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REVIEW

# Challenging rehabilitation environment for older patients

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Lian MJ Tijsen[1–3]
Els WC Derksen[4]
Wilco P Achterberg[1]
Bianca I Buijck[2,3]

[1]Department Public Health and Primary Care, Leiden University Medical Center, Leiden, The Netherlands; [2]Oktober, Bladel, The Netherlands; [3]De Zorgboog, Bakel, The Netherlands; [4]Department Primary and Community Care, Center for Family Medicine, Geriatric Care and Public Health, Radboud University Medical Center, Nijmegen, The Netherlands

**Introduction:** After hospitalization, 11% of the older patients are referred to rehabilitation facilities. Nowadays, there is a trend to formalize the rehabilitation process for these patients in a Challenging Rehabilitation Environment (CRE). This concept involves the comprehensive organization of care, support and the environment on a rehabilitation ward. However, since literature on the principles of CRE is scarce, this review aimed to explore and describe the principles of CRE.

**Methods:** A search was made in PubMed for relevant literature concerning CRE. Then, articles were hand searched for relevant keywords (ie, task-oriented training, therapy intensity, patient-led therapy, group training), references were identified, and topics categorized.

**Results:** After evaluating 51 articles, 7 main topics of CRE were identified: 1) Therapy time; ie, the level of (physical) activity; the intensity of therapy and activity is related to rehabilitation outcomes, 2) group training; used to increase practice time and can be used to achieve multiple goals (eg, activities of daily living, mobility), 3) patient-regulated exercise; increases the level of self-management and practice time, 4) family participation; may lead to increased practice time and have a positive effect on rehabilitation outcomes, 5) task-oriented training; in addition to therapy, nurses can stimulate rehabilitants to perform meaningful tasks that improve functional outcomes, 6) enriched environment; this challenges rehabilitants to be active in social and physical activities, and 7) team dynamics; shared goals during rehabilitation and good communication in a transdisciplinary team improve the quality of rehabilitation.

**Discussion:** This is the first description of CRE based on literature; however, the included studies discussed rehabilitation mainly after stroke and for few other diagnostic groups.

**Conclusion:** Seven main topics related to CRE were identified that may help patients to improve their rehabilitation outcomes. Further research on the concept and effectivity of CRE is necessary.

**Keywords:** geriatric rehabilitation, postacute care, care process, aging

## Introduction

The global population aged ≥60 years has increased from 382 million in 1980 to 962 million in 2017 and has expected to increase to 2.1 billion by 2050. The population aged ≥80 years is expected to increase more than threefold, from 137 million in 2017 to 425 million in 2050.[1] Currently, high-income countries have the highest prevalence of older people.[2] Related to the aging of the population is the increase in multimorbidity and geriatric syndromes (frailty, impaired cognition, continence, gait and balance problems). This leads to a higher risk of disability with impairments in functioning in daily life.[2–4]

Correspondence: Lian MJ Tijsen
LUMC, Department Public Health and Primary Care, Postzone V0-P, Postbus 9600, RC 2300, Leiden, The Netherlands
Tel +31 62 156 2554
Email l.m.j.tijsen@lumc.nl

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Patients with frailty or multimorbidity have a higher risk for hospitalization and adverse outcomes, such as hospitalization-associated disability and the inability to live independently.[5] In older persons, common reasons for hospitalization are cardiac events, infections, fall-related injuries, stroke, cancer, or medical/surgical interventions.[6] Hospitalization-associated disability occurs in at least 30% of the patients aged ≥70 years. For frail older persons, the rates of hospitalization-associated disabilities are as high as 40% and patients may, therefore, be unable to return home.[5,6]

