There's No Place Like Home

An Evaluation of Early Supported Discharge for Stroke

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Background and Purpose—Because stroke management is aimed at facilitating community reintegration, it would be logical that the sooner the patient can be discharged home, the sooner reintegration can commence. The purpose of this study was to determine the effectiveness of prompt discharge combined with home rehabilitation on function, community reintegration, and health-related quality of life during the first 3 months after stroke.

Methods—A randomized trial was carried out involving patients who required rehabilitation services and who had a caregiver at home. When medically ready for discharge, persons with stroke were randomized to either the home intervention group (n=58) or the usual care group (n=56). The home group received a 4-week, tailor-made home program of rehabilitation and nursing services; persons randomized to the usual care group received services provided through a variety of mechanisms, depending on institutional, care provider, and personal preference. The main outcome measure was the Physical Health component of the Measuring Outcomes Study Short-Form-36 (SF-36). Associated outcomes measures included the Timed Up & Go (TUG), Barthel Index (BI), the Older Americans Resource Scale for instrumental activities of daily living (OARS-IADL), Reintegration to Normal Living (RNL), and the SF-36 Mental Health component.

Results—The total length of stay for the home group was, on average, 10 days, 6 days shorter than that for the usual care group. There were no differences between the 2 groups on the BI or on the TUG at either 1 or 3 months after stroke; however, there was a significantly beneficial impact of the home intervention on IADL and reintegration (RNL). By 3 months after stroke, the home intervention group showed a significantly higher score on the SF-36 Physical Health component than the usual care group. The total number of services received by the home group was actually lower than that received by the usual care group.

Conclusions—Prompt discharge combined with home rehabilitation appeared to translate motor and functional gains that occur through natural recovery and rehabilitation into a greater degree of higher-level function and satisfaction with community reintegration, and these in turn were translated into a better physical health. **(*Stroke*. 2000;31:1016-1023.)**

Key Words: outcome assessment ■ quality of life ■ randomized control trials ■ rehabilitation

A major component of stroke management is aimed at facilitating functional independence and community reintegration. It would, therefore, be logical that the sooner the patient can be returned home following stroke, the sooner the reintegration process can commence. In addition, prolonged hospitalization may be detrimental to people with stroke through fostering of dependent relationships, social isolation, and immobility. However, for many, the sequelae of stroke are such that discharge home without support services is not feasible or safe, and patients tend to remain in the acute-care institution longer than necessary.

An alternative option to hospital-based care is the concept of prompt supported discharge that commences as soon as the patient is medically stable to leave hospital and comprises home-based rehabilitation and medical services. There are a growing number of randomized studies that have addressed this important issue.[1–3] All 3 of the studies completed to date were carried out in Europe and found that early supported discharge reduced length of stay without any detrimental (or beneficial) effect on motor, functional or social outcomes. However, 1 study[2] found that the ability to perform higher-level activities of daily living (ADL) was enhanced by the

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home-based intervention. These 3 studies all contrasted some form of supported discharge that provided home-based rehabilitation services on an "as-needed" basis to usual or routine care. In all studies, routine care was heterogeneous, with a mix of primarily rehabilitation interventions provided in a variety of settings, including inpatient, day-hospital, and outpatient. All studies emphasized that usual care was the best possible care and that the setting depended on the level of care required and patients' preferences. Although these trials showed no negative effects of prompt discharge and that home care was even more economical than usual care,[4] it would not be unusual to hypothesize benefits. Lack of evidence for benefit could have arisen because there was no real benefit or because of choice of outcomes to be measured, timing of outcome measurement, unmeasured features of the environment in which the studies were conducted, or by chance.

The present study was designed to evaluate, in a Canadian setting, the effectiveness of prompt discharge combined with home rehabilitation on health-related quality of life (HRQL), community reintegration, and function, during the first 3 months after stroke. The working hypothesis was that in comparison to usual care, home rehabilitation would shorten length of hospital stay and enhance HRQL and community reintegration without a detrimental effect on recovery of basic motor and functional activities.

