

ORIGINAL RESEARCH

Benefits of Centralized Scheduling in a Postacute Residential Rehabilitation Program for People With Acquired Brain Lesions: A Pilot Study



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Abstract

Objective: To determine whether the use of a designated staff person to coordinate and schedule therapy services in a postacute residential rehabilitation program for people with acquired brain lesions results in (1) a higher-intensity treatment and a reduced length of stay; (2) reduced rehabilitation costs; and (3) increased patient and staff satisfaction.

Design: This nonrandomized retrospective study from 2009 through 2012 uses data collected relative to 2 different methods of scheduling: (1) self-planning, in which each single team member makes appointments that are then displayed on a shared board; and (2) managed planning, in which appointments are made by a designated staff person.

Setting: A residential center for people with postacute acquired brain lesions.

Participants: Patients (N=20) with acquired brain lesions who had similar clinical and demographic characteristics comprised the managed planning group (n=10) and the self-planning group (n=10).

Interventions: Not applicable.

Main Outcome Measures: Organizational measures (length of stay in rehabilitation, number of treatment hours, total cost of rehabilitation), clinical outcome scales (Disability Rating Scale, FIM, and Barthel Index), perceived quality of treatment by patients (questionnaire), and perceived satisfaction of team members (Job Descriptive Index).

Results: All patients improved on all clinical rating scales at the time of discharge (all effect sizes are large). In the managed planning group, the number of treatment hours increased (Cohen's $d=2.15$), resulting in reduced length of stay (Cohen's $d=.95$) and cost of rehabilitation (Cohen's $d=1.22$). In addition, the quality of treatment perceived by the patients and their families increased, while team member satisfaction did not change.

Conclusions: The use of a designated staff person to manage therapy services improves efficiency and efficacy of a patient-centered health care system. The proposed scheduling system results in a remarkable cost saving for the National Health System.

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In the health care system, an important topic of discussion is the prioritization and efficient use of staff and financial resources. The patient population with acquired brain lesions is extremely heterogeneous and has different functional impairments, thus requiring multiprofessional care. A multiplicity of knowledge and skills is necessary to provide comprehensive,¹ early, and

intensive rehabilitation.² This requires collaboration between highly specialized professionals in a transprofessional team. Efficient teamwork promotes gains on various levels: to the patients (clinical outcome), to the entire service (organization), and to the perceived satisfaction of patients, caregivers, and professionals.³ Even if the use of a team approach is recommended, few studies^{4,5} have investigated how the team should be developed, organized, and managed to provide efficient therapies.

Disclosures: none.

Table 1 Description of steps representing the rehabilitative pathway

Steps	Description
Step 1 Medical examination	The physician visits the patient and decides which further specific assessments are necessary. From the beginning, depending on the patient's needs, social support may be involved in order to prepare for the postdischarge period.
Step 2 Specific assessments	Specific assessments may involve a motor therapist, a neuropsychologist, a speech therapist, an occupational therapist, an educational therapist, a nurse, and a physician. Each professional uses specific ability scales.
Step 3 Team meeting	The physician and team of professionals meet to define rehabilitation interventions and their frequency, specific rehabilitation goals, and the current and expected global outcome. The initial timing, frequency, and intensity of treatments are based on the rehabilitative needs emerging from the assessment.
Step 4 Rehabilitative program	The rehabilitative program consists of 3 phases. In the first phase, patients are engaged on shared and realistic goals of treatment with the aim to promote routine and gradual reorientation toward daily life skills and to promote good adherence to the treatment. In the second phase, the aim is to achieve recovery or compensation. The third phase aims to promote the use and the integration of abilities acquired, and to encourage the development of new personal goals to pursue during the following treatment as outpatients. Depending on the achievement or the failure of the rehabilitation goals, the team can revise the planning of interventions, introducing or ending treatment sessions. The team meets at least once a month to discuss the clinical evolution of the patient. The timing of discharge and the arrangements for ongoing management are periodically debated. When the team definitely considers the discharge as possible, each professional assesses the patient.
Step 5 Discharge	After this, the physician and team meet. Once confirmed by the ability scales that the patient has reached his/her rehabilitative goals or his/her condition has not improved, the patient is finally discharged.
Step 6 Postdischarge	There are 3 main possibilities in postdischarge: (1) return to home; (2) passage from inpatient charge to day patient charge in the same rehabilitation center; or (3) transfer to another care facility.

This study compares 2 different strategies of scheduling therapies in a rehabilitation center for people with acquired brain lesions. The objectives were to determine whether the use of a designated scheduling manager results in (1) a higher-intensity treatment and a reduced length of stay (LOS) reaching the same clinical outcome; (2) reduced rehabilitation costs; and (3) increased patient and staff satisfaction. Cost saving and perceived satisfaction were also explored.

