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HEART & STROKE FOUNDATION
Canadian Partnership for Stroke Recovery

Chapter 5: The efficacy of stroke rehabilitation

Abstract

Effective stroke rehabilitation is characterised by an interdisciplinary team working cohesively and closely to provide a comprehensive program for each patient. These programs vary in the types of therapies provided as well as their intensity, frequency, and duration. Evidence related to stroke rehabilitation effectiveness, location, management, and composition is presented in this review. As well, past meta-analyses of stroke rehabilitation effectiveness, cost-effectiveness, and comparison with other interventions are presented.

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Key Points

- Acute stroke care, characterized by intensive monitoring and treatment for medical complications, is associated with reductions in combined death/disability and the need for institutionalization, but not reductions in mortality, length of hospital stay, or functional disability.

- Interdisciplinary combined acute and rehabilitation stroke units reduce combined death/dependency, need for institutionalization, and length of hospital stay, but not overall mortality, when compared to general medical wards.

- Interdisciplinary specialized subacute stroke rehabilitation is associated with reduced mortality and combined death/dependency, but not the need for institutionalization or length of hospital stay, when compared to general rehabilitation.

- Subgroups of patients will benefit from subacute rehabilitation in different ways: patients with more severe strokes experience reduced mortality; those with moderate strokes experience improved functional outcomes; and those with mild stroke do not improve to a greater extent compared with standard care.

- Discrete care elements associated with stroke units do not provide the same benefit when provided by a mobile stroke team.

- Specialized stroke care can improve multiple outcomes including mortality, dependency, need for institutionalization, and length of hospital stay.

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5.1 Stroke Rehabilitation Programs

Stroke rehabilitation is characterised by an interdisciplinary team working cohesively and closely to provide a comprehensive program for each patient. They are inevitably found in rehabilitation centres or acute care hospitals. Weekly team conferences are held to establish or revise rehabilitation goals and plans, assess patient progress, identify barriers or complications, and develop a plan for discharge or transfer to another type of rehabilitation program. These programs may vary in the types of therapies offered as well as their intensity, frequency, and duration. Brandstater and Basmajian (1987) identified common features of comprehensive stroke rehabilitation programs (Table 5.1.1).

Table 5.1.1 Common Elements of Comprehensive Stroke Rehabilitation Programs

- Commitment to continuity of care from the acute phase of the stroke through long-term follow-up.
- Use of an interdisciplinary team of professionals experienced in and dedicated to the care of the patient with stroke.
- Careful attention to the prevention, recognition, and treatment of comorbid illnesses and medical complications.
- Early initiation of goal-directed treatment that takes maximal advantage of the patient's abilities and minimizes disabilities.
- Systematic assessment of the patient's progress during rehabilitation, with adjustment of treatment to maximize benefits.
- Emphasis on patient and family/caregiver education, with attention to psychological and social issues affecting both the patient and family/caregiver.
- Early and comprehensive discharge planning aimed at a smooth transition to the community, promoting social reintegration and resumption of roles in the home, family, recreational, and vocational domains.

Clinical practice guidelines for adult stroke care (Duncan et al., 2005) endorsed by the American Heart Association recommend that stroke rehabilitation care be provided by a multidisciplinary team and delivered in a setting that is formally coordinated and organized. The authors also acknowledged the need for a flexible approach and were unable to identify a universally applicable “best practice” approach applicable to all stroke patients. The authors noted the heterogeneity of the literature on which their recommendations were based, the inability to identify the nature of the intervention(s) under study, and the inability to elucidate the distinctively unique aspects of care that enabled superior outcomes when compared to standard care.

5.2 Reviews of Stroke Rehabilitation Efficacy

While the benefits of a stroke rehabilitation service may seem obvious, determining the impact of this treatment was difficult, due to problems with study design and methodology (lack of randomization, inappropriate control group selection, failure to blind assessors, difficulty in controlling for all possible confounders) and difficulties inherent to stroke rehabilitation (controlling for spontaneous neurological recovery, daily fluctuation in individual function, and difficulties in measuring functional outcomes). Despite these difficulties, earlier comparative studies demonstrated patients cared for by specialized stroke rehabilitation teams had lower one-year mortality, achieved greater gains in activities of daily living by discharge, and were less likely to be in a nursing home at follow-up (Anderson et al., 1979; Dombovy et al., 1987). However, pre-selection of patients and concerns about observer bias raised concerns over the validity of these findings.

5.2.1 Meta-Analyses of the Effectiveness of Stroke Rehabilitation

Systematic reviews and meta-analyses have been conducted to evaluate the effectiveness of stroke rehabilitation compared to conventional care. All identified reviews provided evidence of a benefit of specialized stroke care.

Langhorne et al. (1993) evaluated 10 RCTS that had been conducted between 1962 and 1993, comparing the management of stroke patients in specialized units to those managed on general medical wards. Of the 10 studies identified, 8 used strict randomization procedures while the other two used a quasi-randomized approach, whereby patients were assigned based on a "first-come, first-serve" policy. The latter procedure resulted in an excessive number of patients being allocated to the general medical ward, and so the authors evaluated the results of these trials separately. The results of the ten trials revealed that management of stroke patients on a stroke unit was associated with lower mortality rates than general medical ward management, with a 28% reduction in the risk of death occurring in the first 17 weeks post stroke. Exclusion of the two trials using informal randomization procedures also revealed a reduction in mortality for patients in stroke units of 37% in the first 17 weeks and 21% in the first year post stroke.

Ottenbacher and Jannell (1993) conducted a review of the literature and examined existing clinical trials that investigated the effectiveness of stroke rehabilitation programs improving functional outcomes and discharge destinations. One hundred and twenty-four research studies were identified, and 36 trials evaluating 3,717 patients were examined in a meta-analysis. The authors reported that those patients who participated in an individualized program of stroke rehabilitation performed better than 65% of those patients in the comparison group. Greater functional improvements were observed in younger patients and those with relatively short stroke onset to rehabilitation admission intervals. This review consisted largely of individual interventions as well as some interdisciplinary rehabilitation studies, and thus it has limited application in determining the efficacy of stroke rehabilitation inpatient interdisciplinary programs.

The Canadian Coordinating Office of Health Technology Assessment (CCOHTA) conducted a review of stroke unit care compared to care on a general medical ward (Noorani et al., 2003). The review was confined to RCTs published from 1995 to July 2002, which yielded six RCTs including a total of 1,709 patients with an average age of 76 years. Stroke unit care was associated with a reduction in the odds of death (OR 0.60, 95% CI 0.42-0.86), an outcome that was recorded in all studies, and the estimated number needed to treat to prevent one death was 11 (range, 7-25). There was also an increase in the odds of return to living at home among the four studies in which the outcome was evaluated (OR 1.42 95% CI 1.05-1.92). In the three trials where it was recorded, the median Barthel Index score was one point higher after 12 months among patients in stroke units (13.9, range 8-17) compared to the scores of patients in general medical wards (12.9, range 6-16.8) in the three trials that evaluated the Barthel Index. There was also a non-significant reduction in the need for institutional care of patients from stroke units at follow-up (OR 0.64), as reported in the six trials that evaluated this outcome (Noorani et al., 2003).

The Stroke Unit Trialists' Collaboration (2013) was a Cochrane review that systematically reviewed a total of 28 randomized trials that compared services provided along a continuum of care from 'more organized' to 'less organized' stroke unit care. Primary outcome measures included death, dependency, and requirement for institutionalized care at follow-up. At a median of one-year follow-up, stroke unit care was associated with a significant reduction in death (OR 0.87, 95% CI 0.69-0.94, p=0.005). Stroke unit care was also associated with a reduction in the combined outcomes of death or institutional care (OR 0.78, 95% CI 0.68-0.89, p=0.0030) and death or dependency (OR 0.79, 95% CI 0.68-0.90, p=0.0007). There was no indication that

organised stroke unit care resulted in longer hospital stay. The benefits of specialized stroke care were independent of age, sex, stroke severity, or stroke type.

Given that the evidence for organized stroke units was mainly derived from clinical trials, it is worth considering whether the positive results were applicable in routine clinical practice. Results from population-based studies using administrative datasets showed similar findings to the clinical trials. In Finland, an adjusted hazard ratio for death in stroke unit versus no stroke unit for men and women was 0.79 and 0.83, respectively (Terent et al., 2009). In Scotland, an absolute risk difference of 3% for survival and 5% for home discharge was reported for stroke units (Langhorne et al., 2010a).

A systematic review on observational studies of stroke units was performed to determine whether the benefits seen in previous trials were generalizable to clinical practice (Seenan et al., 2007). Comparisons were conducted between stroke units and alternative interventions (i.e. conventional care on a general medical, neurology ward, or mobile stroke team). For patients receiving stroke unit care, there was a significant reduction in the odds of death (OR 0.79, 95% CI 0.73-0.86) and odds of death or poor outcome (OR 0.87, 95% CI 0.80-0.95) at one year post stroke. A subsequent review employed Bayesian analysis to investigate the impact of organized stroke units and demonstrated a similar reduction in mortality (O'Rourke & Walsh, 2010). The review evaluated the available evidence while adjusting for the heterogeneity and bias in non-randomized studies.

5.2.2 Evidence of Cost-Effectiveness

While stroke unit care has been associated with improved outcomes, it has been assumed that they are a more costly intervention. As a result, there has been a proliferation of studies evaluating costs and cost-effectiveness of this form of care. Stroke represents a significant economic burden in developed countries, and so estimating costs and cost-effectiveness associated with stroke care is fraught with uncertainty. Stroke recovery and residual disability are highly variable, the contribution of informal caregivers is often ignored, and costing the discrete components of care provided within institutions is difficult. These factors and others limit the generalizability of the results of most studies. However, the results from several studies suggest that stroke unit care may in fact be cost-effective when compared to other interventions.

In a smaller study, Van Exel et al. (2003) found that a substantial reduction in length of stay on a stroke unit resulted in cost savings, despite a higher per diem cost. However, costs were transferred onto nursing homes and other facilities when patients were discharged and in need of ongoing care. Patient costs were dominated by the institutional costs, although the cost of care provided by informal caregivers was not considered. Costs were determined by age, disability, pre-morbid residence, presence of an informal caregiver, as well as institutional barriers such as waiting lists and bed blockages. A subsequent observational study by Kalra et al. (2005) found stroke unit care to be more effective than home care and to be of equal cost (using per patient day alive). These findings suggest that stroke unit care is more cost-effective than home care (or stroke team care).

A theoretical cohort of patients with all levels of stroke severity was followed over five years in a French study (Launois et al., 2004). The total difference in cost, which was slightly higher for stroke unit care compared with conventional care, was €13,359 per patient. However, the number of trimesters of life lost for patients treated initially on a stroke unit was fewer (4.8 vs. 7.7). Patients treated in stroke units also spent more trimesters experiencing only minor disability compared to patients treated on conventional units (11.0 vs. 8.3). The associated incremental cost-

effectiveness ratio was €1,359 per year of life gained without disability, a value far below the currently accepted willingness to pay threshold of €53,400 (Launois et al., 2004).

Using data from the SCOPES (Stroke Care Outcomes: Providing Effective Services) trial over six months, Moodie et al. (2006) compared the cost-effectiveness of stroke units, conventional care, and a mobile service. The total per patient costs were AUD$15,383, $15,903, and $12,251 for stroke units, conventional care, and mobile services respectively. Compared with conventional units, stroke units were associated with greater adherence to processes of care and fewer cases of severe complications, reflecting best practice. While better outcomes were achieved with stroke unit care, the incremental costs were higher compared with conventional care ($9,867-16,372 per patient); the authors did not provide a willingness to pay threshold. When comparing stroke units and mobile services, however, the costs were lower and the outcomes were better for stroke unit care.

Using data from the South London Stroke Register, Saka et al. (2009) projected the cost-effectiveness of three types of care over a 10-year period: stroke units with early supported discharge (ESD), stroke units without ESD, and general medical wards without ESD. Although the costs of stroke units with or without ESD were greater than general medical ward care, the Quality Adjusted Life Years (QALY) was lowest for the model of a stroke unit with ESD. Using the cost-effectiveness threshold of £30,000, as is commonly used in the UK, the combined model was a cost-effective strategy compared with the other two models. The incremental cost-effectiveness ratio of stroke unit care with ESD was £10,661 compared to the general medical ward and £17,721 compared to the stroke unit without ESD.

In a systematic review, Brady et al. (2005) examined the evidence regarding the cost of stroke rehabilitation services. The authors concluded that there was “some” evidence that costs associated with stroke units and care on other hospital wards were comparable. However, there was no specific outcome evaluated in the study, precluding any assessment of cost-effectiveness.

5.2.3 Comparisons with Other Interventions

An earlier analysis studied the potential effectiveness and costs of various interventions for 2400 strokes each year in a population of 1 million (Hankey & Warlow, 1999). Stroke unit care demonstrated absolute treatment effect similar to that of thrombolysis and greater than aspirin, but was appropriate for a larger population of patients with acute stroke. The number needed to treat per 1 million with 2400 strokes was 18 for stroke unit care, 16 for thrombolysis, and 83 for aspirin. As well, the percentage of death/dependents avoided was 8.3% for stroke unit care, 1.8% for aspirin, and 1.2% for thrombolysis.

A population-based study in Australia that analyzed different stroke interventions also favoured organized stroke unit care, as this provided the greatest potential absolute benefit to the community as a whole (Gilligan et al., 2005). When eligible patients were extrapolated to the population 46 (95% CI 17-69) of every 1,000 cases could have been saved from death or dependency with stroke unit management, compared to only 6 (95% CI 1-11) by using aspirin and 11 (95% CI 5-17) by thrombolysis.

While thrombolysis is a potent intervention, the aforementioned studies revealed that management in stroke units had the greatest population benefit and thus, should be a priority in stroke management (Gilligan et al., 2005; Hankey & Warlow, 1999). An editorial by Donnan et al. (2003) using results synthesized from previously published articles came to the same conclusions. The authors found that the potential absolute benefit associated with stroke unit care was 1,472 compared to 575 for thrombolysis.