Subjects and Methods

A stratified, blocked and balanced, randomized controlled trial was carried out with patients admitted for acute stroke to 5 acute-care hospitals in Montreal (Canada). This study targeted persons with persistent motor deficits after stroke, who had caregivers willing and able to provide live-in care for the subject over a 4-week period after discharge from hospital. Stroke patients who, by 28 days after stroke, still required the assistance of more than 1 person to walk were excluded, as were patients with cognitive impairment (>5 errors on the Short Portable Mental Status Questionnaire[5,6]) or with important coexisting conditions that affected their ability to function independently (eg, dialysis requirement, paraplegia).

Project nurses consulted emergency room records and admission lists on a daily basis to identify potentially eligible persons. These persons were then informed of the study and were monitored to identify whether they met all eligibility criteria, including the presence of a willing caregiver. The medical status of the patient was also monitored with the "Stroke Ready for Medical Discharge Checklist."[7] When consent was provided and patients were medically ready for discharge according to criteria on the checklist (eg, diagnosis known, all tubes out, alert and responsive, normal temperature, coagulation controlled, and treatment plan instigated for newly arising conditions or complications), baseline, prerandomization data on outcome measures were obtained.

Randomization was stratified by site and balanced within block sizes that varied from 4 to 8. Opaque, sealed envelopes were prepared and held in the central office; group assignment was revealed over the telephone when all baseline assessments had been completed.

Persons were assigned at random to 1 of 2 groups: home care or usual care. The home intervention consisted of prompt discharge from hospital with the immediate provision of follow-up services by a multidisciplinary team offering nursing, physical therapy (PT), occupational therapy (OT), speech therapy (ST), and dietary consultation. The duration of the intervention was 4 weeks for all participants. Medical follow-up was arranged at discharge and was not a direct part of the intervention, although project nurses were easily able to contact treating physicians when the need arose. Intervention, which was individualized to a patient's needs, was coordinated by the team member who had the most contact with the patient; this was usually the nurse or the physical therapist. Rehabilitation care was provided at home, and all participants received at least 1 home visit from nursing personnel. Subsequent home visits were arranged as needed and supplemented with telephone monitoring. The amount of therapy received by patients was set by the therapist on the basis of assessment of need. Patients were not scheduled to have >1 active treatment session per day, although a nursing visit was sometimes scheduled on the same day as therapy. Arrangements for further care after intervention was also made as needed.

The usual care group experienced the current practices for discharge planning and referral for follow-up services. These comprised a range of services, including PT, OT, and ST, as requested by the patient's care provider and offered through extended acute-care hospital stay; inpatient or outpatient rehabilitation; or home care via local community health clinics. Patients could also arrange for private care for which they themselves paid (rehabilitation services are covered by the government only if offered through a designated hospital or community center).

All patients experienced the same organization of care before randomization. Four of the 5 healthcare institutions had long-standing acute stroke teams that provided comprehensive and coordinated care to all patients with stroke. The fifth hospital was a specialized neurological hospital, without a stroke team per se but with considerable stroke expertise.

Measurement

The main outcome measure for this study was the Physical Component Summary of the Medical Outcomes Study Short Form-36 (SF-36).[8] This is a well-known HRQL or health-status measure that has been validated for stroke.[9] It comprises 36 items organized into 8 scales, with each scale scored out of 100 points. Two summary scales are available, one for physical health and one for mental health. These have been standardized to have a mean of 50 and SD of 10.[10] Higher scores are associated with better quality of life. The 8 subscales of the SF-36 were considered secondary outcomes.

