehabilitation provided by family members and Red Cross volunteers E2: Receive conventional 10 day hospitalization (in patient rehab) Duration: 6mo	• NIHSS (-) • Barthel Index (-) • Modified Rankin Scale (-) • Mortality (-)

Anderson et al. (2000)
RCT (8)
N_{Start}=86
N_{End}=49
TPS = Acute/Subacute
	E: Early supported discharge with home rehabilitation (median 5wks, range 1-19wks)
	C: Conventional rehabilitation
	Duration: 6mos
		• SF-36 – all subscales (-)
		• Modified Barthel Index (-)
		• Adelaide Activities Profile – all subscales (-)
		• Nottingham Health Profile (-)
		• Care satisfaction (-)
		• McMaster Family Assessment Device (-)
		• Mortality (-)
		• Falls (-)
		
		Caregiver
		
		• SF-36 for all subscales (-)
		  • Except: mental health (+exp)
		• General health questionnaire – all subscales (-)
		• Adelaide Activities Profile – all subscales (-)
		  • Except: household maintenance (+exp)
		• Nottingham Health Profile (-)
		• Care satisfaction (-)
		• McMaster Family Assessment Device (-)

Indredavik et al. (2000) Fjaertoft et al (2003) Fjaertoft et al. (2004) Fjaertoft et al. (2005) Fjaertoft et al. (2011) RCT (7) N_{Start}=320 N_{End}=NR TPS=Acute	E: Receive care on an enhanced stroke unit with early supported discharge (out) C: conventional care Duration: 26wks	• Barthel Index ≥ 95 (-) • Modified Rankin ≤ 2: (+exp) Follow up at 52wk • Nottingham Health Profile (+exp) • Frenchay Activities Index (-) • Montgomery Asberg Depression Scale (-) • Mini Mental State Exam (-) • Caregiver Strain Index (-)
Kalra et al. (2000) RCT (8) N_{Start}=457 N_{End}=449 TPS=Acute	E1: Receive care on a stroke unit (IQR physiotherapy time 12hrs – 39.3hrs) E2: Receive care by a stroke team (IQR physiotherapy time 2.7hrs – 10.7hrs) E3: Receive care at home (ESD) (IQR physiotherapy time 3hrs – 13.8hrs) Duration: 3mo	E1 vs E2 • Barthel Index (+exp1) • Modified Rankin Scale (+exp1) • Mortality (+exp1) E1 vs E3 • Barthel Index (+exp1) • Modified Rankin Scale (-) • Mortality (-) E2 vs E3 • Barthel Index (-) • Modified Rankin Scale (-) • Mortality (-)

Mayo et al. (2000) RCT (7) N_{Start}=114 N_{End}=96 TPS=Acute	E: Receive home intervention after early supported discharge C: Receive usual post stroke care Duration: 4wks	• Barthel Index (-) • Timed Up &Go (-) • Reintegration to Normal Living (-) • Stroke Rehabilitation Assessment of Movement (-) • Older Americans Resource Scale - IADL (-) • Short Form 36 – all subscales (-) • Except: Physical health (+exp)
Duncan et al. (1998) RCT (5) N_{Start}=20 N_{End}=20 TPS=Subacute	E: Receive home based exercise program (8wks) C: Receive usual post-stroke care. Duration: 3mo	• Gait velocity (+exp) • Berg balance scale (-) • 6-minute walk test (-) • Barthel index (-) • Lawton Instrumental ADLs (-) • Short Form 36 – Physical Component (-) • Jebsen Test of Hand Function (-)

Holmqvist et al (1998)
von Koch et al. (2000)
von Koch et al (2001)
Thorsen et al. (2005)
Ytterberg et al. (2010)
RCT (7)
N_{Start}=81
N_{End}=81
TPS=Acute
	E: Receive early supported discharge with continuity of rehabilitation at home
	C: Receive routine rehabilitation service
	Duration: 3mo
		• Barthel Index (-)
		• Katz ADL (-)
		• Frenchay Activities Index (-)
		• Lindmark Motor Capacity (-)
		• Nine-hole peg test (-)
		• 10 metre timed walk (-)
		• Reinvag Aphasia Test (-)
		• Sickness impact profile
		  • Physical dimension (-)
		  • Psychosocial dimension (+exp)
		  • Independent categories (-)

Ricauda et al. (1998) RCT (3) N_{Start}=40 N_{End}=40 TPS=NR	E: Rehabilitation at home C: Rehabilitation at general medical ward Duration: until 'discharge'	• Functional Independence Measure (+exp) • Mortality (-) • Short Portable Mental Status Questionnaire (+exp)
Rudd et al. (1997) RCT (7) N_{Start}=331 N_{End}=262 TPS=Acute	E: Receive specialist community rehabilitation for up to 3 months after discharge C: Receive conventional care Duration: 12mo	• Barthel Index (-) • Frenchay Aphasia (-) • Hospital Anxiety and Depression Scale – Anxiety (+exp) • Hospital Anxiety and Depression Scale – depression (-) • Mini mental state exam (-) • Motricity Index (-) • 5m walk test (-) • Rivermead ADL (-) • Total Nottingham Health Profile (-) • Caregiver strain Index (-)
Rodgers et al. (1997) RCT (6) N_{Start}=92 N_{End}=87 TPS=	E: Early support discharge C: Conventional care Duration: 3mo	• Oxford handicap Scale (-) • Nottingham Extended ADL (-) • Darmouth Coop Global Health Status (-) • General Health Questionnaire – carers (-)

Abbreviations and table notes: C=control group; D=days; E=experimental group; H=hours; Min=minutes; RCT=randomized controlled trial; TPS=time post stroke category (Acute: less than 30 days, Subacute: more than 1 month but less than 6 months, Chronic: over 6 months); Wk=weeks.
+exp indicates a statistically significant between groups difference at α=0.05 in favour of the experimental group
$+exp_2$ indicates a statistically significant between groups difference at α=0.05 in favour of the second experimental group
+con indicates a statistically significant between groups difference at α=0.05 in favour of the control group
- indicates no statistically significant between groups differences at α=0.05