5.3 Individual Studies of Stroke Rehabilitation Efficacy

A total of 39 studies were identified, of which 14 were non-RCTs and 25 were RCTs (Tables 5.3.1 and 5.3.2). There were several cases when multiple publications were considered to be a single entity, when either the subsequent evaluations from an initial group of patients were published at a later date, or different groups of authors reported the results derived from the same group of patients. However, a two-part trial evaluated different interventions using the same group of patients (Ronning & Guldvog, 1998a, 1998b), and so these were analyzed as two distinct trials.

Table 5.3.1 Non-Randomized Studies Evaluating Specialized Stroke Rehabilitation

Controlled Studies	Retrospective Studies	Prospective Case Series
Feigenson et al. 1979 Strand et al. 1979 Gompertz et al. 1995 Jorgensen et al. 1995, 2000 Kramer et al. 1997 Gursel et al. 1998 Patel et al. 1998 Krepsi et al. 2003 Suwanwela et al. 2007	McCann & Cuthbertson 1976 Webb et al. 1999 Bethoux et al. 1999 Stavem & Ronning 1998	Dam et al. 1993

Table 5.3.2 Randomized Controlled Trials Evaluating All Stroke Care Models

Acute Stroke Care (n=7)	Combined Acute/Rehabilitation (n=7)	Subacute Rehabilitation (n=7)	Mobile Stroke Teams (n=4)
Ronning & Guldvog 1998 (a) Cabral et al. 2003 Sulter et al. 2003 DiLauro et al. 2003 Cavallini et al. 2003 Silva et al. 2005 Langhorne et al. 2010	Garraway et al. 1981 Sivenius et al. 1985 Indredavik et al. 1991 Kaste et al. 1995 Fagerberg et al. 2000 Ma et al. 2004 Chan et al. 2014	Peacock et al. 1972 Stevens et al. 1984 Kalra et al. 1993 Kalra & Eade 1995 Juby et al. 1996 Ronning & Guldvog 1998 (b) Yagura et al. 2005	Dey et al. 2005 Wood-Dauphinee et al. 1984 Kalra et al. 2000, 2005 Hamrin et al. 1982

5.3.1 Methodological Quality

Only randomized or quasi-randomized trials were assigned a PEDro score (Table 5.3.1.1). Trials with a score of 9 or greater were considered to be of excellent methodological quality, a score of 6 to 8 considered good quality, a score of 4 or 5 considered fair quality, and a score of 3 or less considered poor quality. The inability of non-pharmacological studies to blind patients or therapists to the treatment condition prevented any study from receiving a score of greater than 8 out of a possible 10 points.

Table 5.3.1.1 Quality of RCTs Evaluating Stroke Rehabilitation (n=23)

Study Quality	PEDro Score	Number of Studies
Excellent	9-10	1
Good	6-8	14
Fair	4-5	10
Poor	<4	0
Total Studies Reviewed		23

In terms of the individual components of PEDro criteria, only a small percentage of studies received points for concealed allocation, blinding, or intention-to-treat analysis (Table 5.3.1.2). In some studies, random allocation was not possible because the investigators did not have control over the assignment of patients to their rehabilitation destinations (i.e. patients assigned to the most available bed).

Table 5.3.1.2 Proportions of Studies Meeting PEDro Criteria

PEDro Scale Item	n	%
Random allocation	20	80
Concealed allocation	12	48
Baseline comparability	25	100
Between-group comparisons	24	96
Blinded participant	0	0
Blinded therapist	2	8
Blinded outcome assessor	15	60
Adequacy of follow-up	22	88
Intention to treat analysis	9	36
Inclusion of point estimates	25	100

Given the large number of studies, only the results from RCTs and quasi RCTs were used to formulate conclusions. Many of the studies included in this review compared the outcomes of patients who had received specialized in-patient rehabilitation or stroke unit care to those receiving conventional care, usually on a general medical ward. However, the term “stroke unit” was broadly defined and the description of the characteristics features of individual units were often vague. Models of care differed with respect to such features as timing of admission, duration of stay, the services provided, and the characteristics of patients included in the studies. Given that this review examined studies that assessed all types of the stroke care along the continuum, from “super-acute” to subacute, studies were categorized in an effort to compare the effectiveness of similar interventions:

i. Acute stroke unit care: patients randomized within 24 hours and remained for a period of two weeks or less (n=7)
ii. Units combining both acute and rehabilitative care (n=7)
iii. Rehabilitation units with transfer from another service or facility after a delay, usually within two weeks of stroke (subacute) (n=7)
iv. Mobile stroke teams (n=4)

5.3.2 Summarizing the Results by Model of Care

Although many studies providing similar interventions and outcomes were grouped together, formulating overall conclusions was challenging. In order to overcome this difficulty, pooled analyses were conducted using Review Manager software (version 4.2.8), when sufficient data was available. The Peto Odds Ratios (OR) and weighted mean differences (WMD; random effects model) were calculated for the outcomes of interest. The results obtained from this meta-analytic technique were considered to constitute the highest level of evidence (Level 1a).

All RCTs and quasi RCTs were included in the formulation of conclusions. A study was considered to be positive if the outcome(s) of the group receiving specialized care were significantly better than the control group, based on statistical tests of significance. A study was considered to be negative if there were non-statistically significant differences in outcome measures between the intervention groups, or in patients in the control group had better outcomes. Final conclusions

were determined through the summation of scores reporting a positive effect (+) or non-significant differences (-) for a particular outcome. Studies with the highest PEDro scores and largest sample sizes received priority when formulating conclusions and were used to "tiebreak" in the event of equal PEDro scores. Levels of evidence were drawn based on the results of the meta-analyses (see Chapter 1, Section 1.3). The outcomes of interest were mortality, dependency, institutionalization, and length of stay, although these outcomes were not universally assessed in all studies.

5.4 Acute Stroke Units

Seven RCTs evaluating the benefit of acute stroke care were identified, which assessed the following interventions (Table 5.4.1):

1. Stroke unit with continuous monitoring vs. Conventional stroke unit (Cavallini et al., 2003; Langhorne et al., 2010b; Silva et al., 2005; Sulter et al., 2003)
2. Early, intensive rehabilitation vs. Conventional rehabilitation (Di Lauro et al., 2003; Langhorne et al., 2010b)
3. Acute stroke unit vs. General medical ward (Cabral et al., 2003; Ronning & Guldvog, 1998b)

Table 5.4.1 Studies Evaluating Acute Stroke Care

Author (Year) Country PEDro Score Sample Size	Methods	Outcomes
Ronning & Guldvog (1998b) Sweden 6 (Quasi RCT) N=550	Patients were assigned to receive care on a stroke unit or general medical ward.	1. Patients treated on the stroke unit had higher Scandinavian Stroke Scale scores and a lesser incidence of recurrent stroke compared to patients treated on the general medical ward. 2. Patients on the stroke unit were treated medically more aggressively including increased use of parenteral fluids and antibiotics. 3. Odds of death, deterioration, and need for long-term care at 7 months were similar for both groups.
Cabral et al. (2003) Brazil 6 (RCT) N=74	Patients were randomized to receive care on a stroke unit or general medical ward.	1. There were no significant differences in survival between the groups at days 10, 20, or 90 or at 6 months. 2. There were no significant differences in combined death/disability at 6 months.
Cavallini et al. (2003) Spain 5 (Quasi RCT) N=268	Patients were assigned to a stroke unit or cerebrovascular unit within 36 hours post stroke. Stroke unit patients received continuous monitoring for 72hr. Cerebrovascular unit patients were monitored every 3-4hr. Both groups followed the same acute management and early rehabilitation guidelines. Good outcome was considered to be discharge home or candidacy for inpatient rehabilitation.	1. Mean length of stay was longer for patients treated on the cerebrovascular unit (17.1 vs. 9.2 days, p<0.0001). 2. Stroke unit care was associated with a good outcome (OR 2.63, 95% CI 1.4-4.8). 3. Care setting was a significant predictor of good outcome in multiple logistic regression (OR 0.42, 95% CI 0.26-0.68).

		4. Cardiac complications were more frequently detected in the stroke unit group. Mean duration of these adverse events was shorter in the stroke unit group (1 vs. 2.4 days, p<0.02).
Di Lauro et al. (2003) Italy 7 (RCT) N=60	Patients with some disability were randomized to receive intensive, early rehabilitation (2hr/d within 24hr), or regular acute rehabilitation (45min/d) for 14 days. Both groups went on to receive continued rehabilitation at a specialized centre for 60 days.	1. There were no significant differences between groups in the NIH Stroke Scale or Barthel Index scores at either 14 days or 180 days.
Sulter et al. (2003) Netherlands 7 (RCT) N=54	Patients were randomized to a stroke care monitoring unit or a stroke unit. Patients on the monitoring unit were monitored intensively for at least 48hr followed by appropriate, immediate interventions. After the monitoring period, patients in the monitoring group were transferred to the stroke unit for rehabilitation.	1. Mortality was significantly lower on the monitoring unit (1 vs. 7; OR: 0.11, 95% CI 0.02-0.96). 2. Patients on the monitoring unit had a shorter length of stay (16±5 vs. 25±7 days). 3. Hypoxia was identified and treated more frequently on the monitoring unit, although this was the only difference between the groups in terms of complications/treatments.
Silva et al. (2005) Spain 3 (Quasi RCT) N=530	Patients were assigned within 24hr of onset to a conventional care stroke unit or a semi-intensive stroke unit with continuous monitoring of cardiac, respiratory, metabolic, and neurological functions during the first 72hr. Both groups were treated following the same medical and nursing protocols.	1. There were no significant differences between the groups in terms of medical complications (pneumonia, urinary tract infections, or pulmonary embolism). 2. There was a significant increase in the detection of newly diagnosed atrial fibrillation, hypotension, hypoxia, and hyperthermia in the semi-intensive stroke unit, which lead to a change in medical management. 3. At 1 year, mortality and combined mortality/dependency were not significantly different between the two groups. 4. The odds of 1 year mortality for semi-intensive stroke unit allocation was lower (OR 0.19, 95% CI 0.07-0.54) in patients with severe stroke (CSS≤4), than in those with mild-to-moderate stroke (OR 0.64, 95% CI 0.37-1.11).
Langhorne et al. (2010a) Scotland 8 (RCT) N_{Start}=32 N_{End}=31	**Population:** Early Mobilization group (EM; N=16): Mean age=64yr; Males=10, Females=6. Control Early Movement (Control EM; N=16): Mean age=71yr; Males=6, Females=10. Automated Monitoring group (AM; N=16): Mean age=64yr; Males=6, Females=10. Control Automated Monitoring (Control AM; N=16): Mean age=70yr; Males=10, Females=6. **Intervention:** Patients were randomised to 1 of 4 nurse-led treatment protocols in a factorial (2x2) design: (1) standard stroke unit care, (2) EM, (3) AM, or (4) combined EM and AM. Outcomes were assessed at baseline and 3 months.	1. EM was associated with significantly greater independence at 3 months (p<0.05). 2. AM was associated with significantly greater detection of predefined physiological complications (p<0.05). 3. No statistical differences between AM and EM control groups were found for any clinical outcomes. 4. These associations remained after correcting for age, stroke severity, and co-interventions.

	Outcomes: Rankin Scale; Barthel Index; Complications.	

5.4.1 Continuous Monitoring

Results from studies evaluating the benefits of continuous versus intermittent monitoring were mixed (Table 5.4.1.1). Only Sulter et al. (2003) reported a statistically significant reduction in mortality at 3 months (7 vs. 1, p=0.05) and reduced length of total hospital stay among patients who received continuous monitoring for the first 48 hours following stroke. The main difference in care between the two units was a statistically significant increase in the detection and subsequent treatment of hypoxia for patients on the intensive monitoring unit; these patients were also discharged from hospital sooner (16±5 vs. 25±7 days).

There was no overall benefit of intensive monitoring for patients for all levels of stroke severity, when assessed at discharge from the unit. Silva et al. (2005) suggested that patients with severe stroke might experience reduced mortality, without a corresponding reduction in dependency. Patients with a severe stroke, defined as a Canadian Stroke Scale score of ≤4, experienced a significant decrease in the odds of death (OR 0.19, 95% CI 0.07-0.54) compared to patients with a score >4 (OR 0.64, 95% CI 0.37-1.11).

Cavallini et al. (2003) also reported a higher number of complications with subsequent treatment in patients who were continuously monitored in the first 72 hours, although these authors did not report a statistically significant reduction in mortality during the hospitalization period. However, a greater proportion of patients experienced a good outcome, which was defined as a patients' ability to live independently at home or determined to be a suitable candidate for intensive inpatient rehabilitation. The difference in timing of outcome may explain the contradictory findings regarding mortality.

A more recent but smaller study (Langhorne et al., 2010a) randomized patients into one of four groups: usual care, early mobilization (EM), automated monitoring (AM), or both EM and AM. Results of factorial analysis (2 x 2) revealed no significant difference between AM and the control condition in Rankin Scale score, Barthel Index score, or length of hospital stay after 3 months (Langhorne et al., 2010a). These results suggest that automated monitoring may not affect the independence of patients post stroke. However, physiological abnormality episodes, such as tachycardia, were more offend detected in the AM group.

A Cochrane review regarding continuous monitoring of patients post stroke (Ciccone et al., 2013) examined the results of only three articles, all of which were previously discussed (Cavallini et al., 2003; Langhorne et al., 2010a; Sulter et al., 2003). The authors concluded that continuous monitoring provided no significant reduction in dependency, death from vascular causes, neurological complications, or length of hospital stay.

Table 5.4.1.1 Acute Continuous Monitoring Compared to an Alternative Intervention

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Silva et al. (2005) (3)	-	-	NA	NA
Cavallini et al. (2003) (5)	-	-	+	+
Sulter et al. (2003) (7)	+	-	+	-
Langhorne et al. (2010) (8)	NA	+	-	NA

5.4.2 Early, Intensive Rehabilitation

Two studies evaluated the impact of early, intensive rehabilitation (Table 5.4.2.1). Di Lauro et al. (2003) evaluated the benefits of early, intensive rehabilitation provided for two weeks immediately following stroke. There were no differences between treatment groups in disability (measured by the Barthel Index) or stroke severity (measured by the modified NIH Stroke Scale) immediately following the treatment at two weeks or at 180 days. The null results may be due to small sample size, short treatment period, insensitive outcome measures, and/or lack of contrast between treatment arms. Two hours of active therapy may be of insufficient intensity as to confer a benefit, in which case there may truly be no benefit compared to 45 minutes of daily therapy. No other outcomes of interest were evaluated in this study (e.g. mortality, institutionalization, length of stay).