Methods

The study was conducted in a rehabilitation center for people with acquired brain lesions. In accordance with the local National Health System, the center can accommodate up to 11 inpatients and 24 day patients. The occupancy rate is almost 100%. The number of treatment sessions available is tailored to the full occupancy rate.

The center has adopted the holistic approach to rehabilitation,⁶ applied in a transprofessional manner. This model is comparable to the neurobehavioral program as defined by Malec and Basford⁷ (for comparisons between different types of comprehensive rehabilitation, see Geursten et al⁸). Neurobehavioral programs integrate cognitive, emotional, behavioral, physical, and vocational rehabilitation while emphasizing self-awareness. The aims of rehabilitation, based on this model, are to (1) promote adherence and routine and gradual reorientation, (2) achieve recovery or compensation, (3)

integrate abilities, and (4) develop new personal goals. Steps concerning the rehabilitative pathway are reported in [table 1](#). Its duration varies widely from a few weeks to several months.

This research compares data collected retrospectively about 2 different methods of scheduling in subsequent 2-year periods. The rehabilitative approach and techniques were based on the neuro-behavioral program during both periods. The team members remained the same for the 2 methods of scheduling.

Self-planning

Each team member plans patients' treatments at the beginning of the week. Each schedule has to be arranged in accordance with others on 1 shared timetable. Scheduling may vary weekly for various reasons such as clinical evolution, medical exams, and vacations. At the end of the week, actual treatments are recorded with a computer program.

Managed planning

A neuropsychologist coordinator meets weekly with team members to arrange all patients' treatments with consideration for therapists' requests and organizational constraints. Scheduling may vary weekly for various reasons such as clinical evolution, medical exams, and vacations. Decisions on priorities concerning scheduling are made by the coordinator based on the recommendations expressed by the team. The printed weekly schedule is provided to each team member.

For both types of scheduling, clinical and organizational measurements were taken, along with the perceived quality. The

List of abbreviations:

- DRS** Disability Rating Scale
- LOS** length of stay

Table 2 Measurement of central tendency in the 2 groups of patients at admission and discharge for all the clinical scales applied

Scheduling Method		Admission	Discharge	Effect Size (<i>r</i>)
Self-planning	DRS	8.00±3.4	6.4±2.83	.49
	FIM	68.4±20.9	89.00±19.6	.63
	Barthel	33.0±18.88	54.5±23.7	.63
Managed planning	DRS	7.3±3.71	6.3±4.14	.40
	FIM	78.78±31.87	93.56±26.42	.56
	Barthel	47.0±32.8	65.9±34.58	.60

NOTE. Values are mean ± SD or as otherwise indicated. All effects size values suggested that, considering all the scales, the probability of having a different score (higher in case of the Barthel Index and FIM, lower in the case of DRS) at the time of discharge with respect to admission was ≥74%.

clinical measures were recommended by the national guidelines for acquired brain injury as reported in the final document of the National Consensus Conferences.⁹

Clinical outcome scales

We considered the following validated scales: Disability Rating Scale (DRS),^{10,11} FIM,^{12,13} and the Barthel Index.^{14,15}

The DRS is a 30-point ordinal scale that measures environmental and social disability. It is administered by psychologists to assess the consequences of brain injury. It provides quantitative information to document the progress of patients with severe head injury, from coma to community reintegration. A score of 30 indicates complete disability. It has been validated both for traumatic and vascular brain injury.

The FIM is an ordinal scale that is administered by trained therapists to evaluate the amount of disability and the need for physical and cognitive assistance to perform activities of daily living. It includes both motor and cognitive items. The maximum score of 126 indicates that the patient is completely independent.

The Barthel Index is a 10-item scale that measures the person's daily functioning depending on whether help is required to perform the task. It includes items about daily living and mobility, and is administered by trained nurses to monitor improvements over time. The maximum score of 100 indicates complete independence.

Scale of perceived quality: patients and caregivers

The level of perceived quality was determined with a questionnaire used internally by the center. It was delivered to all patients and caregivers when entering the assessment phase. Completing the questionnaire was voluntary, and the questionnaires were

returned anonymously by use of a letterbox. The questionnaire included items on the following: hospitality, comfort, staff, information received, whether expectations were met, and an evaluation of the center based on care and organization. Each item had the following response options: excellent, satisfactory, sufficient, insufficient, very bad, don't know, and no answer.

Scale of job satisfaction: team members

All the team members involved were required to complete anonymously the Job Descriptive Index¹⁶ during both self-planning and managed planning. This scale measures perceptions about the quality of work, wages, the possibility of promotion, supervision, and work relationships. Each section score has a minimum of 0 and a maximum of 54. Scores <22 indicate that the job is unsatisfactory, scores between 22 and 32 indicate neutrality, and scores >32 indicate job satisfaction.