Conclusions about early supported discharge

MOTOR FUNCTION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving motor function.	4	Mayo et al., 2000; Duncan et al., 1998; Holmqvist et al., 1998; Rudd et al., 1997

AMBULATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving ambulation.	6	Gjelsvik et al., 2014; Askim et al., 2004; Donnely et al., 2004; Duncan et al., 1998; Holmqvist et al., 1998; Rudd et al., 1997
1b	**Early supported discharge with home therapy** may not have a difference in efficacy compared to **early supported discharge with day clinic therapy** for improving ambulation.	1	Gjelsvik et al., 2014

BALANCE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving balance.	6	Gjelsvik et al., 2014; Askim et al., 2004; Mayo et al., 2000; Duncan et al., 1998
1b	**Early supported discharge with home therapy** may not have a difference in efficacy compared to **early supported discharge with day clinic therapy** for improving ambulation.	1	Gjelsvik et al., 2014

COGNITION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving cognition.	4	Torp et al., 2006; Ricauda et al., 1998; Rudd et al., 1997

MENTAL HEALTH			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving mental health.	3	Bautz-Holter et al., 2002; Indredavik et al., 2000; Rudd et al., 1997
1a	**For caregivers:** **Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving mental health.	2	Anderson et al., 2000; Rodgers et al., 1997

APHASIA			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving aphasia.	2	Holmqvist et al., 1998; Rudd et al., 1997

ACTIVITIES OF DAILY LIVING			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving activities of daily living.	17	Sanatana et al., 2017; Gjelsvik et al., 2014; Hofstad et al., 2014; Torp et al., 2006; Askim et al., 2004; Donnely et al., 2004; Bautz-Holter et al., 2002; Suwanwela et al., 2002; Anderson et al., 2000; Indredavik et al., 2000; Kalra et al., 2000; Mayo et al., 2000; Duncan et al., 1998; Holmqvist et al., 1998; Ricauda et al., 1998; Rodgers et al., 1997; Rudd et al., 1997
1b	**For caregivers:** **Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving activities of daily living.	1	Anderson et al., 2000

QUALITY OF LIFE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving quality of life.	10	Torp et al., 2006; Askim et al., 2004; Donnely et al., 2004; Anderson et al., 2000; Indredavik et al., 2000; Mayo et al., 2000; Duncan et al., 1998; Holmqvist et al., 1998;; Rodgers et al., 1997; Rudd et al., 1997
1b	**For caregivers:** **Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving quality of life.	1	Anderson et al., 2000

STROKE SEVERITY			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving stroke severity.	6	Hofstad et al., 2014; Askim et al., 2004; Suwanwela et al., 2002; Indredavik et al., 2000; Kalra et al., 2000; Rodgers et al., 1997

COMMUNITY REINTEGRATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving community reintegration.	3	Torp et al., 2006; Anderson et al., 2000; Mayo et al., 2000
1b	**For caregivers:** **Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving community reintegration.	1	Anderson et al., 2000

CAREGIVER BURDEN			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Early supported discharge** may not have a difference in efficacy compared to **conventional care** for improving caregiver burden.	4	Askim et al., 2004; Donnely et al., 2004; Indredavik et al., 2000; Rudd et al., 1997

Key Points

Early supported discharge may not be efficacious compared to conventional care for outpatient stroke rehabilitation.

Early supported discharge with home therapy may not be more beneficial than early supported discharge with day clinic therapy for ambulation or balance.

Outpatient Stroke Rehabilitation

Adapted from: https://ten-pac.com/blog/tenzing-pacific-blog-1/post/inpatient-vs-outpatient-9

Outpatient therapy in the sub-acute phase of stroke (4-8 weeks post stroke) is often prescribed following discharge from in-patient stroke rehabilitation units. Continuing therapy may include hospital-based "day" hospital programs or home-based rehabilitation.

The Outpatient Service Trialists (2003) identified 14 studies that had randomized stroke patients to receive specialized outpatient therapy-based interventions (usually physiotherapy/occupational therapy or occupational therapy alone which largely focused on modifying task-oriented behaviour such as walking or dressing) or no routine treatment, including the results from 1,617 patients.

Outpatient therapy was associated with an improvement in ADL and EADL function at the end of scheduled follow-up but was not associated with reductions of death or dependency, nor did it affect the outcomes assessed for carers.

A Cochrane review (Aziz et al. 2008) evaluated the benefit of therapy-based rehabilitation programs initiated more than one-year following stroke. Five trials were identified involving 487 subjects (Green et al., 2002; Mulder et al., 1986; Sackley et al., 2006; Wade et al., 1992; Werner & Kessler, 1996). The authors concluded that there was insufficient evidence to demonstrate that therapy was superior to usual care, which usually amounted to no additional care.

A recent meta-analysis (Ferrarello et al., 2011) including the results from 15 RCTs that examined the benefit of additional therapy late (>6 months) following stroke. The majority of the studies provided physiotherapy in an outpatient setting. The length of treatment ranged from 6 to 52 hours. The combined treatment effect for all outcomes assessed was 0.29, 95% CI of 0.14 to

0.45, indicating a small effect. The treatment effect associated with ADL was small and not significant (0.08, p=0.58).

16 RCTs were found evaluating home or hospital outpatient rehabilitation within 6 months of the index stroke. 12 RCTs compared home-based outpatient therapy to conventional care (Chaiyawat & Kulkantrakorn, 2012; Chiu & Man, 2004; McClellan & Ada, 2004; Ricauda et al., 2004; Evans et al., 2001; Andersen et al., 2000; Gilberston et al., 2000; Wolfe et al., 2000; Walker et al., 1999; Goldberg et al., 1997; Forester & Young, 1996; Corr & Bayer, 1995). Two RCTs compared clinic-based outpatient therapy to conventional care (Welin et al., 2010; Hui et al., 1995). One RCT compared client-centered occupational therapy in a nursing home to conventional care in nursing home (Sackley et al., 2006). One RCT compared enhanced home therapy to conventional home therapy (Logan et al., 1997).