Langhorne et al. (2010a) randomized patients into one of four groups: usual care, early mobilization (EM), automated monitoring (AM), or both EM and AM. The EM group underwent standard care plus a protocol aimed to have patients to sit, stand, and walk within 24 hours of stroke, which continued at least four times per day. Results of factorial analysis (2x2) showed a significant difference between EM and the control condition in Rankin Scale and Barthel Index scores after 3 months of mobilization (Langhorne et al., 2010a). These results suggest that early mobilization may improve the independence of patients post stroke, although there was no significant difference in length of hospital stay between EM and control.

Table 5.4.2.1 Acute Intensive Rehabilitation Compared to Alternative Intervention

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Di Lauro et al. (2003) (7)	NA	-	NA	NA
Langhorne et al. (2010a) (8)	NA	+	-	NA

5.4.3 Acute Stroke Unit Care

Neither of the two studies evaluating stroke units, characterised by acute admission and short length of stay, reported any benefits with respect to mortality or functional outcome when compared to care on a general medical ward. However, Ronning and Guldvog (1998b) noted trends in favour of stroke unit care for both outcomes at 7 months follow up. The same authors observed better processes of care (i.e. more early mobilization and greater frequency of medications) associated with stroke unit care. As well, Scandinavian Stroke Scale Scores were higher for stroke unit patients at 7 months. Cabral et al. (2003) assessed outcomes at six months and similarly reported no statistically significant between-group differences. Results from subgroup analysis, on the basis of stroke severity, also failed to demonstrate any benefit (Table 5.4.3.1).

Table 5.4.3.1 Acute Stroke Unit Care Compared to General Medical Ward Care

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Ronning & Guldvog (1998b) (6)	-	-	-	-
Cabral et al. (2003) (5)	-	-	-	NA

5.4.4 Meta-Analyses of Acute Stroke Units

To assess the overall effect of acute stroke care compared to alternative strategies, pooled analyses were conducted for the outcomes of interest, including mortality, length of stay, and the need for institutionalization. The diversity of measurements used to assess functional outcome precluded the application of meta-analysis to this outcome. However, there was sufficient data available to enable a pooled result for the combined outcome of death/disability, although

dependency was defined differently between studies. The results are presented in figures 5.4.4.1 to 5.4.4.4.

Table 5.4.4.1 Criteria Used to Define Dependency

Study	Criteria
Acute Stroke Unit	
Ronning & Guldvog (1998b)	Not stated in original publication; used figures from Cochrane meta-analysis
Cavallini et al. (2003)	Modified Rankin score ≥ 4
Cabral et al. (2003)	Modified Rankin score ≥ 3
Sulter et al. (2003)	Modified Rankin score ≥ 4 or Barthel Index < 60
Silva et al. (2005)	Modified Rankin score > 2

Figure 5.4.4.1 Mortality

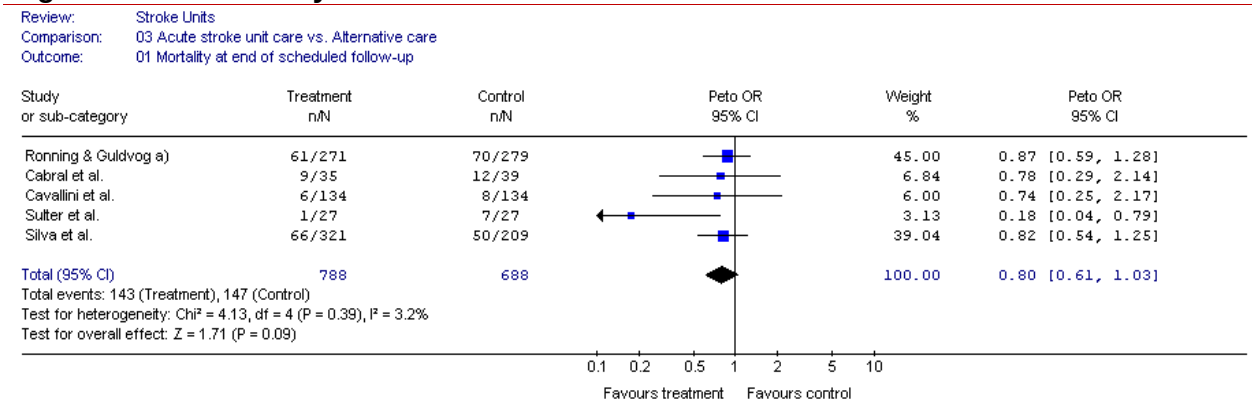


Figure 5.4.4.2 Combined Death/Dependency

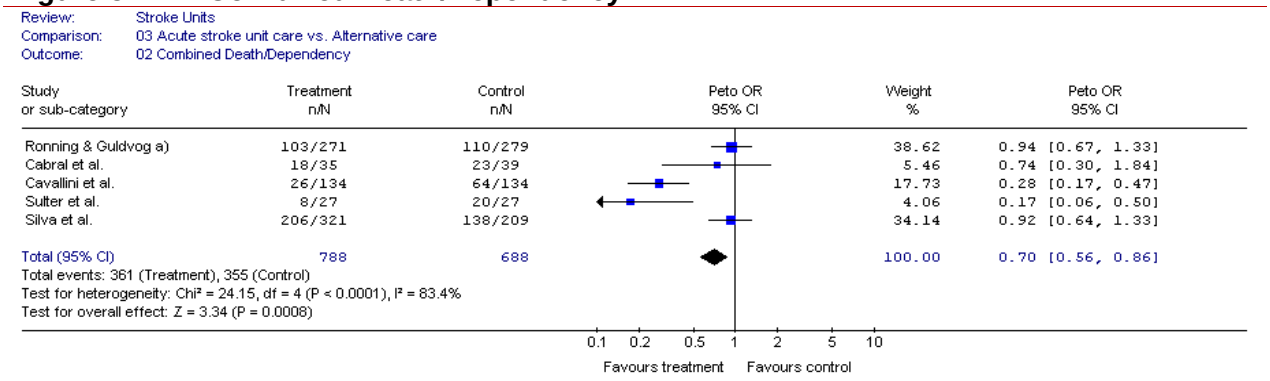


Figure 5.4.4.3 Need for Institutionalization

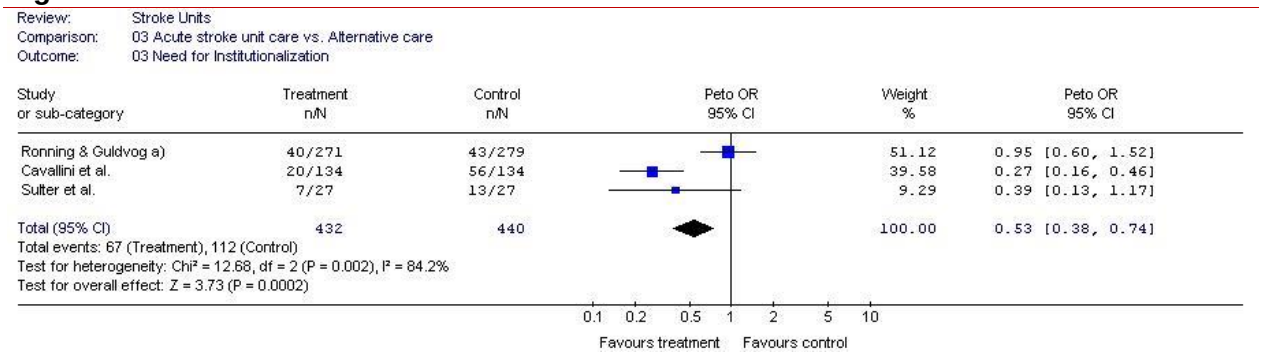
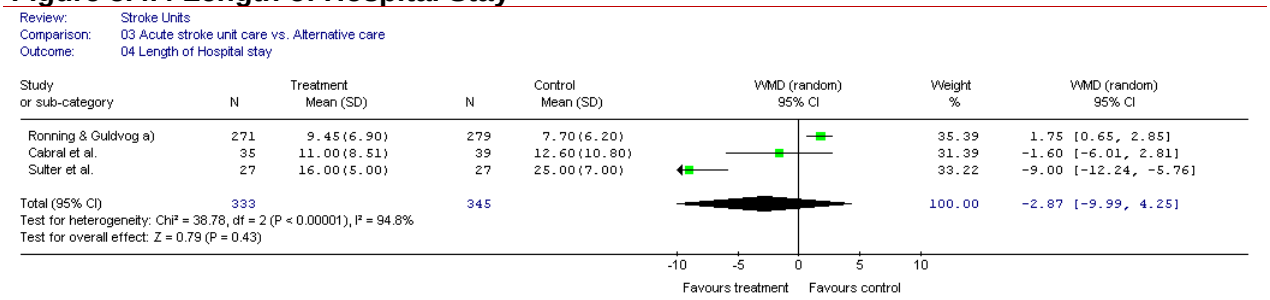


Figure 5.4.4 Length of Hospital Stay



Conclusions Regarding Acute Stroke Units

Based on the results from meta-analyses, there is Level 1a evidence that acute stroke care is associated with a reduction in death/dependency and institutionalization, but not with reductions in mortality or length of stay, when compared to alternative care.

There is Level 1a evidence that acute stroke care is not associated with a reduction in functional disability when compared to alternative interventions.

Acute stroke care, characterized by intensive monitoring and treatment for medical complications, is associated with reductions in combined death/disability and the need for institutionalization, but not reductions in mortality, length of hospital stay, or functional disability.

5.5 Combined Acute and Rehabilitation Units

Seven studies evaluating combined acute/rehabilitation stroke units were identified. All these studies admitted patients acutely and offered both acute and rehabilitative care (Table 5.5.1). A single intervention was assessed:

1. Combined stroke unit or neurology ward vs. General medical ward (Chan et al., 2014; Fagerberg et al., 2000; Garraway et al., 1980b; Indredavik et al., 1991; Kaste et al., 1995; Ma et al., 2004; Sivenius et al., 1985).

Table 5.5.1 Studies Evaluating Acute Stroke Care with a Rehabilitation Component

Author (Year)	Methods	Outcomes

Country PEDro Score Sample Size		
Garraway et al. (1980b)a UK 5 (RCT) N=311	Patients with moderate to severe strokes admitted within 7 days of onset were randomized to receive treatment on a stroke unit or a medical unit on call for emergency admissions.	1. A greater proportion of stroke unit patients were classified as independent when compared to medical unit patients, 50% vs. 32% at 60 days. When comparing only survivors, the proportion of independent patients rose to 62%. 2. A greater proportion of stroke unit patients were referred for physical and occupational therapy; there were shorter delays between admission and start of therapy.
Garraway et al. (1980a)b Garraway et al. (1981) UK 5 (RCT) N=192	Follow up study of patients from Garraway et al. 1980a.	1. At one year, there were no longer significant differences in the proportion of patients who were classified as independent: 55% of stroke unit patients and 52% of medical ward patients were assessed as independent.
Sivenius et al. (1985) Finland 6 (RCT) N=95	Patients able to tolerate an intensive rehabilitation program at 1 week post stroke were randomized to an intensive physiotherapy program on a stroke unit or a control group receiving conventional physiotherapy on a general medical unit.	1. Patients receiving intensive physiotherapy significantly improved their level of ADL and mobility at 3, 6, and 12 months; the greatest gains were achieved in the first 3 months.
Indredavik et al. (1991) Norway 7 (RCT) N=220	Patients within 7 days post stroke were randomized to a combined acute/rehabilitation stroke unit or a general medical unit.	1. Patients who were treated on the combined stroke unit were more likely to have been discharged home, were less likely to have been institutionalized, and were more likely to have higher Barthel Index scores at both 6 weeks and 1 year. 2. The 6-week mortality rate was lower for patients treated on the combined stroke unit.
Kaste et al. (1995) Finland 8 (RCT) N=232	Patients within 7 days post stroke were randomized to receive care on a stroke unit or a general medical unit.	1. In-patient, 6 month and one-year mortality rates and LOS were significantly lower for patients treated on a stroke unit. Stroke unit patients had improved functional outcomes and were more likely to be discharged home.
Indredavik et al. (1997) Norway 7 (RCT) N=220	5-year follow-up study of Indredavik et al. 1991.	1. At 5 years post stroke, a greater proportion of patients originally treated on the stroke unit were alive and residing at home with higher Barthel Index scores when compared to patients treated on the general medical ward.
Indredavik et al. (1999b) Norway 7 (RCT) N=220	5-year follow-up study of Indredavik et al. 1991.	1. 5-year mortality rate for patients initially treated on a stroke unit was lower. 2. A greater proportion of patients treated on the stroke unit were classified as independent.
Indredavik et al.	10-year follow-up study of Indredavik et al.	1. At 10 years post stroke, a greater

(1999a) Norway 7 (RCT) N=220	1991.	proportion of patients initially treated on the stroke unit were alive (25 vs. 13%), residing in their homes (20 vs. 8%), and had Barthel Index scores ≥ 60 (20 vs. 8%) compared to patients treated on a general medical ward.
Fagerberg et al. (2000) Sweden 8 (RCT) N=249	Patients were randomized to receive care on a stroke unit or a general medical ward.	1. Of the 173 patients followed, treatment on a stroke unit was not associated with improved mortality, better ADL function, discharge to residence, or higher quality of life at 3 months or 1 year post stroke.
Ma et al. (2004) China 5 (RCT) N=392	Patients were randomized to care on a stroke unit or general ward. The stroke unit was characterized by rehabilitation services, computer-aided speech-language pathology therapy, psychological services and multi-media-aided health education support.	1. The mean change in Barthel Index scores was significantly greater for stroke unit patients (20 ± 24 vs. 10 ± 23, p<0.0001). 2. The mean change scores for the National Institute of Health Stroke Scale and the Oxford Handicap Scale were also significantly higher for stroke unit patients from admission to time of discharge.
Chan et al. (2014) Australia 9 (RCT) N_{Start}=47 N_{End}=41	**Population:** Experimental Group (EG; N=20): Mean age=73.5±9.9; Males=11, Females=9. Control Group (CG; N=21): Mean age=72.6±14.1; Males=12, Females=9. **Intervention:** Patients were randomized into EG or CG. CG received traditional stroke care and EG received comprehensive stroke care. Outcomes were assessed at baseline, discharge, and 90 days post discharge. **Primary Outcomes:** Functional Independence Measure (FIM); Length of hospital stay (LOS).	1. No significant difference between EG and CG in FIM for both discharge and 90-day post discharge follow-up. 2. No significant difference between EG and CG in LOS. 3. There was a significant difference between EG and CG in FIM efficiency.