After hospitalization on an acute geriatric ward, 11% of those aged ≥75 years are referred for rehabilitation to a rehabilitation unit.[7] For individuals with disability, the aim of rehabilitation is to regain and maintain optimal functioning in interaction with the environment.[2,4] Specifically, geriatric rehabilitation is defined as a multidisciplinary set of evaluative, diagnostic, and therapeutic interventions whose purpose is to restore functional ability or enhance residual functional capability in elderly people with disabling impairments.[8] Rehabilitation occurs within a specific period of time and involves identification of a person's problems and needs, which leads to the defining of rehabilitation goals with subsequent interventions offered by a multidisciplinary team. The rehabilitation team consists of therapists and rehabilitation workers, such as occupational therapists, physical therapists, psychologists, social workers, speech and language therapists, dietitians, nurses, and physicians.[4]

Rehabilitation of geriatric patients has a positive effect on outcomes for functioning, relative risk for nursing home admission, and relative risk for mortality.[9] After rehabilitation in a Skilled Nursing Facility (SNF), on average 73% of the geriatric patients are discharged to their home situation. However, this percentage varies between diagnostic groups, where 63% of the patients after stroke are able to go home compared to 81% of the patients with a traumatic injury.[10]

Recently, one study investigated the implementation of a structured program to increase activity for stroke survivors receiving inpatient rehabilitation.[11] This program is similar to the rehabilitation programs on geriatric rehabilitation wards in SNFs in the Netherlands. In these SNFs, the rehabilitation process is formalized in what is called a "Challenging Rehabilitation Environment" (CRE). However, since there is no official definition of a CRE, there are considerable differences between the wards. CRE involves the comprehensive organization of care and support by the rehabilitation team, as well as the environment in which the rehabilitation takes place.[12] However, because the above mentioned program did not include the environment or team dynamics of the multidisciplinary team, it seems to be less specific than a CRE.[11]

This narrative review explores the evidence from relevant literature regarding topics related to a CRE with the aim to address the question: What is a challenging rehabilitation environment and which topics can be identified to help model such an environment?

## Method

To answer the research question, a narrative review was performed. Therefore, a literature search was made in PubMed using combinations of the following terms: 1) rehabilitation, 2) multidisciplinary, 3) enriched environment, and 4) patient participation. After accepting a publication for inclusion in the present review, the list of keywords was searched for relevant keywords to supplement the literature search for this article; this led to the list of search terms presented in Table 1.

Likewise, the list of references of each included article was hand searched for potential additional relevant articles. Articles were included if they were in English and were related to (post) acute rehabilitation (preferably for older persons), the organization of the rehabilitation process, type of therapy, or the level of activity of patients. Possible new keywords were included if they were related to elderly, facilities where rehabilitation takes place and treatment during rehabilitation.

Based on the content, the main topics on CRE were determined; studies could provide information on multiple topics. The information was summarized in a data table used to categorize the available evidence.

## Results

The selection procedure led to the inclusion of 51 articles, mainly from Europe, Australia, and the USA. Based on these articles, seven main topics were identified that were considered important for a CRE, ie, 1) therapy time, 2) group training, 3) patient-regulated exercise, 4) family participation, 5) task-oriented training, 6) enriched environment, and 7) team dynamics.

These topics are discussed separately below.

## Therapy time

Of the 51 articles, 20 reported on how patients spent their day on a rehabilitation ward, describing the amount of

**Table 1** Search terms used for the present review

| Population and facilities | Type of rehabilitation care | Potential topics |
|---|---|---|
| Elderly | Stroke rehabilitation | Multidisciplinary |
| Aged | Recovery of function | Transdisciplinary |
| Skilled nursing facilities | Rehabilitation | Interdisciplinary |
| Nursing homes | Geriatric rehabilitation | Task-oriented training |
| Rehabilitation centers | Slow-stream rehabilitation | Group training |
| Inpatients | Public health | Patient-regulated exercise |
| Caregiver | Integrated care | Independent practice |
| | Post-acute care | Patient-led therapy |
| | | Patient-directed therapy |
| | | Time use |
| | | Therapeutic activities |
| | | Therapy intensity |
| | | Therapy time |
| | | Functional exercise |
| | | Patient participation |
| | | Enriched environment |
| | | Healing environment |
| | | Therapeutic climate |
| | | Active rehabilitation climate |
| | | Active rehabilitation culture |
| | | Therapeutic milieu |
| | | Challenging rehabilitation environment |

therapy given and the effect of increased therapy time on rehabilitation outcomes. Increased therapy time and the level of activity of patients was an important predictor of better rehabilitation outcomes.[13–32]