The methodological details and results of all 16 RCTs are presented in in Table 4.

Table 4. RCTs evaluating hospital or home-based outpatient rehabilitation within 6 months of the stroke

Authors (Year) Study Design (PEDro Score) Sample Size$_{start}$ Sample Size$_{end}$ Time post stroke category	Interventions Duration: Session length, frequency per week for total number of weeks	Outcome Measures Result (direction of effect)
Home-based therapy vs conventional care		
Chaiyawat & Kulkantrakorn (2012) RCT (7) N_{Start}=60 N_{End}=58 TPS=Acute	E: Home based physiotherapy (6mo) C: Standard care Duration: 2yrs	• Barthel Index (+exp) • Thai Mini-mental State Exam (-) • Hospital Anxiety & Depression Scale (+exp)
Chiu & Man. (2004) RCT (7) N_{Start}=53 N_{End}= TPS=Acute	E: Additional home-based intervention for use bathing devices C: no additional intervention Duration: 3mo	• Functional Independence Measure (-)
McClellan & Ada (2004) RCT (8) N_{Start}=26 N_{End}=23 TPS=Subacute/Chronic	E: 6 week home based rehabilitation C: Upper limb home based care Duration: 6wks	• Functional reach test (+exp) • Motor Assessment Scale - Walking (-) • Stroke Adapted Sickness Impact Scale (-)
Ricauda et al. (2004) RCT (7) N_{Start}=120 N_{End}=75 TPS=Acute	E: Home based multidisciplinary rehabilitation immediately post-stroke C: Standard inpatient care Duration: 6mo	• 6-point ADL score (-) • Functional Independence Measure (-) • Canadian Neurological Scale (-) • National Institutes of Health Stroke Scale (-) • Geriatric Depression Scale (+exp)
Evans, Robert & Hendricks. (2001) RCT (4) N_{Start}=180 N_{End}=180 TPS=Subacute	E: Home Based Rehabilitation C: Conventional Care Duration: 3mo	• Functional Independence Measure (-) • Short Form 36 (-) • Mental Health Index (-) • Social Support Questionnaire (-) • Family Assessment Device (-)
Andersen et al. (2000) Andersen et al. (2002) RCT (8) N_{Start}=155 N_{End}=133 TPS=Subacute	E1: Home based physician visits (3x) E2: Home based physiotherapy rehabilitation (6wks) C: Standard care Duration: 6mo	E1/E2 vs C • Length of stay (+exp1, exp2) • Readmission (+exp1, exp2) • Functional Quality of Movement Scale (-) • Barthel Index (-) • Frenchay Activities Index (-) • Instrumental Extended ADLs (-)
Gilbertson et al (2000)	E: Occupational therapy at home (10 visits)	• Nottingham Extended ADL (+exp)

RCT (8) N_{Start}=138 N_{End}=133 TPS=Subacute	C: Standard rehabilitation Duration: 8wks	• Barthel Index (+exp)
Wolfe et al. (2000) RCT (7) N_{Start}=43 N_{End}=32 TPS=Subacute	E: Home based rehabilitation team C: Standard community care Duration: 1yr	• Barthel Index (-) • Nottingham Health Profile (-) • Rivermead Activities of Daily Living (-) • 5m timed walk (-) • Motricity Index (-) • Mini Mental State Exam (-) • Hospital Anxietry and Depression Scale - Anxiety (-) • Hospital Anxiety and Depression Scale - Depression (-) • Frenchay aphasia screening test (-) • Modified Rankin Scale > 3 (-) • Caregiver Strain Index (-)
Walker et al. (1999) Walker et al. (2001) RCT (7) N_{Start}=185 N_{End}=163 TPS=Acute	E: Home based occupational therapy C: conventional care Duration: 6mo	• Extended ADL (+exp) • Barthel Index (+exp) • London Handicap Scale (+exp) • General Health Questionnaire – patient (-) • General Health Questionnaire – carer (-) • Carer Strain Index (+exp)
Goldberg et al. (1997) RCT (5) N_{Start}=55 N_{End}=41 TPS=Subacute	E: Home-based outpatient care with active case management C: Conventional care Duration: 6mo	• Frenchay Activities Index (+exp)
Forster & Young (1996) RCT (6) N_{Start}=240 N_{End}=207 TPS=Acute	E: Home visits by outreach nurse C: Standard care Duration: 12mo	• Barthel Index (-) • Frenchay Activities Index (-) • Nottingham Health Profile (-) • General Health Questionnaire – carer (-)
Corr & Bayer, (1995) RCT (6) N_{Start}=110 N_{End}=89 TPS=Acute	E: Home based occupational therapy C: Standard care Duration: 12mo	• Barthel Index (-) • Nottingham Extended ADL (-) • Geriatric Depression Scale (-) • Pearlman's six-point Quality of Life Scale (-) • Readmission (+exp)
Clinic-based therapy vs conventional care		
Welin et al. (2010) RCT (6) N_{Start}=163 N_{End}=152 TPS=Subacute	E: Stroke outpatient clinic C: Routine care Duration: 12mo	• Barthel Index (-) • Mortality (-) • Scandinavian Stroke Scale (-) • Percieved Health Status (-) • Montgomery-Asberg Depression Scale (-) • Blood pressure (-) • Modified Rankin Scale (-)
Hui et al. (1995) RCT (5) N_{Start}=120 N_{End}=105 TPS=Subacute	E: outpatient rehabilitation day clinic C: Conventional Care Duration: 3mo	• Barthel Index (-)
Client-centered occupational therapy in nursing home vs conventional care in nursing home		
Sackley et al. (2006) RCT (7) N_{Start}=118 N_{End}=105 TPS=NR	E: Client-centered occupational therapy in nursing home C: Standard care in nursing home Duration: 3mo	• Barthel Index (-) • Rivermead mobility index (-)
Enhanced home therapy vs conventional home therapy		
Logan et al. (1997) RCT (8) N_{Start}=111	E: Enhanced home occupational therapy C: routine home occupational therapy Duration: 3mo	• Barthel Index (-) • Nottingham Extended ADL (+exp) • General Health Questionnaire – patient (-)