5.5.1 Heterogeneity of Patients and Interventions

Studies varied with respect to the eligibility of the patients. Three trials appeared to accept all patients regardless of stroke severity (Fagerberg et al., 2000; Kaste et al., 1995; Ma et al., 2004). Of the remaining trials, one included patients with evidence of a motor deficit or hemiplegia (Garraway et al., 1980b). Sivenius et al. (1985) excluded patients with either mild or severe stroke, while two others excluded patients who were unconscious on admission (Chan et al., 2014; Indredavik et al., 1991). The heterogeneity of patient characteristics led to difficulties when formulating conclusions.

Of the seven trials, five included a dedicated stroke unit as the intervention and a general medical unit as the control condition (Fagerberg et al., 2000; Garraway et al., 1980b; Indredavik et al., 1991; Ma et al., 2004). Sivenius et al. (1985) and Kaste et al. (1995) offered specialized care on a neurology ward as the intervention, which included patients with diagnoses other than stroke. Mortality was found to be lower in combined stroke units in only a single trial (Indredavik et al., 1991). Indredavik et al. (1999a; 1991; 1997) reported reduced mortality at six weeks, five years, and ten years, although there was no statistically significant difference at the one-year point.

The majority of the studies reported improvements in functional outcomes, as assessed by a wide variety of instruments for activities of daily living (ADL). Five out of seven studies reported significant improvements in patients who received care on a specialized stroke/neurology ward. Although functional independence measure was not statistically significant in Chan et al. (2014), it is important to note that the comprehensive stroke care group did show a greater improvement

in Functional Independence Measure efficiency compared to the traditional stroke care group. The mean Barthel Index score and the proportion of patients classified as independent in ADL at one-year follow-up were greater among patients receiving care on the neurology (mixed) ward (Kaste et al., 1995). Sivenius et al. (1985) noted greater gains in a 27-point ADL score among patients receiving more intensive rehabilitation at 3 months; the gains persisted at 6 and 12 months but were not statistically significant. Only Kaste et al. (1995) failed to report a beneficial effect of specialized treatment. The large proportion of patients included in this trial who had suffered from a mild stroke (45%) may have diluted the impact of the treatment, as patients with more disabling strokes are the group most likely to benefit.

The results were conflicting with respect to reductions in length of stay (LOS). Three studies reported significantly shorter LOS associated with comprehensive stroke units (Garraway et al., 1980b; Indredavik et al., 1991; Ma et al., 2004). Two studies reported no differences in LOS between groups (Fagerberg et al., 2000; Sivenius et al., 1985) and one study did not assess this outcome. The results were also conflicting for the proportion of patients requiring institutionalization following rehabilitation. Indredavik et al. (1991) reported that the proportion of patients requiring institutionalization was lower in patients who had received care on a specialized unit, while Fagerberg et al. (2000) found no difference in LOS between treatment groups. The outcome was not assessed in the remaining studies.

A Cochrane review reviewed twenty-one trials (N=3994) comparing stroke unit care and general medical ward care (Stroke Unit Trialists' Collaboration, 2013). Results of the meta-analysis showed reductions in death (OR 0.87, 95% CI, 0.69–0.94; P=0.005), institutionalized care (OR 0.78; 95% CI 0.68–0.89; P=0.0003), and dependency (OR 0.79; 95% CI 0.68–0.90; P=0.0007), but had no influence on length of hospital stay. These results suggest that comprehensive stroke units are more beneficial to patients then general medical ward care.

The reason for the conflicting results for the outcomes of LOS and institutionalization was unclear, although it may be explained in part due to differences in the processes of care between the individual institutions, variations in the characteristics of the patients included, or the sensitivity of the functional outcome measures used (Table 5.5.1.1).

Table 5.5.1.1 Combined Stroke Unit Care Compared to General Medical Ward Care

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Garraway et al. (1980b) (5)	-	+	+*	NA
Sivenius et al. (1985) (6)	-	+	-	NA
Indredavik et al. (1991) (7)	+ (6 weeks) - (52 weeks)	+ +	+ NA	+ +
Indredavik et al. (1997) (7)	+	+	NA	-
Indredavik et al. (1999a) (7)	+	+	NA	-
Kaste et al. (1995) (8)	-	+	+	NA
Fagerberg et al. (2000) (8)	-	-	-	-
Ma et al. (2004) (5)	NA	+	NA	NA
Chan et al. (2014) (9)	NA	-	-	NA

** No test of statistical significance was performed*

5.5.2 Meta-Analyses of Combined Stroke Rehabilitation Units

To assess the overall effect of combined stroke units compared to alternative strategies, pooled analyses were conducted for the outcomes of interest. If necessary, when summary statistics

and/or measures of variance were not included in the text or tables of individual RCTs, data from a Cochrane review (Stroke Unit Trialists' Collaboration, 2013) were used. Pooled results were possible for the outcomes of mortality, need for institutionalization, and length of hospital stay. The diversity of measurements used to assess functional outcome precluded the application of meta-analysis to this outcome. However, there was sufficient data available to enable a pooled result for the combined outcome of death or disability although dependency was defined differently between studies (Table 5.5.2.1). The results are presented in Figures 5.5.2.1 to 5.5.2.3.

Table 5.5.2.1 Criteria Used to Define Dependency

Study	Criteria
Combined Stroke Unit	
Garraway et al. (1980b)	Inability to complete activities of daily living; scale not used
Sivenius et al. (1985)	Not stated in original publication; used figures from Cochrane meta-analysis
Indredavik et al. (1991)	Not stated in original publication; used figures from Cochrane meta-analysis
Kaste et al. (1995)	Not stated in original publication; used figures from Cochrane meta-analysis
Fagerberg et al. (2000)	Barthel Index < 95

Figure 5.5.2.1 Combined Death/Dependency

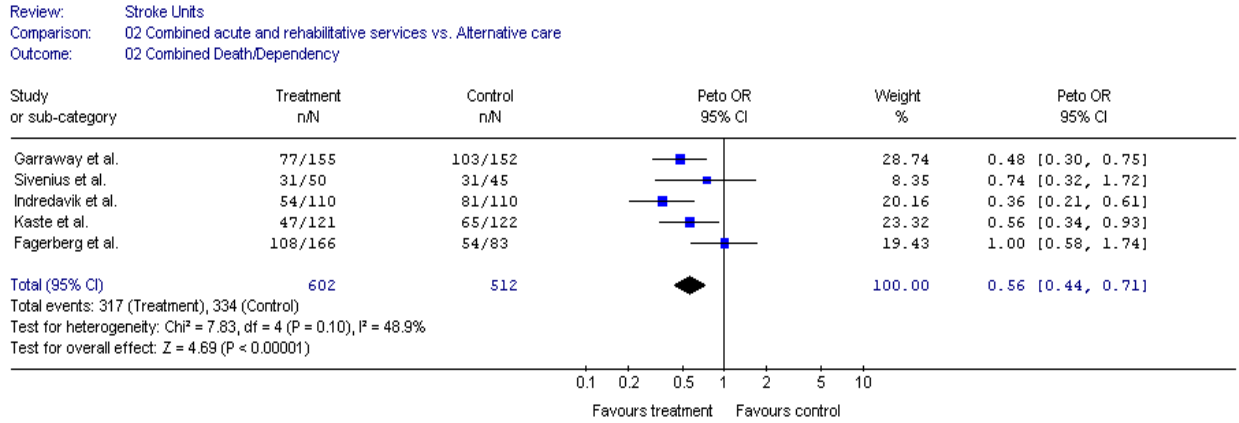


Figure 5.5.2.2 Need for Institutionalization

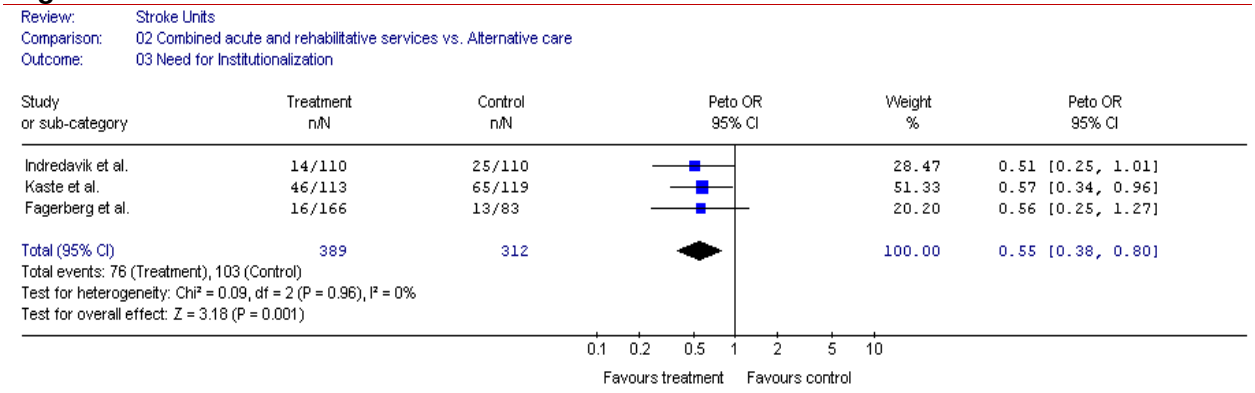
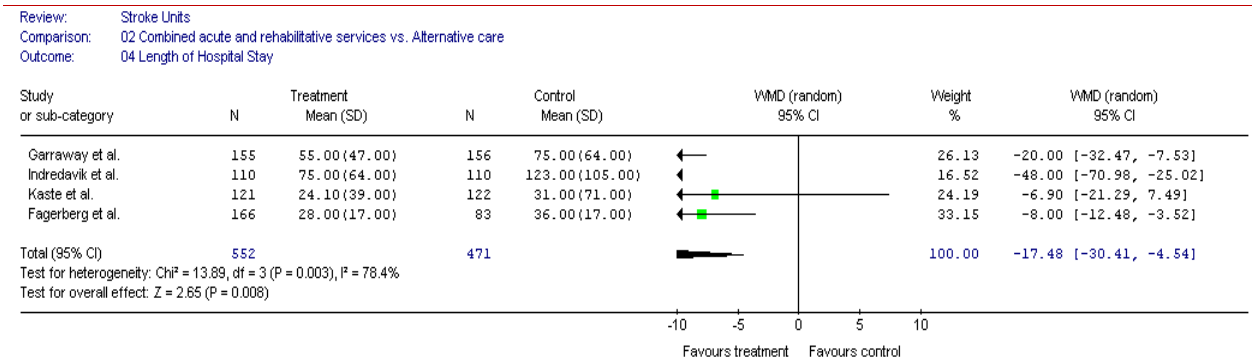


Figure 5.5.2.3 Length of Hospital Stay



Conclusions Regarding Combined Stroke Units

Based on the results from meta-analyses, there is Level 1a evidence that combined acute and rehabilitation stroke units are associated with reductions in death/dependency, institutionalization, and length of stay, but not with reduced mortality, compared to general medical wards.

There is Level 1a evidence that combined stroke units are associated with improved functional outcome compared to general medical wards.

Interdisciplinary combined acute and rehabilitation stroke units reduce combined death/dependency, need for institutionalization, and length of hospital stay, but not overall mortality, when compared to general medical wards.