## Current therapy time

The studies showed that patients have a low level of activity during daytime during inpatient rehabilitation.[13,14,22,25–29]

In Western countries, during inpatient rehabilitation for stroke, patients spent up to 80% of their day during working hours on non-therapeutic activities (of which 28–38% spent sitting or lying). Patients spent 49–60% of their day alone and 48% inactive. The amount of time spent on therapeutic activities ranged from 9% to 56%. Patients with higher functional levels spent more time on therapeutic activities.[13,14,25–29]

Similar results were found for older patients rehabilitating for other conditions within inpatient facilities. For example, patients with orthopedic problems of the lower extremities who were able to walk independently or with support walked for an average of only 8 min/day (as measured with an activity monitor). None of them achieved 10 mins of moderately intensive physical contiguous activity. Consequently, these patients did not reach the amount of activity that is recommended in guidelines (ie, 30 mins of moderate intensive physical activity, completed in bouts of ≥10 mins, on at least 5 days/week).[22]

During inpatient rehabilitation, the professional with whom patients spent the most time was the nurse, ie, up to 13% of the working day (the weekends had even more contact moments than during weekdays). Therefore, the challenge for nurses is to encourage patients to do more task-specific training during their Activities of Daily Living (ADL) and thereby increase therapy time, especially during times when other professionals are less/not present.[13,14,25,27,30]

## Effect of increased therapy time

While patients had low levels of activity and therapy time during inpatient rehabilitation, the therapy time appeared to be related to the outcome of rehabilitation.[13,15–24,31–33]

An increase in therapy time was associated with positive outcomes such as return home, functional recovery, and a shorter length of stay. A decrease of therapy time was associated with return to hospital or death.[18,19,22,23,33] For example, for older patients rehabilitating after hip fracture, 1 hr extra therapy led to a 3.1% increased chance of returning home.[24]

For stroke patients, the amount of therapy time proved to be a predictor of rehabilitation outcomes. Among others, effects were reported in mobility, self-care, and functional recovery.[15,16,31,32] An increase of time spent on therapy led to better results concerning functional recovery, independence in ADL, instrumental ADL, and walking speed, as well as a shorter length of stay in the inpatient facility and an increased chance of returning home.[17–20]

For recovery after stroke, at least 16 hr/week of high-quality therapy is required for older patients for major recovery.[21] For patients aged ≥65 years, an increase from <3 hrs to >3–3.5 hrs of therapy/day led to an improved functional recovery (as visualized with a three-point gain on the functional independence measure) whereas an increase to >3.5 hrs yielded no significant difference.[15] An increase of (independent) practice can be achieved if nurses incorporate the rehabilitation goals in daily care. Task-oriented activities must be an important part of daily reality. Through encouragement by nurses and family, the time spent on therapeutic activities can be increased by 50 min/day.[13,21]

In conclusion, for all patients, the amount of time spent on therapy was related to rehabilitation outcome. However, there tended to be a ceiling effect in the influence of therapy time, while the level of physical activity during inpatient rehabilitation was low. Encouraging patient-regulated exercise and task-specific training during ADL by nurses and family increased therapy time.