N_{End}=86 TPS=Subacute		• General Health Questionnaire – carer (+exp)

Abbreviations and table notes: C=control group; D=days; E=experimental group; H=hours; Min=minutes; RCT=randomized controlled trial; TPS=time post stroke category (Acute: less than 30 days, Subacute: more than 1 month but less than 6 months, Chronic: over 6 months); Wk=weeks.
+exp indicates a statistically significant between groups difference at α=0.05 in favour of the experimental group
+exp_2 indicates a statistically significant between groups difference at α=0.05 in favour of the second experimental group
+con indicates a statistically significant between groups difference at α=0.05 in favour of the control group
- indicates no statistically significant between groups differences at α=0.05

Conclusions about acute/subacute outpatient therapy

MOTOR FUNCTION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving motor function.	1	Andersen et al., 2000
1b	**Client-centred outpatient therapy in nursing home** may not have a difference in efficacy compared to **conventional care in nursing home** for improving motor function.	1	Sackley et al., 2006

AMBULATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving ambulation.	2	McCellan & Ada, 2004; Wolfe et al., 2000

BALANCE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Home-based outpatient therapy** may produce greater improvements in balance than **conventional care.**	1	McCellan & Ada, 2004

COGNITION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving cognition.	2	Chaiyawat & Kulkantrakon, 2012; Wolfe et al., 2000

MENTAL HEALTH			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	6	Chaiyawat & Kulkantrakon, 2012; Ricauda et al., 2004; Evans et al., 2001; Wolfe et al., 2000; Walker et al., 1999; Corr & Bayer, 1995
1a	**For caregivers:** **Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	2	Walker et al., 1999; Forester & Young, 1996

1b	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	1	Welin et al., 2010
1b	**Enhanced home-based outpatient therapy** may not have a difference in efficacy compared to **conventional home-based occupational therapy** for improving mental health.	1	Logan et al., 1997
1b	**For caregivers:** **Enhanced home-based outpatient therapy** may produce greater improvements in mental health than **conventional home-based occupational therapy.**	1	Logan et al., 1997

APHASIA

LoE	Conclusion Statement	RCTs	References
1b	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving aphasia.	1	Wolfe et al., 2000

ACTIVITIES OF DAILY LIVING

LoE	Conclusion Statement	RCTs	References
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving activities of daily living.	11	Chaiyawat & Kulkantrakorn, 2012; Chiu & Man, 2004; Ricauda et al., 2004; Evans et al., 2001; Andersen et al., 2000; Gilberston et al., 2000; Wolfe et al., 2000; Walker et al., 1999; Goldberg et al., 1997; Forester & Young, 1996; Corr & Bayer, 1995
1b	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving activities of daily living.	2	Welin et al., 2010; Hui et al., 1995
1b	**Client-centred outpatient therapy in nursing home** may not have a difference in efficacy compared to **conventional care in nursing home** for improving activities of daily living.	1	Sackley et al., 2006
1a	There is conflicting evidence about the effect of **enhanced home-based outpatient therapy** to improve activities of daily living when compared to **conventional home-based occupational therapy.**	1	Logan et al., 1997

QUALITY OF LIFE

LoE	Conclusion Statement	RCTs	References
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving quality of life.	5	McCellan & Ada, 2004; Evans et al., 2001; Wolfe et al., 2000; Forester & Young, 1996; Corr & Bayer, 1995
1b	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving quality of life.	1	Welin et al., 2010

STROKE SEVERITY			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving stroke severity.	2	Ricauda et al., 2004; Wolfe et al., 2000
1b	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving stroke severity.	1	Welin et al., 2010

COMMUNITY REINTEGRATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving community reintegration.	1	Evans et al., 2001

CAREGIVER BURDEN			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	There is conflicting evidence about the effect of **home-based outpatient therapy** to improve caregiver burden when compared to **conventional care.**	2	Wolfe et al., 2000; Walker et al., 1999

Key Points

Neither home- nor clinic-based therapy appeared to improve outcomes during outpatient rehabilitation.

Eight RCTs were found evaluating home- or hospital-based therapy for outpatient rehabilitation in the chronic phase (greater than 6 months) post-stroke. Three RCTs compared hospital-based therapy to conventional care (Logan et al., 2004; Green et al., 2002; Werner & Kessler 1996). Five RCTs compared home-based therapy to conventional care (Egan et al., 2007; Lin et al., 2004: Parker et al., 2001; Walker et al., 1996; Wade et al., 1992).

The methodological details and results of all eight RCTs are presented in table 5.

Table 5. RCTs evaluating hospital or home-based outpatient rehabilitation 6 months after the stroke