Other secondary outcomes were also assessed to span the spectrum of impairment, disability, and handicap. At the impairment level, the Canadian Neurological Scale (CNS)[11,12] and the Stroke Rehabilitation Assessment of Movement (STREAM)[13,14] were used to evaluate stroke severity (CNS) and voluntary motor ability and basic mobility (STREAM). The CNS[11,12] is a simple clinical instrument that assesses level of consciousness, orientation, speech, and motor function of arm, leg, and face. It has been shown to have good internal consistency and a high degree of interrater agreement. The CNS is scored from 1.5 to 11.5, and a cutoff of 6.0 has been used to distinguish between severe stroke or coma and mild stroke. The STREAM is composed of 30 items, divided equally among 3 major sections: voluntary movement of the upper extremity, voluntary movement of the lower extremity, and basic mobility. It has been shown to have excellent content validity and interrater and intrarater reliability.[13,14]

Three measures assessed disability: the Timed Up & Go (TUG) test, the Barthel Index (BI) for basic ADL (BADL), and the Older Americans Resource Scale for instrumental ADL (OARS-IADL). The TUG[15] is a quick and practical test of basic mobility skills suitable for frail elderly persons, including those with stroke. The test involves asking the individual to rise from a standard armchair, walk 3 meters to a line on the floor, turn, return to the chair, and sit down. The score is the time, in seconds, required to complete the test. Higher scores indicate greater impairment of mobility. The TUG has been shown to have good reliability and to correlate with gait speed, balance ,and physical function.[15–17] The BI[18] is probably the most widely used measure of BADL in stroke research. It was developed to monitor functional independence before and after treatment and to indicate the amount of nursing care needed.[18–20] Ten ADL, including bowel control, bladder control, self-care, ambulation, and stair

climbing, are each assessed on a 3-point scale. Each self-care item is rated by determining whether the patient can perform the activity independently, with assistance or supervision, or not at all; items carry variable weights (0, 5, 10, or 15). The scores reflect the amount of assistance required.

The OARS-IADL[21] is a 7-item scale covering use of the telephone, traveling, shopping, preparing meals, doing housework, taking medications, and handling finances. These tasks are considered necessary for community living.[22] Each item is scored on a 3-point scale, with the total score ranging from 0 to 14 (with 14 indicating no problems with any of the activities).

Handicap was assessed with the Reintegration to Normal Living (RNL) Index. Reintegration to normal living has been defined as "the reorganization of physical, psychologic and social characteristics so that the individual can resume well adjusted living after incapacitating illness or trauma,"[23] the antithesis of handicap. The RNL Index is an 11-item scale that covers areas such as participation in recreational and social activities, movement within the community, and how comfortable the individual is in his or her role in the family and with other relationships. It was developed simultaneously in French and English and can be completed by either a patient or a significant other.[23] A 3-point scoring system is used and yields total values ranging from 22 to 0, with higher scores indicating poorer reintegration.

Assessments were carried out before randomization, immediately after the 4-week intervention (1-month assessment), and 2 months later (3-month assessment) by trained physical or occupational therapists who had not participated in the treatment part of the trial and were not informed about group assignment. Baseline measures of IADL, community reintegration, and HRQL were not made because of a concern that hospitalized individuals could not accurately judge their own capacity to participate in community-based activities.

Statistical Analysis

The main outcome was Physical Health, and the study was designed to recruit 54 subjects per group to have 80% power to detect a 5-point difference between groups (with an SD of slightly <10) at the $P=0.05$ level. In the general population, a difference of this size would be associated with a 30% lower 5-year mortality rate and a 50% reduction in the proportion of persons unable to work.[10] In addition, it is the magnitude of impact possible with nonsurgical interventions.[10]

The principal analysis for comparison of the 2 groups was a fixed-effects, repeated measures model with missing data using generalized estimating equations.[24] This is the model of choice for continuous outcomes when data are missing, unbalanced when there is a within-subject correlation over the repeated measures. It is similar to the simple ANOVA model, except that persons contribute to the estimation until the time they are missing, and the variance estimates take into account the within-person correlation. Missing data arose for 2 reasons: when subjects were too incapacitated for the performance-based measures and when subjects withdrew from the study because of death, moving, or refusal to participate. When persons were unable to perform the TUG, a timed test with higher times associated with greater disability, the highest value from among those who were able to complete the test was used as a substitute. For self-report measures, persons with missing data were excluded. Owing to missing data, the number of persons assessed at each time point differed across measures.