## Group training

During rehabilitation, group training is often used by different therapists (eg, speech and language therapists, occupational therapists, psychologists, and physical therapists), among other things, to enable increased practice time without increasing staffing.[34–36]

Regarding circuit class therapy, physical therapy is provided in groups and focus on repetitive practice of functional and meaningful tasks. This may comprise either a series of workstations arranged in a circuit or a series of individualized activities in a group setting.[34] Compared to individual therapy sessions, in circuit class therapy sessions patients with stroke spent more time in active task practice and a similar amount of time in walking practice.[37] For patients after stroke, circuit class therapy was effective in improving mobility. Patients were able to walk further, faster, less dependently, and were more confident in their balance. Although there seemed to be no greater risk of falls, this item needs further research.[34]

During inpatient rehabilitation after stroke, group training provided by occupational therapists was feasible for task-specific practice, such as dressing tasks. After receiving group training, a clinically significant improvement in dressing performance was found, although no comparison was made with individual therapy. Nevertheless, this study demonstrated that group therapy is feasible, even for personal ADL.[38]

Likewise, for persons rehabilitating after a knee or hip replacement, group training proved to be as effective as individual rehabilitation. Patients who received group training had no different clinical/disability evaluation and level of quality of life compared with patients receiving individual therapy.[39]

## Patient-regulated exercise

Apart from the therapy sessions, patient-regulated exercise is a way to increase the amount of therapy time without increasing staff levels. Among other things, it can be used for motor goals and for goals related to aphasia. Patients rehabilitating after stroke were positive about this form of therapy; they found it useful, enjoyed it, would recommend it to other patients, and considered it an acceptable complement to face-to-face therapy.[40,41] Patients appeared to practice less than recommended (ie, 5–15 mins per session for 7 days, whereas 30 mins per session during 28 days was recommended). Therefore, it is important to ensure that the exercises are challenging, fit the level of the patient, and are tailored to personal interests.[41,42]

Limited research was found regarding patient-regulated exercise for inpatient rehabilitation. A small study in 2002 reported no benefits after 4 weeks of patient-regulated exercise of motor tasks. In this latter study, only 5 patients in the intervention group were tested after the intervention; moreover, these patients missed 20% of the intervention.[43] Later studies showed some improvement in strength, dexterity, word-finding, and confidence in talking; however, due to small study populations and different research goals, no significant results could be extrapolated.[41,42]

In patients rehabilitating after stroke, an increase in autonomy was related to regained abilities and self-confidence. Autonomy can be enhanced by minimizing care routines and by providing room for performing activities independently and privately. Attention to patients' autonomy improved patients' active participation in rehabilitation, quality of life, and independent living after discharge.[44] In stroke patients, self-regulation appeared useful and feasible for improving task performance that

demands both motor and cognitive abilities, by promoting information processing and active learning.[45]

## Family participation

For patients rehabilitating after stroke, prior living conditions (ie, living alone vs not living alone) were predictive for discharge destination. The availability of a caregiver at home was important for discharge to the community after stroke rehabilitation. Therefore, it is important for the caregiver to participate in the rehabilitation process, which helps prepare them for when the spouse/relative returns home.[46]

Additional practice with caregivers led to an increased amount of time spent in exercise which, in turn, led to an improvement in body function, more activities, and better participation after stroke.[47–50] Caregiver support accounted for 5–9% of the upper-limb improvement by increasing the amount of time spent in exercise.[49] The increased involvement of the caregiver reduced the levels of caregiver burden and facilitated the transition to the home setting, with patients becoming more integrated into their community.[50]

One study compared the effects of voluntary training with family members to voluntary training with a physical therapist. Both groups received standard care and the amount of voluntary training was the same. Although there was no significant difference in functional recovery, the family participation group had a significantly shorter length of stay and higher rates of discharge home.[51]

Training of caregivers on common stroke-related problems, and training in lifting and handling techniques, led to decreased costs of care in the year after rehabilitation. Furthermore, after this training, the reported caregiver burden was lower. Both patients and caregivers had less anxiety and depression, and better quality of life.[52]