Authors (Year) Study Design (PEDro Score) Sample Size$_{start}$ Sample Size$_{end}$ Time post stroke category	Interventions Duration: Session length, frequency per week for total number of weeks	Outcome Measures Result (direction of effect)
Clinic-based therapy vs conventional care		
Logan et al. (2004) RCT (8) N_{Start}=168 N_{End}=147 TPS=Chronic	E: Occupational therapy with sessions designed to increase outdoor mobility (>3mo) C: Standard treatment Duration: 4mo	• Getting out of the house (+exp) • Nottingham EADL – all subscales (-) • Except: mobility (+exp) • General Health Questionnaire – patient (-) • General Health Questionnaire – carer (-) • Nottingham Leisure Questionnaire (-)
Green et al. (2002) RCT (8) N_{Start}=163 N_{End}=152 TPS=Chronic	E: Community physiotherapy (13 wks) C: No treatment Duration: 6mo	• Rivermead Mobility Index (-) • Gait speed (-) • Barthel Index (-) • Frenchay Activities Index (-) • Hospital Anxiety and Depression Scale – Anxiety (-) • Hospital Anxiety and Depression Scale – Depression (-) • General Health Questionnaire – carers (-)
Werner and Kessler (1996) RCT (6) N_{Start}=49 N_{End}=40 TPS=Chronic	E: Additional physical and occupational therapy in day clinic C: No treatment Duration: 3mo	• Functional Independence Measure (+exp) • Sickness Impact Profile (+exp) • Beck's Depression Inventory (-)
Home-based therapy vs conventional care		
Egan et al. (2007) RCT (6) N_{Start}=16 N_{End}=14 TPS=Chronic	E: Home visits by an OT (8x) C: No treatment Duration: 3mo	• Canadian Occupational Performance Measure - performance (-) • Canadian Occupational Performance Measure - satisfaction (+exp) • SF-36 – all subscales (-) • Re-integration to Normal Living Index (-)
Lin et al. (2004) RCT (7) N_{Start}=20 N_{End}=19 TPS=Chronic	E: Home-based physiotherapy (10wks) C: No treatment Duration: 3mo	• Barthel Index (-) • Stroke rehabilitation Assessment of Movement – Upper Extremity (-) • Stroke rehabilitation Assessment of Movement – Lower Extremity (-) • Stroke Rehabilitation Assessment of Movement – Mobility (-)
Parker et al. (2001) RCT (6) N_{Start}=466 N_{End}=374 TPS=Acute	E: ADL focused occupational therapy at home E2: Leisure focused occupational therapy at home C: No treatment Duration: 6mo	• Barthel Index (-) • General health questionnaire – patients (-) • Nottingham Leisure Questionnaire (-) • London Handicap Scale (-) • Nottingham Extended ADL (-) • Oxford Handicap Scale (-) • General Health Questionnaire – carer (-)
Walker et al. (1996) RCT Crossover (6) N_{Start}=30	E: Home based occupational therapy for dressing C: No treatment	• Nottingham Dressing assessment (+exp) • Rivermead ADLs (+exp) • Nottingham Health Profile (+exp)

N_{End}=30 TPS=Chronic	Duration 3mo/phase	
Wade et al. (1992) RCT Crossover (6) N_{Start}=94 N_{End}=86 TPS=Chronic	E: Home based physiotherapy C: No treatment Duration: 4mos	• 10m walk test Gait Speed (+exp) • Nin-hole peg test (-) • Hospital Anxiety and Depression Scale – Anxiety (-) • Hospital Anxiety and Depression Scale – Depression (-) • Barthel Index (-) • Frenchay Activities Index (-) • Rivermead Mboility Index (-) • Rivermead Motor Assessment (-) • Nottingham Extended ADLs (-)

Abbreviations and table notes: C=control group; D=days; E=experimental group; H=hours; Min=minutes; RCT=randomized controlled trial; TPS=time post stroke category (Acute: less than 30 days, Subacute: more than 1 month but less than 6 months, Chronic: over 6 months); Wk=weeks.
+exp indicates a statistically significant between groups difference at α=0.05 in favour of the experimental group
+exp_2 indicates a statistically significant between groups difference at α=0.05 in favour of the second experimental group
+con indicates a statistically significant between groups difference at α=0.05 in favour of the control group
- indicates no statistically significant between groups differences at α=0.05

Conclusions about chronic outpatient therapy

MOTOR FUNCTION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving motor function.	1	Green et al., 2002
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving motor function.	2	Lin et al., 2004 Wade et al, 1992

AMBULATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving ambulation.	1	Green et al., 2002
1b	**Home-based outpatient therapy** may produce greater improvements in ambulation than **conventional care.**	1	Wade et al., 1992

BALANCE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Home-based outpatient therapy** may produce greater improvements in balance than **conventional care.**	1	McCellan & Ada, 2004

COGNITION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving cognition.	2	Chaiyawat & Kulkantrakon, 2012; Wolfe et al., 2000

MENTAL HEALTH			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	3	Logan et al., 2004; Green et al., 2002; Werner & Kessler 1996
1a	**For caregivers:** **Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	3	Logan et al., 2004; Green et al., 2002
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	2	Parker et al., 2001; Wade et al, 1992
1b	**For caregivers:** **Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving mental health.	1	Parker et al., 2001

APHASIA			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving aphasia.	1	Wolfe et al., 2000

ACTIVITIES OF DAILY LIVING			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Clinic-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving activities of daily living.	3	Logan et al., 2004; Green et al., 2002; Werner & Kessler 1996
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving activities of daily living.	5	Egan et al., 2007; Lin et al., 2004: Parker et al., 2001; Walker et al., 1996; Wade et al., 1992

QUALITY OF LIFE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Clinic-based outpatient therapy** may produce greater improvements in quality of life than **conventional care.**	1	Werner & Kessler, 1996
1a	There is conflicting evidence about the effect of **home-based outpatient therapy** to improve quality of life when compared to **conventional care.**	2	Egan et al., 2007; Walker et al., 1996

STROKE SEVERITY			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving stroke severity.	2	Parker et al., 2001

COMMUNITY REINTEGRATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1b	There is conflicting evidence about the effect of **clinic-based outpatient therapy** to improve community reintegration when compared to **conventional care.**	1	Logan et al., 2004
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **conventional care** for improving community reintegration.	2	Egan et al., 2007; Parker et al., 2001

Key Points

Neither home- nor clinic-based therapy appeared to improve mental health or quality of life during outpatient rehabilitation.

Home-Based Therapy vs. Hospital-Based Outpatient Therapy

Adapted from: https://www.alzheimersla.org/alzheimers-los-angeles-services/professional-training/hospital-home-transitions/

The increased focus on patient-driven care versus provider-driven care has sparked a debate as to whether stroke patients should be rehabilitated in hospital-based (inpatient and outpatient) programs or by community rehabilitation programs, which are usually home-based.

Young and Lincoln (1994) first debated this issue in the United Kingdom. Young (1994) argued that community care allowed stroke patients to reach their full potential, stating, "I do not believe that hospital care should be replaced by community services but that a more appropriate balance needs to be achieved; one which recognizes the limitations of hospitals and the pressing community (home) needs of stroke patients and their families." Anderson et al. (1992) suggested that stroke rehabilitation required a longer-term commitment, probably at least 3-5 years after the initial stroke. This group argued that community-based rehabilitation offered a greater opportunity to deal with handicaps and address psychosocial issues more effectively following a stroke. A community-based approach was also argued to be more effective and efficient, addressing problems "*in a way that is more relevant to the patient*".

