

# A Synthesis of Peer-Reviewed Literature on Team-Coordinated and Delivered Early Supported Discharge After Stroke

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**ABSTRACT:** This review aimed to summarize data from peer-reviewed studies of team-coordinated and delivered early supported discharge (ESD) for postacute, poststroke rehabilitation. A systematic review was performed in Medline, Embase, and CINAHL for appropriate studies. Information on program details and patient cohorts was synthesized. All programs sought patients with mild-to-moderate functional impairment and minimal cognitive impairment (often based on Barthel Index and Mini-Mental State Examination scores, respectively). All also included at least one subjective admission criterion related to rehabilitation suitability or the suitability of the home environment. Based on the identified studies, ESD programs can assume that 15% of patients screened for ESD will be eligible and care should be provided for 4 to 5 weeks postdischarge. Although the benefits of team-coordinated and delivered ESD poststroke have been well-documented, this review may be helpful for clinicians, administrators, and policy makers looking to establish or refine an ESD program for stroke.

**RÉSUMÉ:** Synthèse de la littérature revue par des pairs sur le congé hospitalier précoce avec soutien coordonné et fourni par une équipe de personnel soignant après un accident vasculaire cérébral. L'objectif de cette revue était de résumer les données des études revues par des pairs sur le congé hospitalier précoce avec soutien (CHPS) coordonné et fourni par une équipe de personnel soignant pour la réadaptation post aiguë après un accident vasculaire cérébral (AVC). Nous avons effectué une revue systématique dans les bases de données Medline, Embase et CINAHL pour identifier les études pertinentes. Nous avons effectué une synthèse de l'information sur les détails des programmes et sur les cohortes de patients. Tous les programmes visaient des patients ayant un déficit fonctionnel de léger à modéré et un déficit cognitif minime (souvent basé sur le score à l'indice de Barthel et au *Mini-Mental State Examination* respectivement). Tous incluaient également au moins un critère d'admission subjectif en lien avec l'adéquation du sujet et de son environnement domiciliaire à la réadaptation. D'après les études identifiées, les programmes de CHPS peuvent présumer que 15% des patients dépistés pour un CHPS y seront éligibles et que les soins devraient être prodigués pendant 4 à 5 semaines après le congé. Bien que les bénéfices du soutien coordonné et fourni par une équipe de personnel soignant après un CHPS aient été bien documentés, cette revue peut aider les cliniciens, les administrateurs et les décideurs qui prévoient établir ou perfectionner un tel programme pour l'AVC.

**Keywords:** Early supported discharge, health services research, stroke

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## INTRODUCTION

The World Health Organization estimates that 15 million people experience a stroke each year, 5 million of whom are left with permanent disability.<sup>1</sup> Despite an abundance of evidence suggesting that poststroke rehabilitation can improve patient recovery and reduce disability,<sup>2</sup> debate still remains about where and when these services are best provided. Early supported discharge (ESD), in which rehabilitative care is provided in the community as an alternative to remaining in the hospital, has gained popularity around the world as a less costly way to rehabilitate moderately and mildly disabled stroke patients. Trials performed to date on ESD suggest that, when provided to appropriate patients, it can reduce the risk of death or dependency,<sup>3</sup> admission to institutional care,<sup>3</sup> length of hospital stay,<sup>3-6</sup> and the overall cost of services<sup>3,5,7</sup> compared with traditional in-hospital rehabilitation. Accordingly, ESD has been included in the Canadian Best-Practice Recommendations for Stroke.<sup>8</sup> If policy

makers and health care providers hope to adhere to best-practice principles in stroke management, ESD is an essential component.