5.6 Subacute Rehabilitation

Thirteen RCTs evaluating subacute rehabilitation (i.e. following transfer from another unit or facility) were identified, which evaluated the following interventions (Table 5.6.1):

1. Stroke rehabilitation or Stroke unit vs. General medical ward (Juby et al., 1996; Kalra et al., 1993; Kalra & Eade, 1995; Stevens et al., 1984; Yagura et al., 2005)
2. Inpatient rehabilitation vs. Ad hoc community care (Ronning & Guldvog, 1998a)

Table 5.6.1 Studies Evaluating Subacute Rehabilitation

Author (Year) Country PEDro Score Sample Size	Methods	Outcomes
Peacock et al. (1972) UK 5 (RCT) N=52	Patients admitted within 2 weeks of stroke were randomized to receive intensive rehabilitation in a stroke centre or routine care on a general ward.	1. There was a trend towards decreased frequency of death and dependency in the stroke rehabilitation group at the end of follow-up (6-8 weeks), although the differences were not statistically significant.
Stevens et al. (1984) UK 6 (RCT) N=228	Patients were randomized to receive care on a stroke rehabilitation ward or a general medical ward.	1. Patients on stroke ward received more occupational and speech therapy. 2. A significantly greater percentage of patients on the stroke ward were assessed as independent in dressing at one-year follow-up. 3. There were non-significant differences in mortality, rate of discharge home, and ADL

		function at one year (but a trend in favour of the stroke unit).
Kalra et al. (1993) UK 5 (RCT) N=245	Patients admitted within 2 weeks of stroke were randomized to a rehabilitation unit or a general medical unit after stratification by stroke severity.	1. Patients with a poor prognosis treated on a general medical ward had higher mortality rates and longer hospital stays. 2. Patients in the stroke rehabilitation unit with moderate stroke severity had better discharge Barthel Index scores and shorter hospital stays.
Kalra et al. (1994b) UK 5 (RCT) N=146	Analysis of 146 patients with moderate stroke from Kalra et al. 1993.	1. Median Barthel Index scores of patients managed on the stroke unit were significantly higher compared to patients on the medical unit (15 vs. 12). 2. Rate of improvement in Barthel Index scores was faster for patients on the stroke unit and these patients had significantly shorter length of stay (6 vs. 20 weeks). 3. Significant gains were achieved at a faster rate without additional physiotherapy or occupational therapy in total.
Kalra (1994a) UK 5 (RCT) N=245	Analysis of Kalra et al. 1993, comparing 101 patients <75yr (younger) and 144 patients ≥75yr (older).	1. Younger stroke unit patients had a significantly higher home discharge rate, higher median Barthel Index scores at discharge, a greater change scores and a shorter length of stay (27 vs. 56 days). 2. The mortality rate of older stroke unit patients was lower.
Kalra & Eade (1995) UK 5 (RCT) N=76	Patients with poor prognosis (Orpington Prognostic Score >5) resulting from severe strokes were randomized to receive care on a stroke unit or general medical unit.	1. Patients treated on the stroke unit had shorter length of stay (43 vs. 58 days), lower mortality (21 vs. 46%), and higher rates of discharge home (47 vs. 19%). 2. There were no differences in median Barthel Index scores between the two groups.
Juby et al. (1996) UK 6 (RCT) N=315	Patients admitted an average of 2 weeks post stroke were randomized to receive care on either an interdisciplinary stroke unit or to care on a general medical and geriatric unit.	1. At both 6 months and 1 year, stroke unit patients had higher Nottingham Extended ADL scores. 2. At 1 year, stroke unit patients had better scores on the General Health Questionnaire. 3. At 6 months, stroke unit patients had higher scores on Barthel Index and Rivermead Mobility Index compared to patients on other units. 4. At 6 months, cognitive readjustment was better for patients on the stroke unit.
Drummond et al. (1996) UK 6 (RCT) N=315	Analysis of patients from Juby et al. 1996.	1. Barthel Index and Rivermead ADL scores of patients on the stroke unit were significantly better than those of patients on the conventional ward at 3mo and 6mo, but not at 12 mo. 2. Patients on the stroke unit had significantly higher Extended ADL scores at 6mo and 12 mo, but not at 3 mo, than patients on the conventional ward.

Lincoln et al. (1996) UK 5 (RCT) N=76	Patients were randomized to receive care on either a stroke unit or other hospital wards.	1. Stroke unit patients spent less time in their beds and more time on other locations on the ward. 2. Stroke unit patients spent more time in individual tasks, self-care, task interactions, and more time interacting with staff. 3. Stroke unit patients were also in the position recommended by therapists more often.
Ronning and Guldvog (1998a) Norway 6 (Quasi RCT) N=251	Patients were randomized to subacute rehabilitation in a hospital-based stroke rehabilitation program or to a community-based program (nursing home 40%, outpatient rehabilitation 30% and no rehabilitation 30%) and followed for 7 months.	1. Greater proportion of community-based rehabilitation patients were dependent or dead compared to hospital rehabilitation patients; no difference in survival at 7 months. 2. Patients with moderate or severe stroke, treated in a hospital-based program, had higher median Barthel Index scores at 7 months (90 vs. 73) and lesser combined dependency and death (23% vs. 38%).
Lincoln et al. (2000) UK 6 (RCT) N=315	5-year follow-up of Juby et al. 1996.	1. Relative risk of death, death or disability and death or institutional care were all in direction of favourable outcomes for patients initially treated on the stroke unit.
Drummond et al. (2005) UK 6 (RCT) N=315	10-year follow-up of Juby et al. 1996	1. Of 176 patients originally allocated to receive treatment on a stroke unit, 122 (69%) were dead, 31 were disabled (Barthel Index 0-17) and 9 were in institutionalized care. (8 were untraced and 4 refused to give consent for follow-up). 2. Of the 139 allocated to a conventional ward, 111 (80%) were dead, 9 were disabled, 2 were in institutional care. (7 were untraced and 4 refused to give consent for follow-up). 3. The relative risks for: death (0.87, 95% CI; 0.78 to 0.97), death or disability (0.91, 95% CI; 0.94 to 1.05) and death or institutional care 0.91 (0.83 to 1.00).
Yagura et al. (2005) Japan 6 (RCT) N=178	Patients within 3 months of stroke were randomized to receive care on a stroke rehabilitation unit with regular interdisciplinary stroke team conferences or a general rehabilitation ward without such conferences in the same rehabilitation hospital.	1. The interval between stroke onset and admission was significantly longer in the SRU (n = 91) group compared with the GRW group (n = 87; 60.4 vs. 53.8 days, $p < 0.05$). 2. Although comparable numbers of patients were discharged home (74.7% in the SRU vs. 71.3% in the GRW), significantly more patients ($p < 0.0001$) with severe disability were discharged home in the SRU group (47.4%) compared with the GRW group (0%). 3. There were no significant differences between the groups on any of the other outcome measures, including FIM and costs.

There were differences between the studies with respect to the characteristics of patients included, as described below (Table 5.6.2) Three of the studies included patients with middle-band or moderately severe stroke (Juby et al., 1996; Peacock et al., 1972; Stevens et al., 1984). Kalra and Eade (1995) only included patients with severe deficits, while both Kalra et al. (1993) and Ronning & Guldvog (1998a) appeared to include patients with all levels of stroke severity,

except for those who were very mildly impaired. Subgroup analyses were provided for two of the studies and were used when formulating conclusions (Kalra et al., 1993; Ronning & Guldvog, 1998a).

Table 5.6.2 Patient Characteristics

Study	Characteristics
Peacock et al. (1972)	Patients with completed stroke entering inpatient rehabilitation
Stevens et al. (1984)	Patients considered "fit and in need of rehabilitation"
Kalra et al. (1993)	Patients with median Barthel Index score of 10 Statistical analysis was based on level of stroke severity, established using the Orpington Prognostic Scale (Mild <3, N=63; Moderate 3-5, N=146; Severe >5, N=36)
Kalra & Eade (1995)	Patients with severe stroke (Orpington Prognostic Scale >5)
Juby et al. (1996)	Patients with moderate stroke
Ronning & Guldvog (1998a)	Patients with Scandinavian Stroke Scale score of 12-52 Statistical analysis based on initial Barthel Index score (<50, N=114; ≥50, N=137)
Yagura et al. (2005)	Patients requiring rehabilitation following discharge from acute hospital within 3 months of stroke

Although some patients were randomized to treatment groups before 2 weeks, all of the patients in these studies received their initial care on a different service unit or facility (Table 5.6.3).

Table 5.6.3 Time From Stroke Onset to Rehabilitation Admission

Study	Treatment Group	Control Group
Peacock et al. (1972)	Unknown	Unknown
Stevens et al. (1984)	Unknown	Unknown
Kalra et al. (1993)	14 days	14 days
Kalra & Eade (1995)	Median: 9 days	Median: 9 days
Juby et al. (1996)	Median: 14 days	Median: 14 days
Ronning & Guldvog (1998a)	Mean: 9.4 days	Mean: 10.4 days
Yagura et al. (2005)	Mean 60.4 days	Mean: 53.8 days

Of the four trials evaluating mortality, only one (Kalra & Eade, 1995) reported a decreased proportion of patients who had died and had been treated on a stroke rehabilitation unit (21% vs. 46%). The patients included in this trial all suffered from a severe stroke. Of the remaining trials, Kalra et al. (1993) reported similar reduction in mortality among patients with severe stroke, but not among those with mild or moderate stroke. Drummond et al. (2005) reported that fewer patients who were initially treated on a stroke rehabilitation unit were dead 10 years later. The two studies that included patients with moderately disabling strokes (Juby et al., 1996; Stevens et al., 1984) did not find an association between decreased mortality and specialized stroke rehabilitation care, although Stevens et al. (1984) did report a trend in favour of specialized care (31% vs. 41% for mortality at 12 months). The apparent benefit conferred upon patients with severe stroke receiving specialized care is unclear, although the reduction in mortality may be related to the prevention and/or effective management of secondary complications (Table 5.6.4).

Table 5.6.4 Stroke Rehabilitation Units Compared to General Medical Ward

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Peacock et al. (1972) (5)	NA	-	NA	NA
Stevens et al. (1984) (6)	-	+ (ADL: dressing) - (ADL: all others)	-	-

Kalra et al. (1994a, 1994b; 1993) (5)	+ (Severe) - (Mild/Moderate)	+ (Moderate) - (Mild/Severe)	+ (Moderate/Severe) - (Mild)	+ (Moderate) - (Mild/Severe)
Kalra & Eade (1995) (5)	+	-	+	-
Juby et al. (1996) (6) Drummond et al. (2005) (6)	- + (at 10yr)	+ (ADL at 3/6mo) - (ADL at 1yr)	- at 1yr NA at 10yr	- at 1yr NA at 10yr
Yagura et al. (2005) (6)	None	-	-	- + (Severe)

All of the trials evaluated functional outcome using at least one activities of daily living (ADL) instrument. Many of the trials reported equivocal results associated with specialized stroke care when the overall result was considered, although there were benefits among subgroups. Kalra et al. (1993) reported that a greater percentage of patients who had suffered from moderately disabling strokes and who received care on a stroke rehabilitation unit had discharge Barthel Index (BI) scores greater than 11 compared to those who were cared for on a medical wards (81% vs. 60%); there was no benefit for patients with either mild (100% vs. 100%) or severe stroke (6% vs. 0%). A later study by Kalra and Eade (1995), which restricted eligibility to patients with severe deficits, also did not report improved ADL performance associated with site of rehabilitation. The median discharge BI scores were 8 for stroke rehabilitation unit patients compared to 6 for general medical ward patients.

Juby et al. (1996) reported significant improvements in BI scores of patients receiving stroke rehabilitation at three and six months post stroke but not at 12 months. The median BI scores for patients randomized to the stroke rehabilitation and the conventional ward were, 17 vs. 15 at 6 months and 17 vs. 16 at 12 months. For the same group of patients at five years following stroke, Lincoln et al. (2000) did not report any differences in the proportion of patients with BI scores of less than 18 (indicating dependency). However, the proportion of patients with combined death and dependency were lower in those treated initially on the stroke rehabilitation unit. Ten years after stroke, Drummond et al. (2005) reported that there was a trend towards reductions in death or disability (RR 0.99, 95% CI 0.94-1.05) and death or institutionalization (RR 0.91, 95% CI 0.83-1.00).

Stevens et al. (1984) measured individual ADL components but did not provide composite scores for comparison. At 12 months, the percentage of patients who had achieved independence in dressing was significantly higher among those who had received specialized stroke rehabilitation care (60% vs. 51%). Although this was the only statistically significant result, there was a trend in favour of stroke rehabilitation for the percentage of patients who had achieved independence in walking (78% vs. 67%), toileting (71% vs. 62%), and eating (47% vs. 38%).

The results for length of stay (LOS) were conflicting (Table 5.6.5). Among six studies that reported a comparison, the control condition was associated with shorter LOS in three studies (Juby et al., 1996; Stevens et al., 1984; Yagura et al., 2005); two of these studies only included patients with moderately severe stroke. There was considerable variation in LOS between studies, which ranged from 29 to 117 days, suggesting significant heterogeneity in the characteristics of included patients and/or variations in policies of individual institutions.

Table 5.6.5 Length of Hospital Stay

Study	Treatment Group: Days (Mean)	Control Group: Days (Mean)
Peacock et al. (1972)	Unknown	Unknown
Stevens et al. (1984)	117	113

Kalra et al. (1993)	48.7	105
Kalra & Eade (1995)	47.2	76.8
Juby et al. (1996)	81.1	63.2
Yagura et al. (2005)	97.7	95.2

Interpretations of the results of studies examining LOS are difficult. While a shorter LOS may be seen as desirable for cost containment strategies, a longer LOS may give patients a greater opportunity to maximize their rehabilitation efforts to achieve the best possible outcome. The intensity of therapy was not well described in many of these studies, and most did not include indicators of treatment efficiency (i.e. change in LOS or functional outcome). None of the studies, which assessed the need for institutionalization, reported an overall reduction associated with stroke rehabilitation compared to the control condition. However, Kalra and Eade (1995) reported that a larger percentage of patients who were treated on a stroke rehabilitation unit were discharged home (47% vs. 19%, $p<0.01$). Somewhat surprisingly, this did not positively alter the number of patients who required institutionalized care (32% vs. 35%), as might be expected.

Kalra et al. (1993) reported that patients with moderate stroke who received stroke unit care were less likely to require long-term care (22% vs. 44%), although there was no reduction in need for patients with either mild (0% vs. 3%) or severe stroke (45% vs. 23%). While the effect for severe stroke patients appears dramatic, the lack of statistical significance associated with the point estimates likely arises from the small number of patients who were randomized to each treatment condition (N=18).

Yagura et al. (2005) reported a significant difference in the number of patients discharged home in a subset of severe stroke patients (47.4% vs. 0, $p<0.001$). The reason for this finding is unclear given that the main difference between treatment groups in this study was the inclusion of a weekly multidisciplinary team meeting. This study admitted patients for further rehabilitation following the longest period from stroke onset to admission (roughly 2 months).

Subgroup analysis from the Stroke Unit Trialists' Collaboration (2013) indicated that the odds of death or institutional care were lower for patients with moderate (OR 0.81, 95% CI 0.66-0.99) and severe strokes (OR 0.48, 95%CI 0.33-0.70). There was no significant reduction associated with the mild stroke (OR 0.76, 95% CI 0.52-1.11). The authors do caution that a small number of outcome events was observed, which limits the statistical power.

5.6.1 Hospital-Based Care vs. Ad Hoc Community Care

A single study by Ronning and Guldvog (1998a) evaluated the benefit of subacute rehabilitation provided either within a hospital on a specialized stroke rehabilitation unit or within the community (Table 5.6.1.1). Of the patients allocated to community-based rehabilitation, 40% were treated in nursing homes, 30% received outpatient physical therapy, and 30% were not offered any treatment. Ronning and Guldvog (1998a) did not report a significant difference in mortality or dependency between groups at seven months for patients receiving hospital based care compared to community-based rehabilitation, regardless of initial stroke severity, but there was a significant reduction in combined death and dependency (OR 0.49, 95% CI 0.28-0.86).