Measures of organizational quality

We compared the LOS in rehabilitation, the average monthly hours of treatment, and the average monthly hours of neuropsychology, physiotherapy, speech and language therapy, and occupational therapy. We considered the financial cost of rehabilitation supported by the National Health System that is the sum of the daily charges for inpatient treatments. We added the weighted cost of a planning manager where it applied. In Italy, the health care system is funded by government revenues, and it guarantees coverage for the entire population (Beveridge Model). The rehabilitation center is reimbursed by the National Health System with a fixed charge per each day of treatment.

Participants

All data were collected retrospectively. Since this is a pilot study and the sample is small, all comparisons were expressed using measures of central tendency and effect sizes. Patients were eligible for inclusion in the study if they (1) were inpatients; (2) required the interventions of ≥3 professionals; (3) were recovered for >30 days; and (4) had completed an assessment, treatment, and a final evaluation within 2 years of managed planning scheduling. Ten patients satisfied these criteria. Based on demographics (age, sex) and anamnestic (lesion type, initial assessment scores) characteristics of this group, an additional 10 patients who recovered during the self-planning scheduling were selected as a historical control group. All patients provided written informed consent for the use of their de-identified data for research at the time of admission.

Both groups comprised 7 men and 3 women with similar mean ages ± SDs (self-planning, 51.0±13.9y; managed-planning,

Table 3 Cumulative percentage of positive responses (excellent and satisfactory) concerning perceived quality of hospitality, comfort, information received, met expectations, care, and organization

Scheduling Method	Hospitality	Comfort	Staff	Information Received	Met Expectations	Care	Organization
Self-planning (n=40; 30% of delivered questionnaires)	67.39	79.28	90.91	41.39	77.01	82.56	84.30
Managed planning (n=30; 21% of delivered questionnaires)	86.61	86.61	93.30	96.43	89.73	96.88	90.18

NOTE. Values are percentages.

Table 4 Responses for Job Descriptive Index

Scheduling Method	Quality of Work	Wage	Possibility of Promotion	Supervision	Work Relationship
Self-planning (n=11)	39.45±9.1	20.00±6.9	7.45±2.6	31.27±10.6	37.40±9.8
Managed planning (n=8)	39.88±9.6	22.00±6.6	6.75±1.8	35.13±11.7	36.50±10

NOTE. Values are mean ± SD. Scores <22 indicate nonsatisfaction, those between 23 and 32 indicate neutrality, and scores >32 indicate satisfaction.

53.6±13.0y; Cohen’s $d = .19$). Both groups comprised participants with the same lesion type (9 vascular, 1 traumatic brain injury). Effect size values suggested small differences in DRS (self-planning, 8.00±3.39; managed planning, 7.3±3.71; $r = .11$), FIM (self-planning, 68.40±20.96; managed planning, 78.78±31.87; $r = .13$), and the Barthel Index (self-planning, 33.00±18.89; managed planning, 47.00±32.85; $r = .16$). This means that considering all of these variables, for a randomly selected pair of individuals, the chance that the characteristics of the individual in the self-planning group were different from those of the individual in the managed planning group was <58%.

Results

Clinical outcome scales

For each outcome scale, we reported effect sizes for within-subject comparisons. All of the included patients had improved at discharge, compared with admission, in all of the clinical scales applied (table 2).

No differences were found between the 2 groups for the DRS (self-planning, 6.40±2.836; managed planning, 6.30±4.138; $r = .102$), FIM (self-planning, 89.00±19.60; managed planning, 93.56±26.42; $r = .201$), and Barthel Index (self-planning, 54.5±23.74; managed planning, 65.9±10.94; $r = .223$) at discharge. This means that, when each of the clinical outcome scales is considered, the chance that a randomly selected pair of individuals from the self-planning group and from the managed planning group would have different evaluations was <61%.

Scales of perceived quality: patients and caregivers

Table 3 shows the cumulative percentage of positive ratings (excellent and satisfactory responses) by the patients and their families. Surveys returned by inpatients and outpatients of the center during the managed planning scheduling showed higher percentages in all areas.

Scale of job satisfaction: team members

The level of perceived satisfaction did not change between the 2 periods for each section of the Job Descriptive Index, except for “supervision,” which improved from neutrality (mean, 31.27) to satisfaction (mean, 35.13). The mean responses and SDs are displayed in table 4.

Measures of organizational quality

A difference was found for the LOS in rehabilitation (fig 1); it decreased from a mean ± SD of 153.1±85.70 days during self-planning to 85.5±52.17 days during managed planning (Cohen’s $d = .95$). This means that for a randomly selected pair of individuals, the chance that the LOS of the patient in the managed planning group was shorter than for the patient in the self-planning group was >74%.

The average monthly hours of treatment per patient increased from a mean ± SD of 28.29±17 hours in the self-planning group to 63.45±15.72 hours in the managed planning group (Cohen’s $d = 2.15$).