The most comprehensive review of poststroke ESD was done by the Cochrane Collaboration in 2012, which performed pooled analyses of 14 randomized-controlled trials compared with usual care.<sup>3</sup> In this review, three forms of ESD intervention were identified: ESD team coordination and delivery, ESD team coordination only,

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and no ESD team. Statistically significant differences between ESD and conventional care were only noted for the two primary outcomes of death or institutionalization, and death or dependency among studies where ESD was team-coordinated and delivered (i.e. the hospital-based ESD team both arranged for and provided services). However, no pooled description of these studies was provided. The authors of this review noted that further research should be completed to “define the important characteristics of effective ESD services.”<sup>3</sup>

In a consensus report on the topic, an international panel of experts on ESD unanimously agreed that specific eligibility criteria for early supported discharge should be used and that eligibility decisions should be based in part on the patient’s level of disability and medical stability.<sup>4</sup> The panel also unanimously agreed that identification of patients suitable for ESD should be made by the ESD team and that flexibility in the criteria is essential. However, the panel did not reach unanimous agreement about what role factors, such as Barthel Index (BI) scores, ability to transfer from bed to chair, or cognitive function, should play in decisions about patient eligibility for ESD.

The objective of this study was to perform a review of the peer-reviewed literature on poststroke ESD that focused on programs providing best practice care (i.e. those that were ESD team-coordinated and delivered). Study inclusion was expanded beyond randomized controlled trials. Information related to the interventions evaluated, the inclusion/exclusion criteria used, the resulting cohort of patients admitted, and the outcomes observed in identified studies was summarized.

## METHODS

A systematic review of the literature was performed in three electronic databases (Medline-OVID, Embase-OVID, CINAHL-EBSCO Host) for peer-reviewed journal articles evaluating team-coordinated and delivered postacute ESD programs for poststroke rehabilitation. Studies published between January 1980 and August 2014 were considered for inclusion. The complete search strategy is presented in Appendix A, but briefly included subject and keyword searches of terms including “stroke,” “cerebrovascular accident,” “rehabilitation,” “early supported discharge,” “home care services,” and “community care.” Titles and abstracts were reviewed and pertinent studies, systematic reviews, and meta-analyses were retrieved. All identified works were reference-searched for additional studies. Studies were included for data extraction if:

- Only patients with primary diagnosis of stroke or cerebrovascular accident were included
- The intervention under study was a team-coordinated and delivered postacute ESD program for poststroke rehabilitation defined as follows:
  - ESD team coordinated and delivered programs: identified according to the definition used by the Cochrane Collaboration<sup>3</sup>
  - Postacute: programs where the patients under consideration had been admitted to hospital for their acute medical management (i.e. not hospital-at-home)
  - Poststroke rehabilitation: patients included in the intervention would otherwise have been admitted to postacute in-hospital rehabilitation
- Inclusion/exclusion criteria were reported

Data extraction consisted of two phases: program description and patient data. Program description included a brief summary of the structure of the ESD program, a description of the control group, and a list of the inclusion/exclusion criteria used to identify suitable candidates. Additional program-specific data included the mean hospital length of stay in the intervention group before discharge, and the proportion of screened patients deemed suitable for ESD (including patients who declined participation but would otherwise have been included).

Extracted patient data began with a description of the cohort included in each trial: mean age, percent female, and proportion with hemorrhagic stroke. This was followed by information on any objective measure of physical, cognitive, social, or psychological status assessed within 48 hours of discharge to the ESD program. Finally, all reported outcome measures at the longest period of follow-up were noted along with results of statistical comparison to the control group.

## RESULTS

A flow chart summarizing results from the literature review is presented in Figure 1. In total, 641 journal articles were screened. Initially, 490 articles were excluded by title (many articles specifically dealt with cardiac rehabilitation and could be excluded on first glance). Ninety-eight articles were removed based on the abstract alone and 45 after review of the full paper. Of these 45 articles, 13 described an ESD program that was not team coordinated and delivered, postacute, or an alternative to inpatient rehabilitation. Of the remaining exclusions, 12 were reviews, 8 were economic analyses of included trials, 5 were follow-up studies of included trials, 5 did not evaluate an ESD program, 1 was a commentary, and 1 did not include stroke patients. No additional studies were located in the reference lists of the identified reviews. In total, eight studies were included for further assessment.<sup>6,9-15</sup>