The validity of ANOVA-type models is predicated on the assumption that data are missing completely at random. One of the difficulties with analyzing quality-of-life data is that data are missing for persons who are deceased, ill, or generally displeased with some aspect of the treatment they are receiving. Substitution of missing data with an imputed value leads to an inaccurate estimate of the variance and will affect statistical testing.[25]

To handle missing data in a more equitable way, we used a form of logistic regression for ordinal or ranked data.[26] To do this, each outcome measure was categorized with use of quartiles, derived from the entire sample, as cut points. A fifth level, ranked as the lowest category, was assigned for subjects not completing the final evaluation. Ordinal regression was then used to estimate the odds of better outcome for persons in the home intervention group compared with those in the usual care control group. This analysis created a summary OR across all possible consecutive cut points, and a score test was used to assess the homogeneity of the OR across cut points. The assumption that data missing would be from those at the lower end of the scoring range on scales was examined by comparing, within each group, those with complete data to those without.

TABLE 1. Comparability* of the 2 Groups Before Randomization

Construct and Instrument	Home Group (n=58)	Usual Group (n=56)
Men, n (%)	37 (63.8)	40 (71.4)
Women, n (%)	21 (36.2)	16 (28.6)
Age, y	70.3±12.7	69.6±12.7
Stroke severity: CNS, 1.5–11.5 (n)	8.9±2.2 (58)	8.9±2.1 (56)
Motor function: STREAM, 0–100 (n)	82.3±19.3 (56)	85.7±11.1 (54)
Mobility: TUG, s (n)	23.3±21.2 (58)	21.5±14.4 (54)
BADL: Barthel, 0–100 (n)	84.6±14.4 (58)	82.7±13.9 (56)

Values are mean±SD.
*No significant differences between groups on any baseline variables.

Results

Recruitment

Over the 2-year recruitment period, 1542 persons with stroke were admitted to the 5 participating hospitals. From this cohort were excluded 318 persons who rapidly improved and were not in need of intensive home-based rehabilitation; 606 persons who did not have a caregiver; and 424 people who did not meet eligibility criteria within the 28-day window for recruitment. Of all eligible persons (n=194), 114 (59%) were recruited; 62 refused, and 14 were participating in other research projects and could not be recruited. Fifty-eight persons were randomized to the intervention group and 56 to the control group. The study was designed to recruit a minimum of 54 subjects per group, although more subjects were desired to deal with losses. Recruitment was slower than expected, so the study was terminated at a natural calendar break.

Table 1 compares the 2 groups on baseline characteristics. There was no difference between the 2 groups on average age or on gender. The average CNS scores for the 2 groups (measured on average 4 days after onset) were comparable, at 8.9; 8 persons in the home group and 4 in the usual care group had CNS scores of <6, indicating severe stroke; only 1 person (home group) had a score >11, indicating mild stroke. Only measures of impairment and disability were available at baseline, and these did not differ between the 2 groups.

Dropouts and Losses to Follow-Up

A total of 11 people in the usual care group missed 1 or both follow-up assessments: 7 refused any evaluations, and 4 others had moved, were institutionalized, or were otherwise unavailable by the time of the 3-month evaluation. There were 7 persons in the home group who were lost by the time

TABLE 2. Impact of Intervention on Primary End Point: Physical Health (SF-36 Physical Component Summary*)

	Home Mean±SD (n)†	Usual Mean±SD (n)†	Significant Effects
Physical health‡	39.5±9.6 (56)	37.2±8.4 (47)	Group
	42.9±10.1 (51)	37.9±10.6 (44)	Group×time
Mental health	45.8±12.7 (56)	45.7±12.3 (47)	
	46.5±11.7 (51)	46.7±10.8 (44)	

*Physical health (Physical Component Summary) and mental health (Mental Component Summary) have been standardized to have a mean of 50 and SD of 10.

†Not all subjects were able to complete the SF-36, and it was not administered until after discharge.

‡Significant effect of group: $F_{1,101}=3.99$; $P=0.048$; significant effect of group×time: $F_{2,94}=4.17$; $P=0.018$.

of the 3-month assessment: 4 because of refusal, 1 because of illness, and 2 because of death (myocardial infarction and previously undetected cancer).