In contrast, Lincoln (1994) argued that hospitals were the best venue to provide the required therapies, since co-ordinated care, so critical to interdisciplinary rehabilitation, was "difficult in practice" to put in place in a community setting, since often the services provided were not stroke focused. The benefits of specialized stroke rehabilitation units have already been discussed in chapter 5. Specialized stroke rehabilitation centres also make it much easier to educate and train new stroke clinicians as well as conduct research.

A number of authors have noted the advantages of rehabilitation at home (Gilbertson & Langhorne, 2000; Gladman et al., 1993; Rudd et al., 1997). From the results of animal studies, it is well known that enriched environments, characterised by increased activities and greater social interactions, contribute to better outcomes (Johansson & Ohlsson, 1996). However, there is evidence that much of a stroke patients' time spent on a rehabilitation unit is both inactive and alone. Surprisingly little time is spent in therapy (Lincoln et al., 1996). Therefore, while theoretically stroke rehabilitation units should provide a more enriched environment compared with other forms of inpatient rehabilitation, the home environment may actually be more

stimulating. Skills learned on the stroke rehabilitation unit may not transfer well to the home (Corr, 1995; Forster & Young, 1996; Indredavik et al., 2000).

There is currently no standard for the services that are provided and their intensity or duration for community-based rehabilitation following stroke. The superiority of home vs. hospital outpatient rehabilitation remains unresolved.

15 RCTs were found evaluating home-based versus hospital-based therapy for outpatient rehabilitation. All 15 RCTs compared home-based therapy to hospital-based therapy (Malagoni et al., 2016; Rasmussen et al., 2016; Olaeye et al., 2014; Balci et al., 2013; Redzuan et al., 2012; Lord et al., 2008; Bjorkdahl et al., 2006; Lincoln et al., 2004; Roderick et al., 2001; Baskett et al., 1999; Ronning & Guldvog, 1998; Gladman et al., 1993; Young & Forester, 1992; Wall & Turnbull, 1987; Gersten et al., 1968).

The methodological details and results of all 15 RCTs are presented in Table 6.

Table 6. RCTs evaluating home-based therapy vs. clinic-based therapy for outpatient rehabilitation.

Authors (Year) Study Design (PEDro Score) Sample Size$_{start}$ Sample Size$_{end}$ Time post stroke category	Interventions Duration: Session length, frequency per week for total number of weeks	Outcome Measures Result (direction of effect)
Malagoni et al. (2016) RCT (7) N_{Start}=12 N_{End}=12 TPS=Chronic	E: Hospital-based training and home-based exercises C: standard rehabilitation program (hospital) Duration: 10wks	• 6-minute Walk Test (-) • Timed Up and Go Test (-) • Stair Climb Test (-) • Short Form 36 (-)
Rasmussen et al. (2016) RCT (6) N_{Start}=71 N_{End}=61 TPS=Acute	E: Home-based therapy (transported home when needed) C: Hospital-based standard inpatient rehabilitation Duration: 3mo	• Rankin Scale (+exp) • Modified Barthel Index (-) • Motor Assessment Scale (+exp) • Cognitive Test CT-50 (-) • EuroQOL-5D (-)
Olaleye et al. (2014) RCT (6) N_{Start}=56 N_{End}=52 TPS=Acute	E: Rehabilitation at home C: Rehabilitation in primary health care centre Duration: 10wk	• Modified Motor Assessment Scale (-) • Short Form Postural Assessment Scale for Stroke (-) • Reintegration to Normal living index (-) • Walking speed (-)
Balci et al. (2013) RCT (7) N_{Start}=25 N_{End}=25 TPS=Acute	E1: Vestibular rehabilitation at home E2: visual feedback posturogrpahy training (hospital) C: usual care	E1 vs E2 vs C • Centre of gravity (-) • Berg Balance Scale (-) • Timed up and go test (-) • Dizziness Handicap Inventory (-) • Dynamic gait index (-)
Redzuan et al. (2012) RCT (3) N_{Start}=106 N_{End}=90 TPS=Acute	E: Outpatient therapy + Home DVDs C: Outpatient therapy Duration: 3mo	• Modified Barthel Index (-) • Occurrence of stroke or related complications (-) • Caregiver Strain Index (-)
Lord et al. (2008) RCT (7) N_{Start}=36 N_{End}=27 TPS=Subacute	E: Rehabilitation in the community (2x/wk, 7wks) C: Hospital-based physiotherapy (2x/wk, 7wks) Duration: 2mo	• 10 Meter Walk Test (-) • 6 minute walk test (-) • Activities-specific Balance Confidence Scale (-) • Subjective Index of Physical and Social Outcome (-)
Bjorkdahl et al. (2006) RCT (8) N_{Start}=59 N_{End}=58 TPS=Subacute	E: Home-based rehabilitation (9hrs/wk) C: Day hospital rehabilitation Duration: 3wks	• Assessment of Motor & Process Skills (-) • Functional Independence Measure (-) • Instrumental Activity Measure (-) • 30 metre walking speed (-) • National Institutes of Health Stroke Scale (-) • Barrow Neurological Institutes Screening (-)
Lincoln et al. (2004) RCT (4) N_{Start}=428 N_{End}=188 TPS=Chronic	E: Rehabilitation from a community stroke team C: Rehabilitation to routine care (day hospitals or outpatient departments) Duration: 6mo	• Barthel Index (-) • Extended Activities of Daily Living (-) • General Health Questionnaire (-) • EuroQOL (-) Caregiver • General Health Questionnaire (-) • Caregiver Strain Index (+exp) • EuroQOL (-)
Roderick et al. (2001) RCT (7)	E: Rehabilitation at home C: Rehabilitation in clinic	• Barthel Index (-) • Rivermead Mobility Index (-)