A summary of the programs explored in the studies of a team coordinated and delivered ESD program is provided in Table 1. All teams included a physiotherapist (PT) and occupational therapist (OT) and most included access to a speech language pathologist (SLP). Most teams also included access to a social worker (SW) or nurse. Inclusion and exclusion criteria frequently focused on patients who had physical impairments that could benefit from rehabilitation, but most also included criteria that excluded patients with serious cognitive impairment or comorbidity that would preclude them from benefiting from rehabilitation. All studies also included some form of subjective criteria to allow clinicians an opportunity to exclude patients they judged to be unsuitable. In studies in which it was reported, the weighted average proportion of acute admissions deemed eligible for ESD was 19% (range, 10% to 46%), with the proportion generally decreasing in more recent studies. The typical period of recruitment into ESD was between 8 and 14 days poststroke, with only two exceptions.<sup>9,15</sup> Mean length of participation in the ESD programs ranged from 30 days to 4 months across studies; however, this was generally shorter in more recent studies (post-2000), where all but one<sup>9</sup> reported ESD duration between 4 and 5 weeks.

A summary of information on the cohort of patients included in the identified trials and their corresponding outcomes is provided in Table 2. The average age of patients was approximately 70 years in all trials (range, 68 to 73) and in all but one study,<sup>11</sup> there were more men than women included. In studies in which it

**Table 1: Summary of program descriptions in identified studies of team-coordinated and delivered postacute ESD for stroke rehabilitation**

Study, year (design)	Composition of ESD team	Control	Inclusion criteria	Exclusion criteria	Patients included/ patients screened	Duration of ESD	ESD patient HLOS (days)
Anderson, 2000 <sup>6</sup> (RCT)	Program coordinator (OT), rehabilitation consultant, PT, OT, SLP, SW, rehabilitation nurse	Inpatient rehabilitation, discharge planning and follow-up care as an outpatient or in community	Medically stable, suitable for discharge, suitable home environment, community rehabilitation team available, GP to provide medical care	Subarachnoid hemorrhage, insufficient physical and cognitive function to perform rehabilitation, lack of caregiver consent	112/398 (28%)	5 weeks median	13 median
Donnelly, 2004 <sup>9</sup> (RCT)	Coordinator, OT, PT, SLP, rehabilitation assistant	Hospital rehabilitation with day hospital follow-up	<4 weeks poststroke, potential to benefit from rehabilitation	Nursing or residential home resident, preexisting disability that precluded rehabilitation	118/896 (13%)	3 months	42 mean
Holmqvist, 1998 <sup>10</sup> (RCT)	PT, OT, SLP, SW (consult), coordinator	Routine inpatient and/or day hospital/outpatient rehabilitation	Acute stroke, Katz ADL A-E, MMSE >23, impaired motor capacity (LS) and/or dysphasia (RAT), no other comorbidity likely to shorten life expectancy	<5-day HLOS, progressive stroke, subdural hematoma, subarachnoid hemorrhage, massive perceptual deficit, renal/heart/respiratory failure, nonstroke epilepsy, alcoholism, psychiatric disease	86/900 (10%)	3-4 months	14 mean
Ljungberg, 2001 <sup>11</sup> (non-RCT)	Nurse, nurse's aide, OT, PT, social welfare officer, neurologist	Inpatient rehabilitation clinic	Expected rehabilitation time <4 weeks, transfer from chair to bed with 1-person assist	Dementia, dysphagia, cannot communicate via telephone or alarm bell even with assistance of a relative	NR	4 weeks	8 mean
Mayo, 2000 <sup>12</sup> (RCT)	Nurse, PT, OT, SLP, dietitian	Usual care (hospital and community rehabilitation)	Persistent motor deficits, able and willing caregiver	>1 person assist to walk after 28 days poststroke, cognitive impairment (SPMSQ), coexisting conditions affecting independence	194/1542 (13%)	4 weeks	9.8 mean
Pessah-Rasmussen, 2009 <sup>13</sup> (non-RCT)	PT, OT, neurologist (SLP, SW, nurse, neuropsychology when necessary)	Registry-identified non-ESD patients	Need for training in personal or extended activities ADL	Severe prestroke dementia, alcohol or drug abuse, unsuitable home conditions, cognitive impairment where insight/communication lead to safety concerns	NR	1997: 43-day mean 2005: 30-day mean	1997: 18-day mean 2005: 10-day mean
Rodgers, 1997 <sup>14</sup> (RCT)	Service coordinator (OT or PT), OT, PT, SLP, SW, OT technician	Conventional care (hospital and community rehab)	Newcastle resident, medically stable, BI 5 to 19 72 hours' poststroke	Residential or nursing home resident, OHS 0 to 3 before stroke, other condition precluding rehabilitation	119/402 (30%)	9 weeks median	13 median
Rudd, 1997 <sup>15</sup> (RCT)	PT, OT, SLP, therapy aide, physician consult	Conventional care (hospital and outpatient rehabilitation)	Able to transfer independently (if living alone) else with assistance	Lived too far for team to visit	302/660 (46%)	Up to 3 months	34 mean