Length of Stay and Services Received

The duration of stay in acute care was significantly shorter by 3 days for the home group (mean 9.8 days, SD 5.3 days) compared with the control group (12.4 days, SD 7.4 days). When duration of stay in rehabilitation hospitals for persons in the usual care group is included, the difference becomes greater: a mean of 16.1 days (SD 14.6 days) for the control group. Seven patients were discharged to inpatient rehabilitation for an average of 29.9 days (range 5 to 69, SD 19.7); their stay in acute care before transfer was 16.6 days.

On average, persons in the home intervention group received, over the 4-week period, 6 PT visits, 4 OT visits, 2 ST visits, and 2.5 nursing visits. The usual care control group actually received more visits, but these are accounted for by extensive inpatient care for 7 patients who were discharged to rehabilitation. The usual care group received, on average, 9 PT visits, 5 OT visits, 2.5 ST visits, and 4 nursing visits. Even though the control group received, on average, more visits, the proportion of patients receiving any care was less. For example, all of the persons in the intervention group received nursing visits compared with only 52% in the control group. Similarly, three quarters of the persons in the intervention group received PT compared with only 50% in the control group.

Impact on Primary Outcome: Physical Health

Results for the impact of the intervention on Physical Health are presented in Table 2. The 2 groups were similar immediately after the intervention, at the 1-month evaluation. At the 3-month evaluation, the home group had a mean physical health score 5 points greater than the usual care group. A 5-point change is considered clinically important,[10] and this was the desired detectable difference at the outset of this study. There was a significant effect of group ($F_{2,94}=3.99$, $P=0.048$) meaning that, over all evaluations, the home group was significantly higher than the usual care group. The group×time interaction was also significant, although only the home group improved between the 1- and 3-month evaluations. Mental health was not a primary end point, but results are presented for completeness; there were no differences either over time or between groups on this measure.

Impact on Secondary HRQL End Points

Information on secondary HRQL end points are presented in Table 3. The home group scored higher than the usual care group on only 3 of the 8 subscales immediately after the intervention and on 6 of the subscales at 3 months. However, the differences were significantly higher only for the Role Physical subscale ($F_{1,101}=5.73$, $P=0.0186$). Both groups improved significantly over time on this subscale, but the home group improved significantly more (group×time interaction: $F_{2,94}=14.17$, $P<0.001$). The significance of the interaction would remain, even after a Bonferroni adjustment of 8 was made to adjust for multiple comparisons.

Impact on Secondary Measures of Impairment, Disability, and Handicap

Table 4 provides a comparison of the 2 groups on measures of impairment, disability, and handicap at baseline (where applicable), at 1 and 3 months. Both groups improved significantly over time on measures of impairment (STREAM and TUG) and BADL, and the home group was not any worse than the usual care group on these measures. The significance of the time factor would remain even with a Bonferroni adjustment of a factor of 5. On IADL, the home group scored higher than the usual group immediately after the intervention and at 3 months, yielding an significant effect favoring the home intervention ($F_{1,100}=4.70$, $P=0.0324$); both groups improved modestly from the 1-month to the 3-month evaluation, but the home group improved significantly more (group×time interaction: $F_{2,92}=4.18$, $P=0.0182$). This effect would lose significance at $P<0.05$ with a 5-factor adjustment for multiple comparisons. For reintegration, the home group improved more than the usual care group from the 1-month to the 3-month evaluation (time×group interaction for RNL associated with $F_{2,94}=5.41$, $P=0.006$). This effect would retain significance at $P<0.05$ with a 5-factor adjustment for multiple comparisons.