## Task-oriented training

Task-oriented training involves the active practice of task-specific motor activities and is a component of current therapy approaches in stroke rehabilitation. A circuit class format is a practical and effective way to provide supervised task-oriented training. Multiple trials and reviews on task-oriented training after stroke showed benefits for functional outcome compared with traditional therapies. These benefits were seen in both upper/lower limb functions and activities (eg, arm/hand function, lower limb function, walking distance, gait speed, and functional ambulation). Task-oriented training led to improvements in functional outcomes and overall health-related quality of life.[38,53–56]

Nurses played a significant role in task-oriented training. They could create opportunities to practice meaningful functional tasks outside of regular therapy sessions. Many interventions could be part of task-oriented training during and outside regular therapy sessions, such as walking (on the ground or on a treadmill), cycling program, endurance training, circuit training, sit-to-stand exercises, and reaching tasks to improve balance. The training needed to be repetitive, task-specific and meaningful for the patient.[53]

A systematic review operationalized 15 components of task-oriented training: 1) functional, 2) directed toward a clear functional or everyday life activity (ADL) goal, 3) patient centered, 4) repeated frequently (overlearning and overload principle), 5) used with real-life object manipulation, 6) performed in a context-specific environment, 7) performed in increasing difficulty levels (exercise progression), 8) varied (within one task), 9) followed by feedback on the exercise performance, 10) exercised in multiple movement planes, 11) included total skill performance, 12) patient customized for training load, 13) offered in random practice, 14) occurred through distributed practice, and 15) composed of bimanual tasks. Not all components were used during a task-oriented training and the number of components used in an intervention after stroke was not associated with the size of the posttreatment effect. The components 2, 9, 13, and 14 were associated with the largest effect sizes. Although no studies have compared the importance of these components for training outcomes, they seemed to be important components of a task-oriented training program.[57]

## Enriched environment

Patients rehabilitating after stroke reported a lack of opportunities to drive one's own recovery outside of therapy time. This was confirmed by clinical staff, who perceived a lack of places to go to, and a passive rehabilitation culture and environment. Therefore, there was a need to increase opportunities for practice and promote active engagement. Creating an enriched environment can be a good solution.[58] An enriched environment can be achieved in both communal and individual areas. Opportunities for enrichment include the provision of music, audio books, regular books and other reading materials, puzzles, games, hobby supplies, tablets and a computer with Internet connection. Other possibilities are the

availability of recreational activities (eg, bingo), as well as communal areas for eating, socializing and daily group activities.[59,60]

Until recently, an enriched environment remained largely a laboratory phenomenon with little translation to the clinical setting. In animals, an enriched environment proved to be a robust intervention for fostering brain plasticity and recovery from various types of brain injury, including stroke.[61] This latter research showed that the ideal enriched environment encourages socialization, exercise, sensory and cognitive stimulation, and task-specific exercise. Reasons for the lack of studies in a clinical setting include difficulties in standardizing enriched environmental conditions across clinical sites, a lack of knowledge concerning what aspect of enrichment represents critical or active ingredients for enhancing brain plasticity, and the actual required "dose" of enrichment is unknown.[61]

A few recent studies on an enriched environment were performed in a clinical setting. One study in a post-acute mixed rehabilitation unit showed that patients in an enriched environment were more likely to be engaged in cognitive, physical and social activities and less likely to be inactive, alone or asleep compared to patients not in an enriched environment.[59] Another study in an acute stroke unit of an Australian hospital showed similar results. The patients rehabilitating in an enriched environment were 71% of the day engaged in any activity vs 58% of the control group. In the physical domain, this was 33% vs 22%, the social domain 40% vs 29%, and in the cognitive domain 59% vs 45%. Patients in the enriched environment had a significantly shorter length of stay.[60]

## Team dynamics

A rehabilitation team (usually) consists of a physician, nurses, and therapists such as occupational therapists, physical therapists, psychologists, social workers, dietician, and speech and language therapists.[4] Rehabilitation is a team effort and the way teams are organized affects the results of rehabilitation. Most of the rehabilitation teams evolved over time from intradisciplinary teams through multidisciplinary and interdisciplinary teams to transdisciplinary teams, resulting in more intensive collaboration.[62–64]