ADL = activities of daily living; GP = general practitioner; HLOS = hospital length of stay; LS = Lindmark scale; NR = not reported; OHS = Oxford handicap scale; RAT = Reinvang aphasia test; RCT = randomized controlled trial; SPMSQ = Short Portable Mental Status Questionnaire; SLP = speech language pathologist; TIA = transient ischemic attack

**Table 2: Summary of patient populations and outcomes in identified studies of team-coordinated and delivered postacute early supported discharge for stroke rehabilitation**

Study, year (design)	Age (mean)	Female (%)	Hemorrhagic stroke (%)	Patient variables measured at randomization or discharge (mean)	Outcome measures and results <sup>a</sup>
Anderson, 2000 <sup>6</sup> (RCT)	72	38	10	All median: BI 85/100, MMSE 28/30, AAP (domestic chores 53/100, household 56/100, service 50/100, social 46/100), GHQ (somatic 5/10, anxiety 4/10, social 8/10, depression 0/10)	6-month: SF-36 (NS), BI (NS), NHP (NS), satisfaction (NS), AAP (NS), MFAD (NS), death (NS), falls (NS)
Donnelly, 2004 <sup>9</sup> (RCT)	68 median	NR	NR	BI 14/20, NEADL 6/21, 10-m timed walk 21 seconds, EuroQol 59/100, SF-36 physical 35/100, SF-36 Mental 48/100, Quality of Life 17/27	1-year: BI (NS), NEADL (NS), 10-m timed walk (NS), EuroQol (NS), SF-36 Physical (NS), SF-36 Mental (NS), QoL (NS), patient satisfaction (+), overall satisfaction (+), carer strain (NS)
Holmqvist, 1998 <sup>10</sup> (RCT)	71	46	7	MMSE 27/30, motor capacity (arm 50/57, leg 34/36, coordination 8/12, mobility 25/27, balance 15/21, total 131/153), 10-m walk test 14 seconds (median), neurological score 49/58, aphasia quotient 24/100	3-month: KATZ ADL (NS), BI (NS), FAI (NS), Lindmark motor capacity (+ coordination, others NS), 9-hole peg test (NS), 10-m walk (NS), aphasia quotient (NS), falls (NS), SIP (+ psychosocial, NS others)
Ljungberg, 2001 <sup>11</sup> (non-RCT)	72	56	9	FIM (hygiene 4.9/7, bathing 2.1/7, dressing upper 4.8/7, dressing lower 3.7/7, toileting 4.1/7, feeding 5.4/7, transfer chair/bed 4.5/7, transfer toilet 4.8/7, transfer tub shower 2.4/7, locomotion 3.4/7, locomotion stairs 2.5/7, comprehension 5.6/7, expression 5.4/7, problem solving 4.5/7, memory 5.5/7)	4-week: modified QPP (+ activity level, staff importance, participation, others all NS)
Mayo, 2000 <sup>12</sup> (RCT)	70	33	NR	CNS 8.9/11.5, STREAM 82.3/100, TUG 23.3 seconds, BI 84.6/100	3-month: SF-36 (+ physical, NS Mental), STREAM (NS), TUG (NS), BI (NS), OARS-IADL (+), RNL (NS)
Pessah-Rasmussen, 2009 <sup>13</sup> (non-RCT)	73	48	15	1997 Katz ADL (A, 6%; B, 18%; C, 17%; D, 7%; E, 24%; F, 7%) 2005: Katz ADL (A, 30%; B, 21%, C, 13%; D, 3%; E, 2%; F, 4%; G, 4%)	No comparison to control reported
Rodgers, 1997 <sup>14</sup> (RCT)	73 median	43	NR	BI 15/20 median	3-month: survival (NS), placement (NS), readmission (NS), NEADL (NS), OHS (NS), WDI (NS), DCGHS (NS), GHQ (NS)
Rudd 1997 <sup>15</sup> (RCT)	70	45	NR	BI 15/20, Frenchay aphasia 18/20, MMSE 21/30, MI 83/100, 5-m timed walk 15 seconds, NHP 11/100	1-year: MI (NS), MMSE (NS), FAS (NS), BI (NS), RADL (NS), HADS (- anxiety, NS depression), 5-m timed walk (NS), NHP (NS), CSI (NS)