Among the patients with initial Barthel Index scores of <50, indicating a moderate to severe level of impairment, only 21% receiving hospital-based care were initially considered to be dependent compared to 50% at 7 months. The need for long-term care among patients with mild stroke who received hospital-based rehabilitation was actually higher than for those who remained in the

community (1.5% vs. 11%), while there were no significant differences for patients with moderately severe stroke (14% for hospital rehabilitation vs. 24% for community rehabilitation).

Table 5.6.1.1 Inpatient Rehabilitation Compared to Ad Hoc Community Care

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Ronning & Guldvog (1998a) (6)	- (Moderate/Severe) - (Mild)	+ (Moderate/Severe) - (Mild)	NA	+ (Mild) - (Moderate/Severe)

5.6.2 Meta-Analyses of Subacute Stroke Units

To assess the overall effect of subacute stroke care compared to alternative strategies, pooled analyses were conducted for the outcomes of interest. If necessary, when summary statistics and/or measures of variance were not included in the text or tables of individual RCTs, data from a Cochrane review (Stroke Unit Trialists' Collaboration, 2013) were used. Pooled results were possible for the outcomes of mortality, length of stay, and need for institutionalization. The diversity of measurements used to assess functional outcome precluded the application of meta-analysis for this outcome. However, there was sufficient data available to enable a pooled result for the combined outcome of death or disability, although dependency was defined differently between studies (Table 5.6.2.1). The results are presented in Figures 5.6.2.1 to 5.6.2.4.

Table 5.6.2.1 Criteria Used to Define Dependency

Study	Criteria
Subacute Unit	
Peacock et al. (1972)	Not stated in original publication; used figures from Cochrane meta-analysis
Stevens et al. (1984)	Not stated in original publication; used figures from Cochrane meta-analysis
Juby et al. (1996)	Not stated in original publication; used figures from Cochrane meta-analysis
Kalra et al. (1993)	Barthel Index <12
Ronning & Guldvog (1998a)	Barthel Index <75
Yagura et al. (2005)	Dependency not measured

Figure 5.6.2.1 Mortality

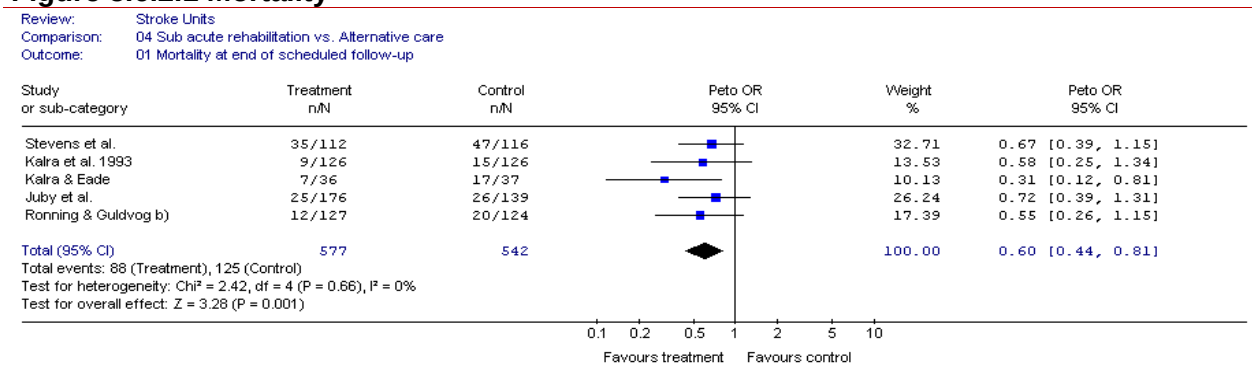


Figure 5.6.2.2 Combined Death/Dependency

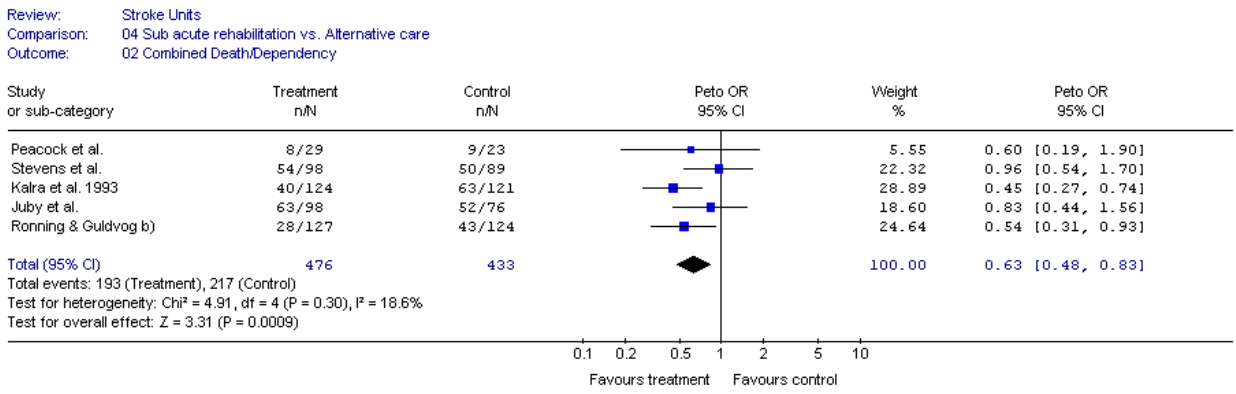


Figure 5.6.2.3 Need for Institutionalization

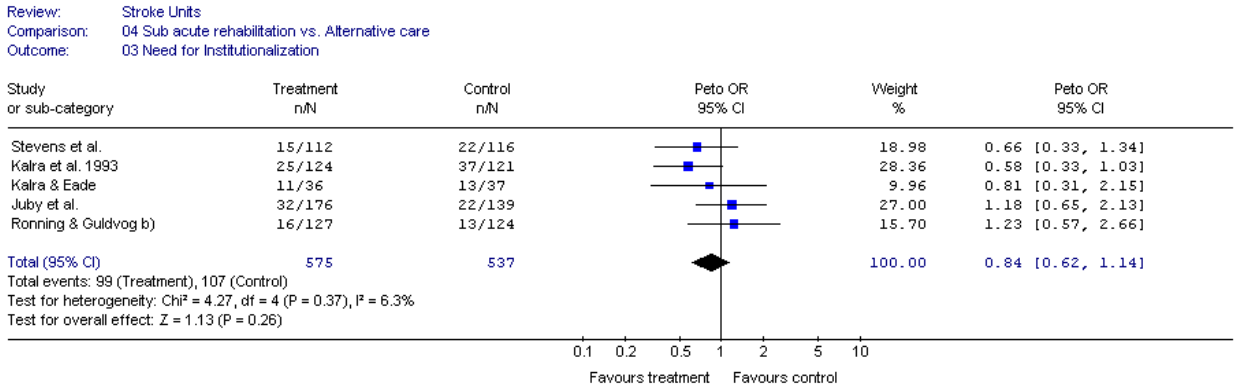
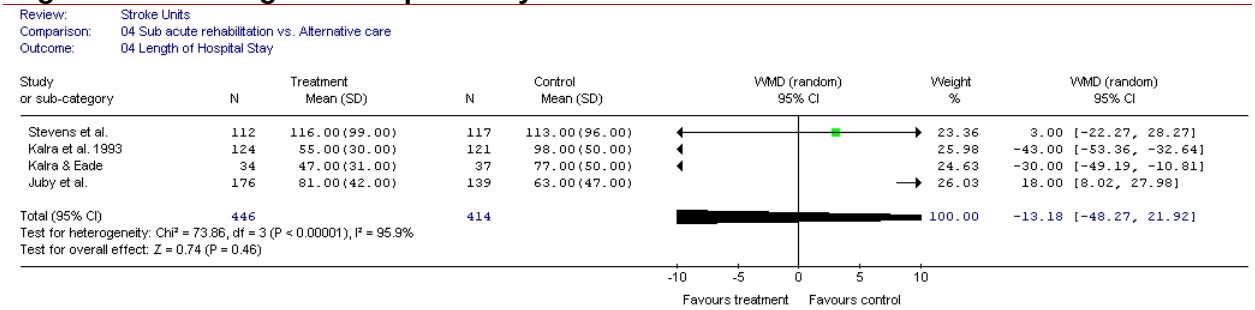


Figure 5.6.2.4 Length of Hospital Stay



Overall Conclusions Regarding Subacute Rehabilitation

Based on the results from meta-analyses, there is Level 1a evidence that specialized, interdisciplinary rehabilitation provided in the subacute phase is associated with reductions in mortality and death/dependency, but not with reduced institutionalization or length of stay, compared to conventional care on a general medical ward.

There is Level 1a evidence that for the subset of more severe stroke patients, specialized stroke rehabilitation reduces mortality but does not result in improved functional outcomes or reduced institutionalization compared to conventional care.

There is Level 1a evidence that for patients with moderately severe stroke, specialized rehabilitation improves functional outcomes but does not reduce mortality compared to conventional care.

There is Level 1a evidence that for patients with mild stroke, specialized rehabilitation does not improve functional outcome or reduce mortality compared to conventional care.

There is Level 1b evidence that patients with severe or moderately severe stroke who receive treatment on a stroke rehabilitation unit have a lower risk of being dependent or dead/dependent compared with patients who receive little or no rehabilitation.

Interdisciplinary specialized subacute stroke rehabilitation is associated with reduced mortality and combined death/dependency, but not the need for institutionalization or length of hospital stay, when compared to general rehabilitation.

Subgroups of patients will benefit from subacute rehabilitation in different ways: patients with more severe strokes experience reduced mortality; those with moderate strokes experience improved functional outcomes; and those with mild stroke do not improve to a greater extent compared with standard care.

5.7 Mobile Stroke Teams

While dedicated stroke units have been associated with improvements in outcome, it is uncertain whether this intervention is transportable. Langhorne et al. (2005) conducted a systematic review of mobile stroke teams evaluating studies that compared care provided by a mobile team of specialized stroke professionals on various wards versus alternative forms of inpatient stroke rehabilitation, most often provided on a general medical ward. While most of the studies evaluating stroke unit care have focused on organized services provided on a discrete ward, the portability of such care has not been extensively investigated. A total of six trials were included in the review, which comprised 1,085 patients.

The proportion of patients who had experienced death, death or institutionalization, and death or dependency at the end of scheduled follow-up were similar between studies comparing mobile stroke teams with general medical ward care (Table 5.7.1). However, patients receiving mobile stroke team care fared significantly poorer compared to patients who had been managed on a comprehensive stroke unit. Although the total number of patients included in the review was relatively small, the authors concluded that mobile stroke team care did not have a major impact on clinically important outcomes.

Table 5.7.1 Results of Meta-Analysis Evaluating Mobile Stroke Teams

Outcome	Comparison	OR (95% CI)
Early Death (median 6 weeks)	Stroke Team vs. General Medical Ward	0.77 (0.52-1.12)
Death		1.03 (0.74-1.42)
Death or Institutionalization		1.10 (0.81-1.49)
Death or Dependency		0.97 (0.71-1.33)
Early Death (median 6 weeks)	Stroke Team vs. Comprehensive Stroke Unit	3.27 (1.26-8.48)
Death		3.08 (1.56-6.11)
Death or Institutionalization		2.62 (1.47-4.67)
Death or Dependency		3.06 (1.73-5.42)

In this review, four trials evaluating the effectiveness of inpatient mobile stroke team care were included. One study included three treatment groups: an inpatient stroke unit, a mobile team, and home care (Kalra et al., 2000; Kalra et al., 2005). For the purposes of this review, the mobile

group was considered the intervention and the home care group was the control condition. In the remaining trials, the control condition was care on a general medical ward. Table 5.7.2 provides details of the interventions supplied by the treatment group.

Table 5.7.2 Mobile Stroke Team Characteristics

Study	Characteristics
Hamrin et al. (1982)	Activation program in nursing; not well described
Wood-Dauphinee et al. (1984)	Physician, physiotherapist, occupational therapist, social worker, and speech-language pathologist
Kalra et al. (2000; 2005)	Physician, nurse, physiotherapist, and occupational therapist
Dey et al. (2005)	Consultant physician and senior physiotherapist

The studies evaluating stroke rehabilitation care are summarized in Tables 5.7.3 and 5.7.4.

Table 5.7.3 Studies Evaluating Acute Stroke Care with a Rehabilitation Component

Author (Year) Country PEDro Score Sample Size	Methods	Outcomes
Hamrin (1982) Sweden 4 (Quasi RCT) N=112	Patients were randomized to receive organised care on a general medical ward or conventional care on a general medical ward for 4 weeks.	1. Significant improvement in Activities Index at 2 and 4 weeks. 2. No significant differences in the mean improvement rate of Activities Index scores at 4 weeks between groups.
Wood-Dauphinee et al. (1984) Canada 6 (RCT) N=130	Patients admitted within 7 days of stroke onset were randomized to receive care on a traditional medical stroke unit or to a rehabilitation unit emphasizing a team approach for 5 weeks.	1. No differences in survival rates between groups. 2. For motor performance, males performed better with team care and females with the stroke unit. 3. Barthel Index scores of males treated on the rehabilitation unit were better than those treated on the stroke unit.
Kalra et al. (2000) UK 8 (RCT) N=457	Patients were randomized to a stroke unit, a stroke team, or home care for a maximum of 3 months.	1. Odds of dying or being institutionalized at 1yr were 3.2 times greater for stroke team and 1.8 times greater for home care patients when compared to stroke unit patients. 2. Barthel Index scores were better for stroke unit patients than for stroke team and home care. 3. Modified Rankin scores were better for stroke unit patients than for stroke team, and home care patients.
Evans et al. (2002) UK 8 (RCT) N=457	Additional results for Kalra et al. 2000.	1. Mortality and mortality/institutionalization rates at 3mo and 12mo for patients with large vessel disease treated on the stroke unit were significantly lower compared to patients treated on general medical wards. 2. The percentage of patients with Barthel Index scores of 15-20 was significantly higher for stroke unit patients. 3. For patients with small vessel disease, there were no significant differences in the outcomes.
Dey et al. (2005) UK 8 (RCT) N=308	Patients admitted within 5 days of stroke were randomized to usual ward-based care or ward-based care including a mobile stroke team.	1. There were no statistically significant differences on any of the outcomes between groups. 2. At 6 weeks: Death 12.3% vs. 12.2%, death/dependency 62.3 vs. 66.2.