In the managed planning group, the average ± SD monthly hours of neuropsychology (9.10±1.695h) increased compared with the self-planning group (3.79±3.13h) (Cohen’s $d = 2.20$). The same was true for occupational therapy (managed planning, 30.70±6.855h; self-planning, 8.24±7.67h; Cohen’s $d = 3.09$) and for motor therapy (managed planning, 19.88±9.07h; self-planning, 13.06±8.47h; Cohen’s $d = .78$).

No differences were found for speech therapy (managed planning, 3.76±4.91h; self-planning, 3.20±4.27h; Cohen’s $d = .12$) (fig 2).

With managed planning scheduling, the manager dedicated 8 hours per week to organize the treatments of 11 inpatients—that is, .104 hours (about 6min) every day per patient. The salary of the manager during that period was €32.78 per hour—that is, €3.41 every day per patient.

The mean ± SD treatment cost for patients in self-planning scheduling was €51,593±33,569.62. The cost in managed planning scheduling was €20,144±14,103.01, with a reduction in the average cost for the National Health System of €31,448 per patient (Cohen’s $d = 1.22$). This means that if a pair of individuals are randomly selected, the chance that the average cost for the individual treated during managed planning scheduling was lower than for the individual treated during self-planning scheduling is 80%.

Discussion

Even though sampling in the case of cerebral lesions is complicated, 2 equivalent groups for demographic and clinical measures were selected in order to focus on the method of scheduling as the independent variable. Results showed that introducing managed scheduling brought an increased intensity of all treatments, with the exception of speech therapy (this was probably because speech was a rehabilitative need only for a few participants during both periods).

The increase in the average hours of interventions resulted in a shortened LOS. This was obtained while maintaining the same clinical outcome, job satisfaction, and perceived quality. Therefore, patients achieved the same degree of clinical improvement

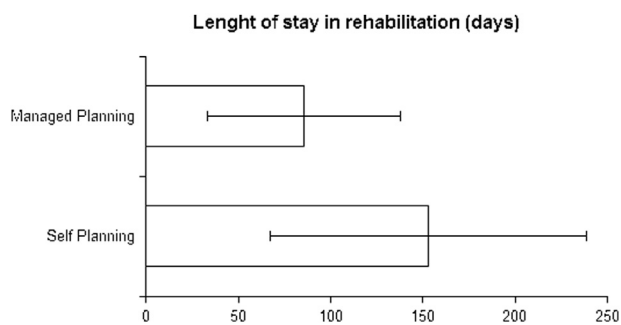


Fig 1 LOS in rehabilitation in days for the 2 groups. Bars represent SD of the mean.

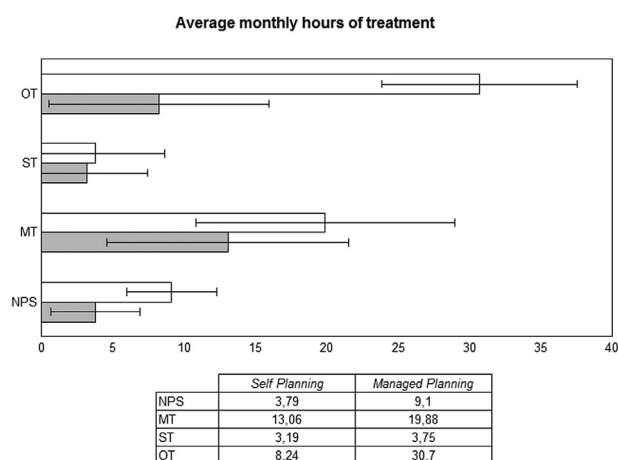


Fig 2 Average monthly hours of treatment in neuropsychology (NPS), motor therapy (MT), speech and language therapy (ST), and occupational therapy (OT). Solid bars, self-planning; open bars, managed planning.

faster. Of note, this led to cost savings, as the National Health System refunds a fixed charge per each day of treatment.

Study limitations

A limitation of the current study was the small sample size. Perceived quality of life rating scales for patients were not used. The cost savings quantified can only be applied to the specific National Health System. We were not able to quantify costs for materials or other indirect services because of the increased number of treatments. We were not able to examine in depth the specific role of coordinator management versus total hours of therapy in determining the improvement in clinical outcome measurements during a shortened LOS.

Conclusions

Scheduling a transprofessional team for patients with acquired cerebral lesions is a complex activity. Several constraints should be considered, including required treatments, nonrehabilitative activities, operative and practical restraints (eg, annual leave, illness, meetings), and financial resources. This study compared 2 different scheduling systems: self-planning and managed planning. Results indicate that managed planning has advantages over self-planning.

Keywords

Brain injuries; Organization and administration; Rehabilitation

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