Impact of Losses to Follow-Up

As indicated earlier, there were a total of 18 losses to follow-up because of refusal to participate, illness, and death: 7 in the home group and 11 in the usual care group. Persons who were lost to follow-up were compared with those who remained in the study on baseline and 1-month measures of impairment and disability to evaluate whether there were any systematic tendencies for poor performance to influence attrition. Table 5 indicates that persons in the usual care group who could not be evaluated had significantly lower functioning in terms of mobility (higher TUG scores) and performance of BADL (lower BI) than persons who completed the final evaluation. It was not possible to make comparisons on measures of handicap and HRQL because they were not carried out at baseline and were also missing at later evalu-

TABLE 3. Impact of Intervention on Secondary HRQL End Points: Subscales of the SF-36

SF-36 Subscale*	Time, mo	Group†		Significant Effects
		Home	Usual	
Physical function index	1	54.3±26.7	53.4±26.8	
	3	60.5±29.5	49.2±31.5	
Role: physical‡	1	23.7±35.1	10.6±21.3	Group, group×time
	3	46.6±40.9	31.2±34.6	
Role: emotional	1	53.6±45.7	53.2±46.4	Time
	3	66.0±41.9	61.4±40.6	
Pain index	1	73.5±30.7	75.1±26.2	
	3	75.5±26.7	72.1±27.4	
General health perceptions	1	62.6±22.9	55.1±24.2	
	3	63.5±20.8	56.7±25.0	
Vitality	1	53.1±20.8	48.7±25.0	
	3	50.7±23.9	46.4±22.9	
Social function	1	59.6±33.2	57.2±35.0	Time
	3	71.3±28.5	64.2±28.7	
Mental health index	1	67.1±21.9	67.7±22.3	
	3	65.2±20.8	66.4±19.2	

Values are mean±SD.

*All subscales of the SF-36 are scored out of a maximum of 100 points.

†Not all subjects were able to complete the SF-36: 1 month, 56 and 47 subjects, respectively; and 3 months, 47 and 44, respectively, for the home and usual groups.

‡Significant effect of group: $F_{1,101}=5.73$; $P=0.019$; group×time: $F_{2,94}=14.17$; $P<0.0001$.

ations. The pattern was not so clear cut in the home intervention group, in which loss to follow-up did not appear to be related to poorer outcome on previous evaluations. Thus, the 2 persons who died, the 1 who was too ill to participate, and the 4 who refused to participate could not necessarily have been predicted.

Exclusion of these 18 people from the analysis is inefficient and could potentially lead to biased results. To permit the inclusion of this valuable information, the primary outcome was categorized into an ordinal variable using the interquartile range as cut points, and a fifth level was assigned for persons not completing the evaluation. Ordinal regression was then used to estimate the odds of better outcome for persons in the home intervention group compared with those in the usual care control group, independent of how the outcome is categorized. The results indicate that there were still no significant differences between the 2 groups on measures of impairment and disability except for IADL, which was significantly better for the home intervention group at both evaluations. For the measure of handicap (the RNL), the home intervention group scored better at the 3-month evaluation. For physical health, the difference between the 2 groups at both the 1- and 3-month evaluations was >2-fold (OR 2.14 and 2.21), and the 95% CIs excluded unity.

In contrast to the finding in Tables 2 through 4, which excluded persons with missing data, the effect of the intervention on physical health was almost as strong immediately after the intervention as it was after 3 months. It was in the first month that most of the losses occurred in the control group, and there were 2 negative outcomes in the intervention group (1 death and 1 person too ill to participate); fewer losses occurred subsequently.

Discussion

The hypothesis for this study was supported. Prompt and supported discharge led to better physical health. The difference detected (5 points) is clinically meaningful.[8,10] In addition, other end points were also impacted favorably, notably IADL and reintegration to community living. There was no negative impact on recovery of basic motor and functional skills. We also hypothesized that length of stay would also be shortened for the home intervention group because of immediate access to home-based services and because of the Ready for Discharge Checklist.[7] Indeed, the total length of stay was shortened by an average of 6 days: 10 days in the home intervention group compared with 16 days for the usual care group, which included inpatient rehabilitation for 7 subjects.