		3. At 12 months: Death 29.6& vs. 23.8%, death or dependency 60.7% vs. 66.9%, death/institution 39.5% vs. 35.4%). 4. No differences in ADL ability or quality of life at 12 months between groups.
Kalra et al. (2005) UK 8 (RCT) N=457	Additional results for Kalra et al. 2000.	1. Mortality and institutionalization were significantly lower among patients managed on the stroke unit compared to the other two forms of management (13.8% compared to 30.2% for stroke team and 23.6% for home care). 2. Although the median Barthel Index and Frenchay Activity Index scores were not significantly different between the groups, patients managed on the stroke unit achieved greater change scores. 3. Stroke units were more cost-effective than home care or stroke teams.

Table 5.7.4 Mobile Stroke Team Compared to Conventional Medical Management

Study (PEDro Score)	Mortality	Dependency	Length of Stay	Institutionalization
Hamrin (1982) (4)	-	-	-	-
Wood Dauphinee et al. (1984) (6)	+ (Males) - (Females)	+ (Males) - (Females)	NA	NA
Kalra et al. (2000; 2005) (8)	-	-	NA	-
Dey et al. (2005) (8)	-	-	NA	-

The results were null with respect to the four outcomes of interest, with the exception of a reduction in mortality and improved functional outcome among women in one trial (Wood-Dauphinee et al., 1984). Hamrin (1982) reported a trend in favour of the control condition, whereby 40% of patients in the experimental group were discharged to institutions compared to 27% of patients in the control group.

Similarly, Kalra et al. reported that a greater percentage of patients receiving stroke team care were less likely to be institutionalized at 12 months (7.4% vs. 9.0%), although a greater percentage were dead (30% vs. 24%), compared to patients treated in their homes (Kalra et al., 2000; Kalra et al., 2005). The null findings may be explained by the fact that mobile stroke teams were not directly responsible for patients care, but rather served in an advisory capacity, possibly limiting their influence. The null findings of mobile stroke units are detailed further in a Cochrane review incorporating two studies comparing mobile stroke units to general medical ward care (Stroke Unit Trialists' Collaboration, 2013). The results of the review suggested no significant overall effect in death, institutionalization, dependency or length of hospital stay (p=0.30).

5.7.1 Meta-Analyses of Mobile Stroke Teams

To assess the overall effect of mobile stroke care compared to alternative strategies, pooled analyses were conducted for the outcomes of interest. If necessary, when summary statistics and/or measures of variance were not included in the text or tables of individual RCTs, data from a Cochrane review (Stroke Unit Trialists' Collaboration, 2013) were used. Pooled results were possible for the outcomes of mortality, length of stay, and need for institutionalization. The diversity of measurements used to assess functional outcome precluded the application of meta-analysis to this outcome. However, there was sufficient data available to enable a pooled result for the combined outcome of death or disability, although dependency was defined differently

between studies (Table 5.7.1.1). The results are presented in Figures 5.7.1.1 to 5.7.1.4.

Table 5.7.1.1 Criteria Used to Define Dependency

Study	Criteria
Mobile Stroke Team	
Hamrin (1982)	Not stated in original publication; used figures from Cochrane meta-analysis
Wood-Dauphinee et al. (1984)	Not stated in original publication; used figures from Cochrane meta-analysis
Kalra et al. (2000; 2005)	Barthel Index <15 or Modified Rankin Scale ≥ 4
Dey et al. (2005)	Barthel Index ≤ 18

Figure 5.7.1.1 Mortality

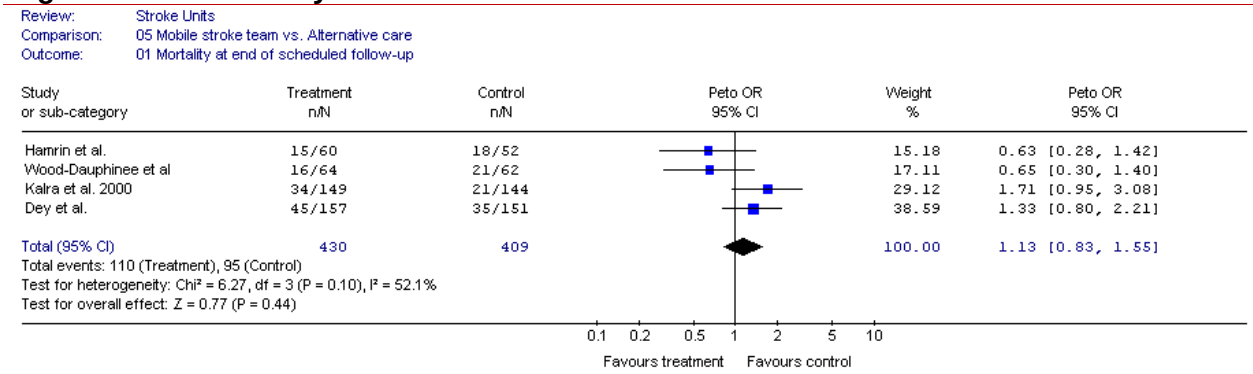


Figure 5.7.1.2 Combined Death/Dependency

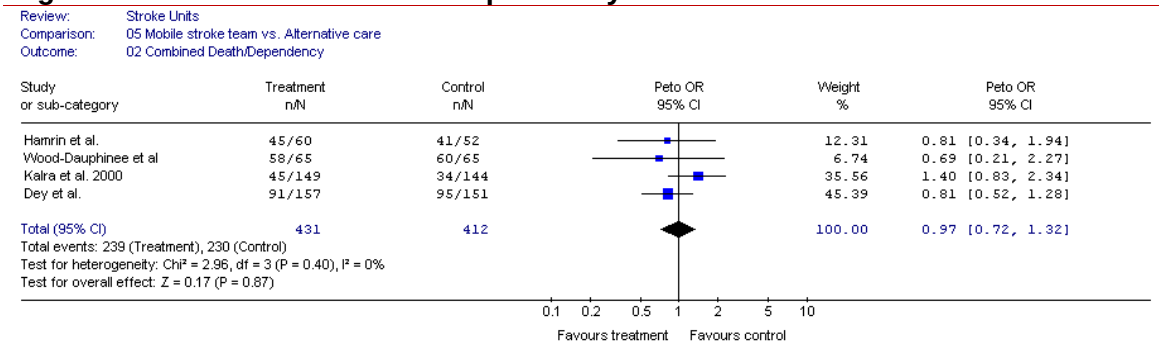


Figure 5.7.1.3 Need for Institutionalization

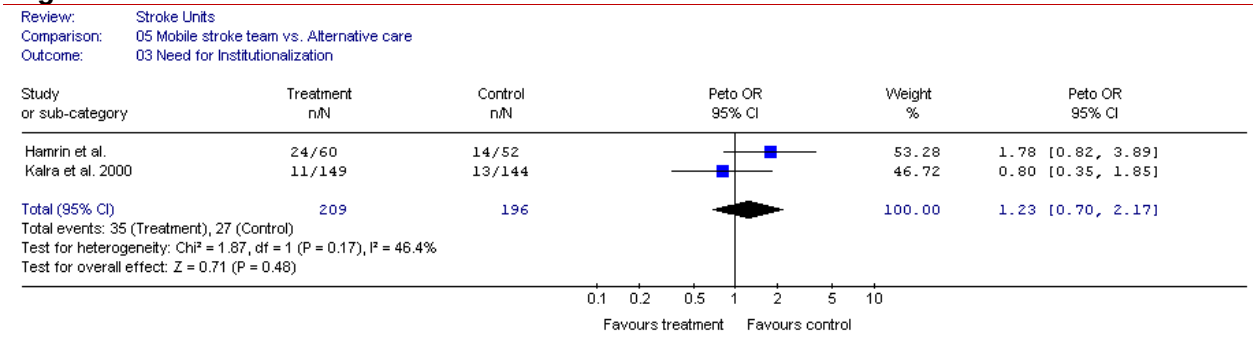
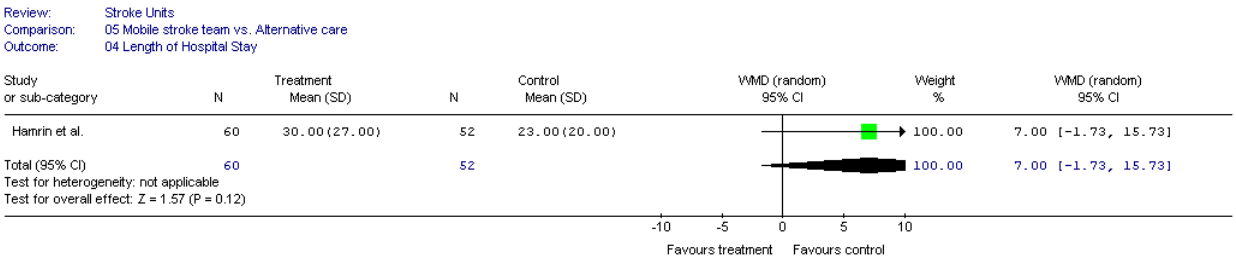


Figure 5.7.1.4 Length of Hospital Stay



Conclusions Regarding Mobile Stroke Teams

Based on the results from meta-analyses, there is Level 1a evidence that mobile stroke teams do not reduce mortality, combined death/dependency, institutionalization, or length of stay.

Discrete care elements associated with stroke units do not provide the same benefit when provided by a mobile stroke team.

5.8 Meta-Analyses of Combined Results

In addition to conducting pooled analyses for individual models of care, all models of care were combined to provide a point estimate of the effectiveness associated with specialized stroke services for the outcomes of mortality, death or dependency, the need for institutionalization, and length of hospital stay. The results are presented in Tables 5.8.1.1 to 5.8.3.1 and Figures 5.8.1.1 to 5.8.3.1.

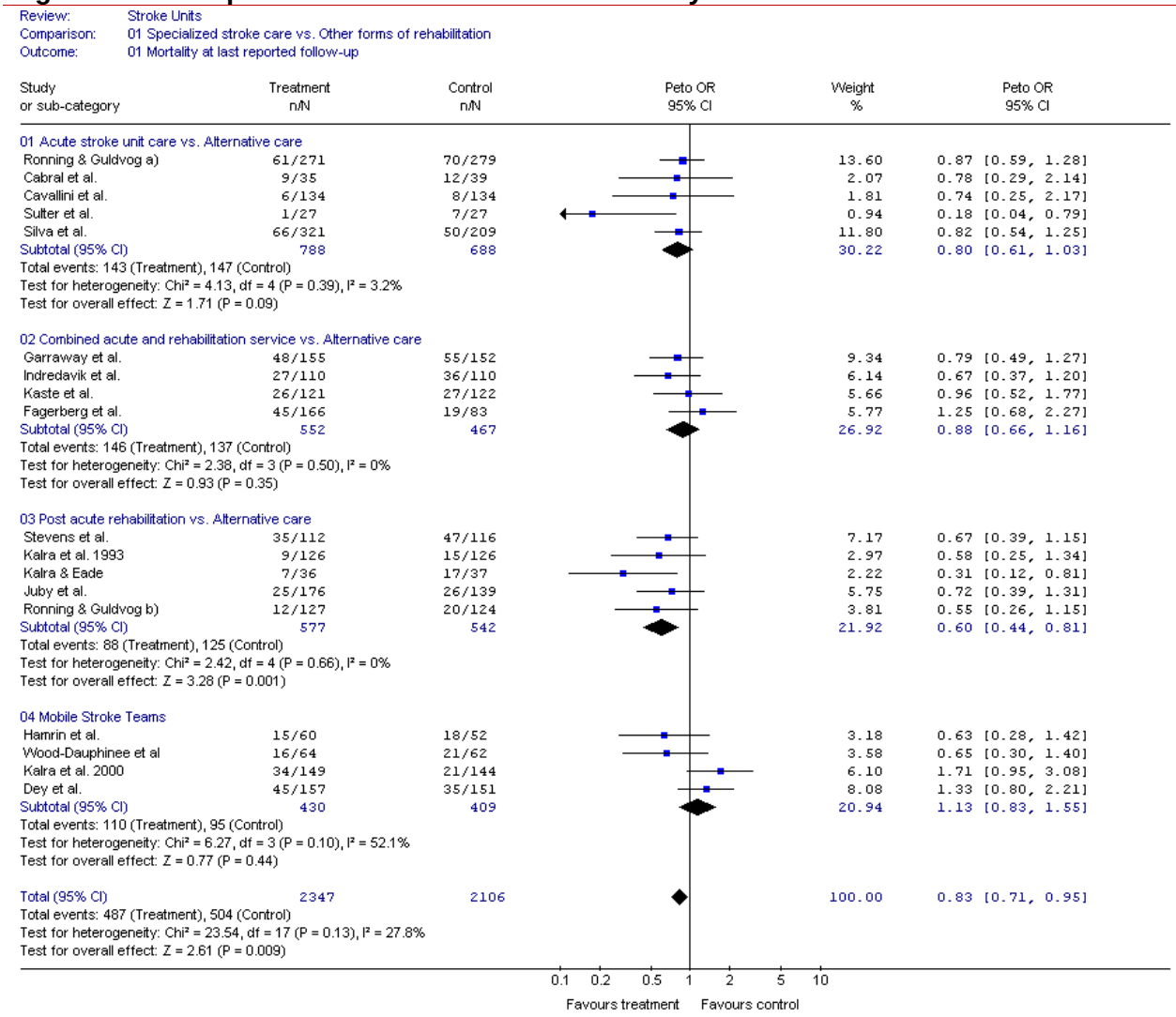
5.8.1 Mortality

A meta-analysis of 18 RCTs evaluated mortality at the end of scheduled follow-up. There was an overall protective effect associated with specialized stroke care compared to alternative care, although most of the individual RCTs did not report statistically significant results. It could be suspected that the greatest influence on mortality would be realized at the level of acute care, during the very early stages of stroke. Surprisingly, of the six trials evaluating very early care, only one small RCT indicated a protective effect (Sulter et al., 2003). The model of care associated with the greatest reduction in odds of death was subacute rehabilitation. The reasons for this finding are not entirely clear, although it may be due to greater attention to managing medical complications such as pneumonia and venous thromboembolism, which can also occur later in the course of recovery.