(+): Significantly better in ESD; (-): significantly better in control; ADL = activities of daily living; AAP = Adelaide Activities Profile; CNS = Canadian Neurological Scale; DCGHS = Dartmouth Coop Global Health Status; FAI = Frenchay Activities Index; FAS = Frenchay Aphasia Scale; FIM = Functional Independence Measure; GHQ = General Health Questionnaire; GP = general practitioner; HADS = Hospital Anxiety and Depression Scale; MFAD = McMaster Family Assessment Device; MI = Mobility Index; NEADL = Nottingham Extended Activities of Daily Living; NHP = Nottingham Health Profile; NR = not reported; NS = no significant difference; OARS-IADL = Older Americans Resource Scale Instrumental ADL; OHS = Oxford handicap scale; QPP = quality from the patient's perspective; QoL = quality of life; RNL = Reintegration to Normal Living; RADL = Rivermead ADL; SF-36 = Short Form 36; STREAM = Stroke Rehabilitation Assessment of Movement; TUG = Timed Up and Go; WDI = Wakefield Depression Inventory

<sup>a</sup>Outcomes reported are intervention vs control comparisons at the longest point of follow-up. Subgroup analyses are not presented. Statistical significance is noted at  $p < 0.05$ .

was reported, the majority of patients had experienced ischemic stroke; however, no study explicitly excluded hemorrhagic patients. None of the studies performed subgroup analyses to compare outcomes between stroke subtypes (e.g. ischemic vs hemorrhagic). Baseline and outcome measurement were performed by a variety of professionals including research associates, nurses, PT, OT, and SLP. A wide variety of functional measures at time of acute discharge were reported across the eight trials, only two of which were reported more than once: BI and Mini-Mental State Examination (MMSE). In trials reporting these scores, the mean BI score at discharge was 16/20 and the mean MMSE was 24/30. Rudd et al reported the most widely dispersed admission scores for both the BI and MMSE; in this study, 1 standard deviation in scores ranged from 11 to 19 in the BI and 14 to 28 on the MMSE.<sup>15</sup> This wide variation in scores reflects more inclusive admission in this particular study that was not seen in the others. Across all eight trials, the majority of outcomes were either similar between ESD and the control group or in favour of ESD. Only once was an outcome demonstrated to be significantly better in the control group (1-year anxiety score on the Hospital Anxiety and Depression Scale<sup>15</sup>).

## DISCUSSION

The benefits of ESD for poststroke rehabilitation have been well-documented and team-coordinated and delivered ESD has been identified as the optimal model of care.<sup>3</sup> The objective of this review was to summarize the literature related to one of these ESD programs to assist decision makers looking to establish, or refine, a best-practice postacute ESD program for stroke rehabilitation. This was done by narrowing the focus of our search to team-coordinated and delivered ESD programs described in the peer-reviewed literature and expanding search criteria beyond randomized controlled trials. Eight studies met the inclusion criteria for this review, and the summary of program information and patient data demonstrate a number of similarities across studies that may be useful in planning an ESD program.