In all these team models, the aim is rehabilitation of the patient, whereas the focus of the professionals often differs. In intradisciplinary teams, the focus is usually on function level; with the transition toward multidisciplinary teams, this focus shifted to a combination of function and activity level. With interdisciplinary teams, this was shifted more toward ADL activities and, to a certain extent, toward participation level.[62,63]

In these four types of team models, a major difference is the level of working on shared goals and the communication between team members. Whereas in intradisciplinary teams there are no shared goals and little communication between professionals, this develops through multidisciplinary and interdisciplinary teams toward very good communication in transdisciplinary teams. In this latter model, professionals cross the border into another team member's professionalism and each team member is responsible for each goal. A shared conceptual framework is used, where discipline-specific theories, concepts, and approaches are combined.[62,63]

An interdisciplinary team and a transdisciplinary team model are similar. One difference is that, in a transdisciplinary team, the patient is also seen as a team member. Also, in a transdisciplinary team, the responsibility of all team members for all goals is more firmly stated, compared to an interdisciplinary team.[62,63]

Not all types of team models have been included in studies on the influence of team models on rehabilitation. The common result in these studies was the importance of shared goals throughout rehabilitation and good communication within the rehabilitation team.[62,63] However, the recommended level of integration between the professionalism of the different team members was not consistent in the various studies. This resulted in a disagreement between the recommendation for a multidisciplinary team model or a transdisciplinary team model.[62,63]

Taking into account the role of the patient in a transdisciplinary team model and the responsibility of all team members for all goals in this model, preference is given to a transdisciplinary team model.

# Discussion

Until now, no scientific vision is available regarding a CRE. This review provides, for the first time, a description of a CRE and the topics that can be identified for modeling a CRE. After examining the relevant literature, seven main topics were identified: 1) therapy time, 2) group training, 3) patient-regulated exercise, 4) family participation, 5) task-oriented training, 6) enriched environment, and 7) team dynamics.

All studies included in this review, regarding therapy time during inpatient rehabilitation, agreed on a low level of activity of patients. Differences in the precise level of

activity could be explained by the way in which the activities were perceived or were concluded to be therapeutic, ie, eating/drinking, transport/travel, ADL, and communication. Other possible explanations were differences in the amount of group therapy, patient-regulated exercise, and family participation. Furthermore, the studies agreed on the importance of activity and increased therapy time for better rehabilitation outcomes for all diagnostic groups.[13–32] The challenge is to increase therapy time; however, in most countries, no increase in revenue or numbers of staff can be expected. Some studies presented ideas to meet this challenge, eg, group therapy, patient-regulated exercise, family participation, and task-specific training during ADL.[13,14,25–30] Since these factors are important in a rehabilitation program, they are also important topics for modeling CRE and to increase therapy time.

Group therapy can be used for multiple goals in multiple diagnostic groups and is an effective way to increase therapy time without increasing staff levels. Although not all studies compared group therapy and individual therapy, all reported a positive effect of group therapy on rehabilitation goals. Studies comparing these two forms of therapy reported at least an equal effect of group therapy compared to individual therapy.[34–39] Therefore, group therapy is an effective way to increase therapy activity and can be used during rehabilitation to work on patient goals. It may enhance rehabilitation outcomes and have a beneficial effect on the length of stay in a rehabilitation facility. Staff needs to be encouraged to let group therapy be part of their treatment options.

During inpatient rehabilitation, patient-regulated exercise is another effective way to increase therapy time without increasing staff levels. Patients were positive about this form of therapy, although treatment fidelity remains a challenge. Increasing autonomy is important to regain self-confidence and improve patients' active participation in rehabilitation.[40–42,44] One included study contradicted the others regarding the effectivity of patient-regulated exercise, by showing no significant benefits after four weeks of patient-regulated exercise; however, this study had a very small population with a high dropout.[43] Moreover, since two later studies showed positive effects of patient-regulated exercise, it seems to be an important part of rehabilitation and suitable to increase therapy time. When patient-regulated exercise is recommended, the exercises need to be stimulating and appropriate for the patient's individual level. Also, evaluation and feedback will help to increase the therapy fidelity of patient-regulated exercise.