Table 5.8.1.1 Pooled Analysis for Mortality

Model of Care	OR (95% CI)
Acute stroke care	0.80 (0.61, 1.03)
Combined acute and subacute stroke rehabilitation	0.88 (0.66, 1.16)
Subacute rehabilitation	0.60 (0.44, 0.81)
Mobile stroke team	1.13 (0.83, 1.55)
Overall	0.83 (0.71, 0.95)

Figure 5.8.1.1 Impact of Stroke Unit Care on Mortality



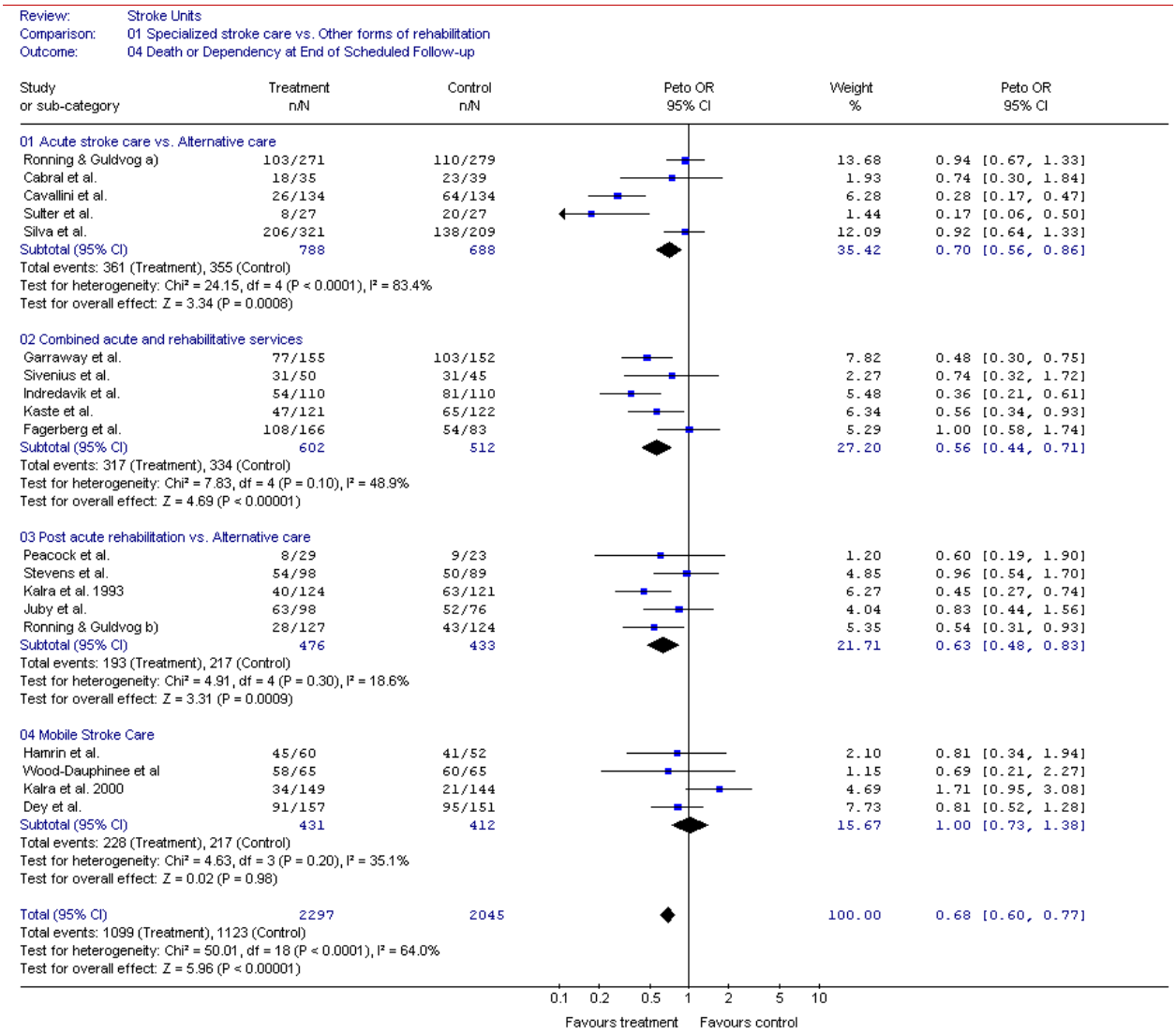
5.8.2 Death or Dependency

All models of care, except for mobile stroke teams, were associated with statistically significant reductions in the odds of death or dependency. The pooled result was similar to that obtained by the Stroke Unit Trialists' Collaboration (2013) for the same outcome (OR 0.79, 95% CI 0.68 to 0.90).

Table 5.8.2.1 Pooled Analysis for Death or Dependency

Model of Care	OR (95% CI)
Acute stroke care	0.70 (0.56, 0.86)
Combined acute and subacute stroke rehabilitation	0.56 (0.44, 0.71)
Subacute rehabilitation	0.63 (0.48,0.83)
Mobile stroke team	1.00 (0.73, 1.38)
Overall	0.68 (0.60-0.77)

Figure 5.8.2.1 Impact of Stroke Unit Care on Death or Dependency



5.8.3 Institutionalization

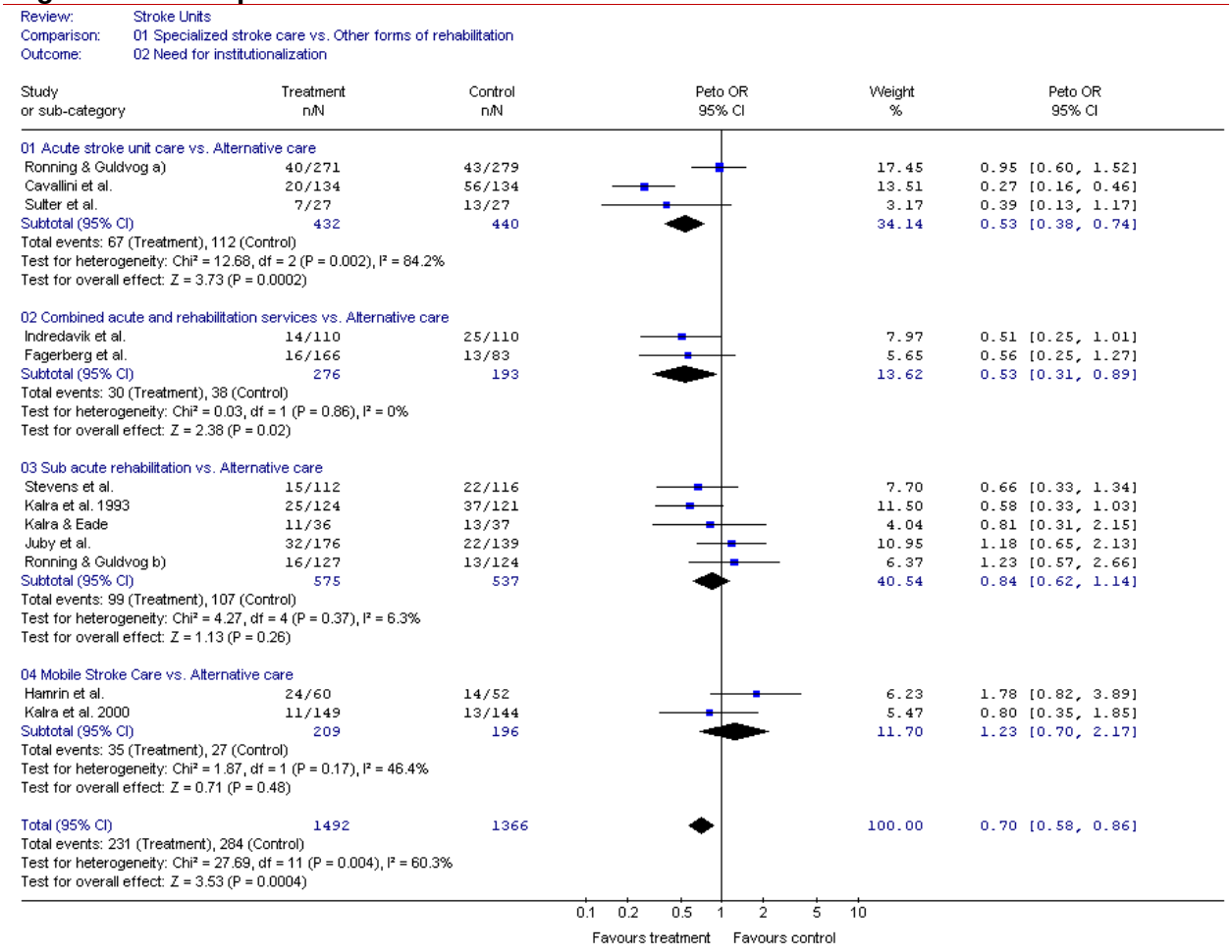
The proportion of patients requiring institutionalization upon discharge was assessed in 12 (57%) studies. Specialized stroke services were associated with reductions in the odds of the need for institutionalization. However, Cavallini et al. (2003) and Brady et al. (2005) assessed the number of patients who were able to live at home or went on to receive intensive rehabilitation at the end of the acute hospitalization period. As well, Sulter et al. (2003) assessed the combined outcome of institutionalization and dependency. Sensitivity analysis revealed that these studies were influential and the overall protective effect was no longer statistically significant without their inclusion (p=0.06).

Table 5.8.3 Pooled Analysis for Need for Institutionalization

Model of Care	Initial Analysis OR (95% CI)	Modified Analysis OR (95% CI)
Acute stroke care	0.53 (0.38, 0.74)	0.95 (0.60,1.52)
Combined acute and subacute stroke rehabilitation	0.53(0.31, 0.89)	0.53(0.31, 0.89)
Subacute rehabilitation	0.84 (0.62, 1.14)	0.84 (0.62, 1.14)
Mobile stroke team	1.23 (0.70, 2.17)	1.23 (0.70, 2.17)

Overall	0.70 (0.58, 0.85)	0.84 (0.68, 1.04)

Figure 5.8.3.1 Impact of Stroke Unit Care on Need for Institutionalization



5.8.4 Length of Stay

Twelve studies were included in the meta-analysis that evaluated length of hospital stay. Overall, specialized stroke services were associated with significant reductions in LOS, although only the results from combined stroke units were statistically significant. Specialized care was associated with almost an average 7-day reduction in hospital stay.

Table 5.8.4.1 Pooled Analysis for Length of Stay

Model of Care	WMD (95% CI) (Days)
Acute stroke care	-2.9 (-10.0, 4.3)
Combined acute and subacute stroke rehabilitation	-17.5 (-30, -4.5)
Subacute rehabilitation	-13.2 (-48.3, 21.9)
Mobile stroke team	13.55 (0.3, 26.8)
Overall	-7.04 (-13.21, -0.9)

5.8.5 Summary

The overall results are summarized in Table 5.8.5.1. Using the results obtained through meta-analyses, specialized stroke care was associated with a significant benefit compared to the alternative intervention for all of the outcomes assessed.

Table 5.8.5.1 Summary of Results: Effectiveness of Stroke Care

Model of Care	Mortality	Death/Dependency	Institutionalization	Length of Stay
Acute	-	+	+	-
Combined	-	+	+	+
Subacute	+	+	-	-
Mobile	-	-	-	-
Overall	+	+	+	+

Conclusions Regarding Stroke Care Based on Combined Meta-Analyses

There is Level 1a evidence that overall, specialized stroke care is associated with reductions in the odds of mortality, combined death/dependency, institutionalization, and length of stay.

Specialized stroke care can improve multiple outcomes including mortality, dependency, need for institutionalization, and length of hospital stay.

Summary

Acute Care

1. ***Based on the results from meta-analyses, there is Level 1a evidence that acute stroke care is associated with a reduction in death/dependency and institutionalization, but not with reductions in mortality or length of stay, when compared to alternative care.***
2. ***There is Level 1a evidence that acute stroke care is not associated with a reduction in functional disability when compared to alternative interventions.***

Combined Acute and Rehabilitation Stroke Units

1. ***Based on the results from meta-analyses, there is Level 1a evidence that combined acute and rehabilitation stroke units are associated with reductions in death/dependency, institutionalization, and length of stay, but not with reduced mortality, compared to general medical wards.***
2. ***There is Level 1a evidence that combined stroke units are associated with improved functional outcome compared to general medical wards.***

Subacute Rehabilitation Units

1. ***Based on the results from meta-analyses, there is Level 1a evidence that specialized, interdisciplinary rehabilitation provided in the subacute phase is associated with reductions in mortality and death/dependency, but not with reduced institutionalization or length of stay, compared to conventional care on a general medical ward.***
2. ***There is Level 1a evidence that for the subset of more severe stroke patients, specialized stroke rehabilitation reduces mortality but does not result in improved functional outcomes or reduced institutionalization compared to conventional care.***
3. ***There is Level 1a evidence that for patients with moderately severe stroke, specialized rehabilitation improves functional outcomes but does not reduce mortality compared to conventional care.***
4. ***There is Level 1a evidence that for patients with mild stroke, specialized rehabilitation does not improve functional outcome or reduce mortality compared to conventional care.***
5. ***There is Level 1b evidence that patients with severe or moderately severe stroke who receive treatment on a stroke rehabilitation unit have a lower risk of being dependent or dead/dependent compared with patients who receive little or no rehabilitation.***

Mobile Stroke Teams

1. ***Based on the results from meta-analyses, there is Level 1a evidence that mobile stroke teams do not reduce mortality, combined death/dependency, institutionalization, or length of stay.***

Overall

1. ***There is Level 1a evidence that overall, specialized stroke care is associated with reductions in the odds of mortality, combined death/dependency, institutionalization, and length of stay.***

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