The composition of the ESD teams described in the eight identified trials was similar. The benefits of an interprofessional team poststroke have been well-documented,<sup>16</sup> and it is evident that they have been recognized as critical components of a coordinated ESD program. All ESD teams included PT and OT as the core of their team and all but one also noted access to SLP. Most teams also included SW or nursing. Patients recovering from stroke (as well as their caregivers) often face challenges with anxiety, depression, and social isolation. One strength of a multidisciplinary rehabilitation team is that it can help patients address medical, physical, cognitive, and social issues concomitantly.<sup>16</sup> Although therapists support functional recovery,<sup>2</sup> nurses and SW play an important role in identifying social and emotional challenges and supporting patients as they recover from stroke.<sup>17-19</sup> Social care has been identified as a particular challenge in securing timely discharge to ESD,<sup>20</sup> which further highlights the importance of the inclusion of nurses and social workers in interprofessional ESD teams. Based on the results of this review, it would be our recommendation that PT, OT, SLP, SW, and nursing be considered as critical components of an effective ESD team.

In an international ESD consensus statement, experts agreed that decisions about admission to an ESD program after stroke should be made by members of the ESD team using specific

eligibility criteria; however, they also noted the need for flexibility in this process.<sup>4</sup> One way to meet this recommendation would be to set evidence-informed screening criteria such that patients meeting all criteria are automatically considered for ESD and patients meeting one or more are considered on a case-by-case basis. The inclusion and exclusion criteria (and resulting cohorts of patients) in the studies identified here offer a few examples of criteria that may be useful in this decision-making process. In general, the criteria used by the studies identified in this review target patients with mild-to-moderate functional impairment, good cognitive function, potential to benefit from rehabilitation, and those who live in a suitable environment for rehabilitation.

The benefits of ESD have been most consistently demonstrated among patients with mild-to-moderate functional impairment. In Cochrane's review, a BI of 10 to 20 was used to identify mild-to-moderate impairment<sup>3</sup>; however, the studies identified here suggest that team-coordinated ESD programs are admitting patients with an average BI of 16/20. The study with the most liberal admission procedures was Rudd et al,<sup>15</sup> in which 1 standard deviation from the mean was still between 11 and 19 on the BI. Automatic admission criteria for ESD could focus on patients with a BI of 16 to 20, whereas those with a BI of 10 to 15 could be flagged for further consideration. Future research should also explore differences in adjusted outcomes between patients with BI of 10 to 15 and 16 to 19 receiving ESD.

In the studies identified here, nearly all also noted cognitive function in their inclusion/exclusion criteria stating concerns for both the patient's ability to participate in rehabilitation and their safety at home. Holmqvist et al explicitly used an MMSE score of 23 in their inclusion criteria<sup>10</sup> and two others reported average admission scores of 28 and 21, respectively.<sup>6,15</sup> In these three studies, the mean score on admission was 24/30. Similar to BI, the study with the widest dispersion of admission MMSE scores was Rudd et al,<sup>15</sup> in which 1 standard deviation from the mean ranged from 14 to 28. Cognitive function should be included in all screening criteria for ESD with automatic focus placed on patients with MMSE scores of 23 to 30, as was done by Holmqvist, whereas identifying patients with scores of 14 to 22 for further consideration. No study to date has compared outcomes between patients with high or low cognitive function explicitly, and more research in this area is also warranted.

In addition to patient characteristics, many of the identified studies also included reference to practical considerations such as the availability of a caregiver, suitability of the home environment, and proximity to the hospital. Although caregiver availability has been demonstrated to play a significant role in patient recovery after stroke,<sup>21,22</sup> suitability of the home environment and proximity to the hospital also represent interesting practical considerations. The importance of flexibility in decisions regarding ESD has regularly been mentioned by ESD experts.<sup>4,20</sup> Although a patient may meet all of the physical and cognitive characteristics of a typical ESD candidate, few clinicians would feel comfortable discharging patients to an unsuitable home environment (or no home at all). In these cases, the best interest of the patient should be the most important factor in decisions regarding ESD suitability. Care should be taken to document these instances so that they can be studied in detail and analyses can be adjusted appropriately during program evaluation. In a similar way, the distance to a patient's home may practically exclude them from ESD in some instances. Admission criteria for ESD must be developed

separately for each facility to reflect the unique context of their surrounding geography. Program leaders should also be encouraged to be innovative in the way they provide services. Although provision of ESD in rural settings has been demonstrated to be effective,<sup>2,3</sup> other innovative solutions for meeting patient needs such as the use of telemedicine, family participation, and partnership with local care providers should be explored in more detail. However, careful attention should be paid to the key concepts that have made team-coordinated and provided ESD successful, such as early detection of patients, continuity of care, and timely service provision. Well-designed research should be promoted in rural and remote settings to better inform the effectiveness of innovative ESD programs in these areas.