The findings from this study concur with those found in the 3 other early supported discharge trials. A study from London, England,[3] reported a similar reduction in length of stay: 12 days for intervention group and 18 days for the community control group. Outcome was similar between the 2 groups because all patients who required rehabilitation received services. Swedish investigators[1] also found that

TABLE 4. Comparison of the 2 Groups on Secondary Measures of Impairment, Disability, and Handicap

Construct and Instrument	Time, mo	Group, mean±SD (n)		Significant Effects
		Home	Usual	
Motor function: STREAM, 0–100	0	82.3±19.3 (56)	85.7±11.1 (54)	Group×time
	1	90.3±12.4 (55)	91.7±10.1 (47)	
	3	93.3±11.7 (51)	92.9±10.0 (43)	
Mobility: TUG, s	0	23.3±21.2 (58)	21.5±14.4 (54)	Group×time
	1	16.5±16.3 (55)	15.5±18.0 (46)	
	3	14.1±12.4 (50)	12.7±6.4 (44)	
BADL: BARTHEL, 0–100	0	84.6±14.4 (58)	82.7±13.9 (56)	Group×time
	1	94.3±10.6 (54)	93.3±10.1 (46)	
	3	97.1±6.9 (48)	95.1±10.6 (43)	
IADL: OARS, 0–14	1	10.1±3.4 (54)	8.6±3.5 (46)	Group
	3	11.0±3.5 (51)	9.5±3.9 (44)	Group×time
Reintegration: RNL, 22-0	1	6.0±4.1 (56)	6.1±3.6 (47)	Group×time
	3	4.0±3.7 (51)	5.7±4.6 (44)	

For STREAM, significant effect of group×time: $F_{2,185}=24.11$; $P<0.0001$. TUG, significant effect of group×time: $F_{2,194}=13.92$; $P<0.0001$. BI, significant effect of group×time: $F_{2,194}=34.14$; $P<0.0001$. IADL, higher scores indicate better performance; not evaluated before hospital discharge. Significant effect of group: $F_{1,100}=4.70$; $P=0.0324$; significant effect of group×time: $F_{2,92}=4.18$, $P=0.018$. RNL, lower scores indicate greater satisfaction with community reintegration; not evaluated before hospital discharge. Significant effect of group×time interaction: $F_{2,94}=5.41$, $P=0.006$.

early supported discharge was highly effective in reducing hospital stay (mean 14 days for home rehabilitation group compared with 29 days for routine rehabilitation group), and this reduction in hospital stay did not have a negative effect on motor, functional, or social outcomes. Another British study[2] found that early supported discharge resulted in a shorter length of stay (median 13 days) compared with conventional care (median 22 days) and, similar to our study, at 3 months after stroke the intervention group demonstrated greater capacity for carrying out higher-level ADL.

The impact on length of stay in this Montreal study was not as large as originally anticipated. Just prior to initiation, the provincial government implemented healthcare budgetary cuts, particularly in the hospital sector. As a result, hospitals were closed and length of stay was shortened for almost all conditions. In addition, this study imposed the use of the Ready for Discharge Checklist for all persons being considered for this trial, and the presence of this checklist served as a strong stimulant for hastening discharge in the control group.

Analysis of the quality of life data is challenging because of the issue that data are not missing completely at random. The ordinal regression model used as a secondary analysis made the assumption that the data missing were for persons who would have scored at the lowest end of the range of values. This assumption was reasonable for the usual care group but not entirely so for the home group, and it potentially penalized this group. The estimates from this model could, therefore, still be an underestimate of the effect of the home intervention. A 2-fold increase in physical health favoring the home group was found at both the 1- and 3-month evaluations. In addition, the home group also showed better outcome for IADL and reintegration. In ANOVA models, the assumption is made that data are missing completely at random; when this assumption is violated, as was the case here (data missing for deceased and

TABLE 5. Initial Scores on Outcome Measures for Persons Who Completed the Final Evaluation Compared With Those Who Did Not

	Home Group		Usual Group	
	With Evaluation (n=51)	No Evaluation (n=7)	With Evaluation (n=45)	No Evaluation (n=11)
CNS	8.9±2.2	8.9±2.6	8.8±2.3	9.1±1.0
STREAM	82.3±19.2	82.2±22.0	85.6±11.0	86.3±11.9
TUG	23.7±21.9	20.8±17.2	20.6±14.8	25.5±11.8
BI	84.3±15.0	86.0±11.5	84.9±12.9	75.4±15.2

Values are mean±SD.