N_{Start}=140 N_{End}=112 TPS=Subacute	Duration: 6mo	• Frenchay Activities Index (-) • Short Form 36 – Physical (-) • Short Form 36 – Mental (-)
Baskett et al. (1999) RCT (7) N_{Start}=100 N_{End}=88 TPS=Subacute	E: Home visits by trained specialists C: Outpatient/day hospital services Duration: 3mo	• Barthel Index (-) • 10 Meter Walk Test (-) • Motor Assessment Score (-) • Frenchay Arm Test (-) • Nine-hole Peg Test (-) • Grip Strength (-)
Ronning & Guldvog. (1998) RCT (6) N_{Start}=251 N_{End}=251 TPS=Acute	E: Rehabilitation on dedicated hospital ward C: Community services rehabilitation Duration: 7mo	• Barthel Index (-) • Scandinavian Stroke Scale (-) • Short Form 36 – all subscales (-)
Gladman et al. (1993) RCT (6) N_{Start}=327 N_{End}=NR TPS=Subacute	E: Domiciliary rehabilitation service C: Hospital-based rehabilitation service Duration: 3mo	• Extended ADL – all subscales (-) • Barthel Index (-) • Nottingham health Profile – all subscales (-) Caregivers • Brief Assessment of Social Engagement (-) • Life Satisfaction Index (-)
Young and Forster (1992) RCT (6) N_{Start}=124 N_{End}=108 TPS=Subacute	E: Rehabilitation at home C: Rehabilitation in hospital Duration: 6mo	• Barthel Index (+exp) • Motor Club Assessment (+exp) • Functional ambulation category (+exp) • Frenchay Activities Index (-) • Nottingham Health Profile (-) • General Health Questionnaire – carers (-)
Wall & Turnbull. (1987) RCT (4) N_{Start}=20 N_{End}= TPS=Subacute	E1: Home-based and outpatient clinic rehabilitation (1hr in each, 1x/wk) E2: home-based rehabilitation (1hr, 2x/wk) E3: outpatient clinic rehabilitation (1hr, 2x/wk) C: no treatment Duration: 6mo	E1 vs E2 vs E3 • Walking speed (-) • Gait asymmetry (-)

Gersten et al. (1968)
RCT (5)
N_{Start}=155
N_{End}=128
TPS=Acute
	E: Rehabilitation at home
	C: Rehabilitation in a clinic
	Duration: NR
		• Functional status questionnaire
		  ◦ Functional Status (-)
		  ◦ Social Status (-)
		  ◦ Psychological Status (-)
		• Family and personal adjustment (-)
		• Speech (-)
		• Muscle Strength (+con)

Abbreviations and table notes: C=control group; D=days; E=experimental group; H=hours; Min=minutes; RCT=randomized controlled trial; TPS=time post stroke category (Acute: less than 30 days, Subacute: more than 1 month but less than 6 months, Chronic: over 6 months); Wk=weeks.
+exp indicates a statistically significant between groups difference at α=0.05 in favour of the experimental group
+exp_2 indicates a statistically significant between groups difference at α=0.05 in favour of the second experimental group
+con indicates a statistically significant between groups difference at α=0.05 in favour of the control group
- indicates no statistically significant between groups differences at α=0.05

Conclusions about chronic outpatient therapy

MOTOR FUNCTION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving motor function.	6	Rasmussen et al., 2016; Olaeye et al., 2014; Bjorkdahl et al., 2006; Roderick et al., 2001; Baskett et al., 1999; Young & Forester, 1992

AMBULATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving ambulation.	8	Malagoni et al., 2016; Olaeye et al., 2014; Balcii et al., 2013; Lord et al., 2008; Bjorkdahl et al., 2006; Baskett et al., 1999; Young & Forester, 1992; Wall & Turnbull, 1987
1b	**Home-based outpatient therapy** may produce greater improvements in ambulation than **conventional care.**	1	Wade et al., 1992

BALANCE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving balance.	4	Malagoni et al., 2016; Olaeye et al., 2014; Balci et al., 2013; Lord et al., 2008

COGNITION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving cognition.	2	Rasmussen et al., 2016; Bjorkdahl et al., 2006

MENTAL HEALTH			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving mental health.	2	Lincoln et al., 2004; Gersten et al., 1968
2	**For caregivers:** **Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving mental health.	1	Lincoln et al., 2004

APHASIA			
LoE	**Conclusion Statement**	**RCTs**	**References**
2	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving aphasia.	1	Gersten et al., 1968

ACTIVITIES OF DAILY LIVING			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving activities of daily living.	9	Rasmussen et al., 2016; Redzuan et al., 2012; Bjorkdahl et al., 2006; Lincoln et al., 2004; Roderick et al., 2001; Baskett et al., 1999; Ronning & Guldvog, 1998; Gladman et al., 1993; Young & Forester, 1992;

QUALITY OF LIFE			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving quality of life.	8	Malagoni et al., 2016; Rasmussen et al., 2016; Lincoln et al., 2004; Roderick et al., 2001; Ronning & Guldvog, 1998; Gladman et al., 1993; Young & Forester, 1992; Gersten et al., 1968
1a	**For caregivers:** **Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving quality of life.	3	Lincoln et al., 2004; Gladman et al., 1993; Young & Forester, 1992

STROKE SEVERITY			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving stroke severity.	3	Rasmuseen et al., 2016; Bjorkdahl et al., 2006; Ronning & Guldvog, 1998

COMMUNITY REINTEGRATION			
LoE	**Conclusion Statement**	**RCTs**	**References**
1a	**Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving community reintegration.	3	Olaeye et al., 2016; Lord et al., 2008; Gersten et al., 1968
1b	**For caregivers:** **Home-based outpatient therapy** may not have a difference in efficacy compared to **clinic-based outpatient therapy** for improving community reintegration.	1	Gladman et al.,1993

CAREGIVER BURDEN			
LoE	**Conclusion Statement**	**RCTs**	**References**
2	There is conflicting evidence about the effect of **home-based outpatient therapy** to improve caregiver burden when compared to **clinic-based outpatient therapy.**	2	Redzuan et al., 2012; Lincoln et al., 2004

Key Point

There appears to be no difference in efficacy between home or hospital-based therapy during outpatient rehabilitation.