Based on the criteria identified by this review, an algorithm for admission to ESD could look something like the following. Patients with a BI of 16 to 20, MMSE 23 to 30, and a suitable home environment within a predetermined reasonable distance from the hospital could have a discharge to ESD initiated automatically. Patients with a BI of 11 to 20 or an MMSE of 14 to 30 could be flagged for clinical assessment for suitability for admission to ESD, whereas all other patients could be considered on a case-by-case basis. Of course, other measures of functional independence and cognitive function could also be used, but these should be studied further to identify appropriate cutoff scores. This type of system might help to smooth the transition of appropriate patients to ESD and improve system efficiency, while still allowing an appropriate level of flexibility in the admission process.

In addition to clinical decision-making, the results of this review may also be useful for individuals involved in capacity planning for ESD. Although an ESD program that is too small will not be able to meet the needs of all patients who could benefit from its services, a program that is oversized can be seen as a waste of resources. In the studies identified here, the proportion of screened patients who were deemed suitable for admission to ESD ranged from 10% to 46% and the duration of ESD ranged from 30 days to 4 months. Interestingly, both of these dropped over time. Studies published since 2000 have included a weighted average of 15% of acute stroke survivors in their ESD programs and, with the exception of the study by Donnelly et al,<sup>9</sup> the mean duration of ESD in studies published since 2000 was between 4 and 5 weeks. Pessah-Rasmussen et al<sup>13</sup> specifically noted that in their program the mean duration of care dropped from 43 days in 1997 to 30 days in 2005. These trends likely demonstrate a subtle, but important, shift in thinking around ESD. Based on the results of this review, the authors suggest that decision makers anticipate approximately 15% of stroke survivors as candidates for ESD and consider 4 to 5 weeks as a reasonable average duration of care for planning purposes.

Team-coordinated and delivered ESD after stroke is an important component of an effective stroke rehabilitation system. Cochrane's ESD trialists and Fisher's consensus statement have established a strong foundation with which ESD providers can make informed decisions about program development. This study focused on the way ESD programs are applying this research around the world and offers some perspective on the evolution of ESD care after stroke. Summary of this information may be helpful to health care providers looking to develop or evaluate a regional ESD program. It may also be helpful in informing future research into the topic so that we continue to understand the nuances of providing ESD. This will help to ensure that we

continue to provide effective ESD to meet the needs of our patients and provide value for our healthcare systems.

## LIMITATIONS

In the studies identified by this review, the admission criteria and functional outcomes reported were too heterogeneous to allow for any statistical comparison to be performed. For this reason, a summary of published admission criteria was used as an indicator of clinical judgment. Future research is necessary to explore the relationship between the variables used to select patients for ESD and the functional outcomes they achieve.

## CONCLUSIONS

Team-coordinated and delivered ESD after stroke is a cost-effective way to provide rehabilitation to moderately and mildly impaired patients. A detailed review of ESD programs providing team-coordinated and delivered care suggests some meaningful similarities that can be useful to ESD clinicians and decision makers planning to develop or evaluate an ESD program. Studies suggest that inclusion criteria for ESD should include an objective measure of both physical and cognitive function. BI scores of 16 to 19 and an MMSE greater than 23 could be considered as near-automatic criteria for admission assuming caregiver availability, suitability of the home environment, and proximity to the hospital are also favourable. Capacity planning for ESD can begin by assuming that approximately 15% of stroke survivors will be ESD candidates, and that they will require services for 4 to 5 weeks on average. However, flexibility in program planning and ongoing evaluation is recommended and should be incorporated into future research.

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## DISCLOSURES

MM, RT, AT, JK, and MS have nothing to disclose.

## SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit <http://dx.doi.org/10.1017/cjn.2015.343>

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