TABLE 6. Results of Ordinal Regression Model Examining the Impact of the Intervention on the Outcomes

Outcome	Evaluation Time, mo	Proportional OR	95% CI	
STREAM	1	1.66	0.86	3.22
	3	1.91*	1.00	3.68
TUG	1	1.61	0.92	3.41
	3	1.78	0.81	2.99
BI	1	1.90	0.95	3.79
	3	1.53	0.74	3.14
IADL	1	2.55	1.31	4.97
	3	2.31	1.19	4.48
RNL	1	1.55	0.81	2.99
	3	2.35	1.21	4.56
PCS	1	2.14	1.11	4.5
	3	2.21	1.14	4.27
MCS	1	1.63	0.85	3.12
	3	1.42	0.74	2.71

PCS indicates the SF-36 Physical Component Summary; MCS, Mental Component Summary. Outcomes were categorized at the interquartile range, and a fifth category was created for persons unable or unwilling to be evaluated. The 95% CIs that exclude 1.0 indicate a statistically significant difference. The OR >1.0 indicates that the home group was more likely to have a better outcome than the usual care group.

*This was the only measure for which the score test for homogeneity was significant ($P=0.46$); for all other measures the assumption of homogeneity held.

ill and more data missing in the usual group), the 2 means would appear more similar.

The intervention was multimodal, involving several components including shorter exposure to negative effects of hospitalization, delivery of services to a greater proportion of individuals, and services in the patient's home environment. It is unlikely that the degree to which length of stay was shortened (at most, an average of 6 days) was enough to have an impact on the outcomes. The higher intensity of services received by the intervention group did not have a positive influence on measures of impairment and disability, and these are the end points more usually affected by rehabilitation.[27,28] Therefore, delivering services in the home environment appears to be at least one of the mechanisms by which this intervention improved outcome in terms of reintegration and physical health. In the home environment, it is potentially easier to focus the therapy on the immediate health concerns and needs of the patient and the family; this may have instilled a greater degree of confidence in the patient and family regarding ability to function at home and in the community. There was also a component related to delivery of coordinated care, which is known to improve outcome. However, both groups benefited from the team approach to care, because the acute-care settings all had some degree of team care that extended beyond the walls of the hospital when postacute services were arranged. What occurred with some members of the usual care group was that the "team" did not identify a need for postacute stroke care, and so the patient was discharged without a recommendation for continued care; or the patient was adamant about wishing to return home, which made arrangement of continued care more difficult. Thus, it is difficult to sort out the independent effects of the home environment and the coordinated team approach; components of both probably were instrumental in impacting favorably on outcome.

In addition to quantitative data on outcomes, a considerable amount of qualitative information was volunteered by subjects, family members, and service providers. A common theme from all these groups was that the intervention empowered the subject and his or her family to take charge of the care. The family, instead of being passive observers around the bedside of the patient, was now in charge and actively making decisions and taking action.

A limitation to the study was the inability to blind subjects to the treatment received, with the result that subjects in the intervention arm could have responded more favorably to the self-report measures. If this had been the case, a consistent difference across measures and across time would have been found favoring the home group. This did not occur. There was no difference early on in RNL and Physical Health, but there was a difference in IADL; at the 3-month visit, this pattern was reversed.

Finally, the generalizability of the results warrants comment. Randomized trials are notorious for including only a small percentage of all persons with the problem, and this trial was no exception. However, the largest group that was excluded, persons with no caregivers, could in retrospect have been included. Many of these individuals went home alone anyway and went without services because of health-care system changes. Ethically, because we were deviating from the pattern of usual care, we could not have sanctioned this action for the purposes of research. These persons would probably have benefited equally, if not more, from the intervention.

Conclusion

Home rehabilitation intervention appeared to permit motor and functional gains that occurred with natural recovery and with rehabilitation to be translated into a greater degree of higher-level function and satisfaction with community reintegration; these in turn were translated into a better perception of physical health.

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