Cochrane Reviews for Outpatient Rehabilitation Therapies following Stroke

There are currently five Cochrane reviews examining the effectiveness of Outpatient Therapies for the rehabilitation of stroke. These reviews examine slightly different populations and therapy approaches, however, primary outcomes all focus on the improvement or deterioration in Activities of Daily Living (ADLs) and risk of death. A summary of these reviews is presented in table 7.

Table 7. Previous Cochrane reviews for outpatient rehabilitation

Author, Year Country Title	Methods	Results
Outpatient Service Trialists (2003) UK Therapy based rehabilitation for stroke patients at home	14 RCTs examining therapy interventions to increase task oriented behaviour (physiotherapy, occupational therapy, multi-disciplinary care) compared with conventional or no care were included in the review. Therapies could take place in a hospital, home, or centre based location. Primary Outcome: proportion of patients who were dependent (or had deteriorated) in personal ADLs at the end of follow up Secondary Outcomes: death at follow up, proportion requiring institutionalization at follow up, extended ADL performance, subjective quality of life or mood at follow up, caregiver mood at follow up	No statistically significant difference was found in the combined odds of death or being less dependent at the end of follow up between patients receiving therapy based services vs. controls (OR 0.93, 95%CI: 0.7-1.22, p=0.6). The odds of deterioration in ADLs or dependency were significantly less in the group receiving therapy based services (OR 0.72, 95%CI: 0.58-0.97, p=0.009) There was an overall increase in ADL scores in the therapy group compared with controls (SMD 0.14, 95%CI: 0.02-0.25, p=0.02)
Legg et al. (2007) UK Occupational therapy for patients with problems in ADL following stroke	Nine RCTs were included in the review. All studies were occupational therapy (OT) interventions with a focus on ADL performance compared to usual or no care. Primary Outcome: proportion of patients who were dependent (or had deteriorated) in personal ADLs at the end of follow up, death, or poor outcome (dependency in ADLs) Secondary Outcomes: death at follow up, proportion requiring institutionalization at follow up, extended ADL performance, subjective quality of life or mood at follow up, caregiver mood at follow up	Individuals receiving OT interventions were significantly more independent in ADLs than controls (SMD 0.18, 95%CI:0.04-0.32, p=0.01) The odds of death and deterioration (poor outcome) were significantly less in groups receiving OT therapy when compared with controls (0.60, 95%CI: 0.39-0.91, p=0.02) There were no significant differences in the risk of death or institutionalization between the groups. Reviewers were unable to assess between group differences in mood and quality of life
Aziz et al. (2008) Malaysia Therapy-based rehabilitation services	5 RCTS were included in the review. Trials that examined community based stroke patients receiving therapy services compared with conventional care were reviewed. At least 75% of participants in the included studies were ≥12 months post stroke.	Only one trial reported poor outcome at the end of study follow up. This study reported a significant difference between groups in favour of the treatment group (26% difference in outcome, p-=0.03).

for patients at home more than one year following stroke	Primary Outcome: death or poor outcome, including the proportion of patients who were dependent (or had deteriorated) in personal ADLs at the end of follow up Secondary Outcomes: death at follow up, extended ADL performance, subjective quality of life or mood at follow up, caregiver mood at follow up, hospital re-admission	Pooled analysis was not able to detect a difference between groups in ADL performance (SMD -0.06, 95%CI: -0.32-0.20, p=0.65) No significant differences in death, performance in extended ADLs, subjective health, or mood were noted between groups
Langhorne & Baylan (2017) UK Services for reducing the duration of hospital care for stroke patients	17 RCTs comparing conventional inpatient hospital stroke care with service intervention aimed at providing rehabilitation support in a community setting and, thereby, reducing the length of hospital care, were included in this review Primary outcome: death or long term dependency at end of follow up, length of index hospital stay Secondary outcomes: ADL and extended ADL scores, subjective health status, mood, carer outcomes	The intervention group showed a significantly shortened length of stay in hospital (p<0.0001) The odds of death at end of study was non-significant between groups (OR 1.04, 95%CI: 0.77-1.40, p=0.81). The odds of death or institutionalization and death or dependency was reduced in the intervention group (OR 0.75, 95%CI: 0.59-0.96, p=0.02) and (OR 0.80, 95%CI: 0.67-0.95, p=0.01) respectively. An increase in extended ADL scores were noted in intervention participants (SMD 0.14, 95%CI: 0.03-0.25, p=0.01) No significant differences were noted between groups in Barthel Index ADLs, health status, or mood status.
Fletcher-Smith et al. (2013) UK Occupational therapy for care home residents with stroke	Included studies examined the impact of occupational therapy for care home residents (i.e. long term or nursing care facility) with stroke as compared to standard care. Primary outcome: performance in ADLs at end of study follow up Secondary outcomes: ADL performance at end of intervention, death, global quality of life, mobility, mood, cognition, hospital admission or admission to a higher dependency facility, adverse events	Only one trial was included in this review. The trial was insufficient for conclusions to be drawn regarding all primary and secondary outcomes.

The results of these five reviews are generally quite positive in favour of therapy treatment groups when compared with no therapy or usual care controls. Three of the five reviews observed either less deterioration or greater improvement in intervention subjects when examining measures of ADL and extended ADL. This was even observed in a population of participants that were >12 months post stroke. A reduction in the risk of death, dependency, and poor outcome was also noted in the majority of studies. However, studies looking at improvements in mood, health status, and quality of life were not able to detect any differences in outcomes between groups. Overall, the provision of outpatient therapies to patients following stroke is effective in improving patient

outcomes, particularly pertaining to an improvement (or reduced decline) in ADL performance and the risk of death. Furthermore, in addition to an improvement in ADLs, one study was able to show that therapy services post discharge has the potential to significantly reduce hospital length of stay. There is no current evidence to support the impact of occupational therapy for home care residents, and this may be a potential area of interest for future research.

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