Studies reported the importance of caregivers in the rehabilitation process; moreover, the availability of caregivers is an important predictor for discharge home. Additional practice with caregivers leads to increased exercise time, leading to improved body function, activities and participation, better quality of life for both patient and caregiver, shorter length of stay, and reduced levels of caregiver burden.[46–52] Caregivers should be trained and involved in therapies, not only to increase therapy time but also to increase knowledge of common (stroke-related) problems and their prevention, and to acquire lifting/handling techniques tailored to the needs of the individual patient. Rehabilitation wards need to stimulate caregivers to be part of the rehabilitation process and to teach caregivers about the health problems of their loved ones.

Multiple trials and reviews have investigated task-oriented training after stroke and all studies included in this review reported benefits for functional outcomes compared with traditional therapies. Task-oriented training has proven effective for improving body functions and activities, and quality of life.[38,53–56] Task-oriented training is already part of the current therapy approach during stroke rehabilitation. It is important to involve nurses in task-oriented training; they can create opportunities to practice meaningful functional tasks outside regular therapy sessions.

There is (laboratory) evidence that an enriched environment is effective for the rehabilitation of animals with brain injury.[61] This effect was also shown in two studies in a clinical setting; patients tended to be more active in the cognitive, physical, and social domains in an enriched environment.[59,60] There is still a lack of knowledge concerning what aspects of enrichment represent the critical or active ingredients for enhancing brain plasticity, and the required "dose" of enrichment is unknown. More research is needed on these components of an enriched environment; meanwhile, however, an enriched environment seems to be an effective addition to the rehabilitation program. For creating an enriched environment, it is important to have a communal area. Furthermore, the stimulation of social interaction and the provision of material for activities is important in an enriched environment.

Studies show that rehabilitation is a team effort involving multiple disciplines. Whereas in the past, rehabilitation was an intradisciplinary team effort, this has evolved into interdisciplinary or transdisciplinary teams. In both interdisciplinary and transdisciplinary teams, communication and

working on shared goals is important. In a transdisciplinary team, the patient is seen as a team member; moreover, the responsibility of all team members for all goals is more firmly stated than in an interdisciplinary team; this results in more integration between the professionals of a transdisciplinary team.[62–64] Although all studies mentioned the importance of shared goals and good communication in a rehabilitation team, not all studies included all types of team models in their research. Taking into account the role of the patient in a transdisciplinary team model and the responsibility of all team members for all rehabilitation goals, preference is given to this model; particularly when considering that patients themselves generally know best which goals they have to achieve to be able to go home. The challenge for most rehabilitation teams is to make the patient and their caregiver an equal member of the team, and for all team members to feel responsible for all rehabilitation goals.

This review is the first to provide details on a CRE based on an extensive literature search and, therefore, provides the first evidence-based description of a CRE. Evidence was found that all the identified topics apply to different diagnostic groups. However, the studies on the topics mainly focused on evidence related to rehabilitation after stroke, despite the presence of more diagnostic groups in which older patients need rehabilitation after hospitalization. This is a limitation in this review. Although a CRE seems to be in place for all older patients, more studies are required on the above mentioned topics for all diagnostic groups.[6,10,12] The authors expect that all these topics may prove to be an important factor for all older patients during their rehabilitation.

Based on this review, seven main topics were identified for modeling a CRE. It is important to investigate whether these topics are supported by experts, health care workers and patients in the field of rehabilitation, and to demonstrate the effectivity/efficiency of a CRE in prospective studies. Finally, although the use of technology shows promise for improving activity levels, no body of evidence is yet available to substantiate this.[65] Therefore, more research on this topic is also required.

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## Disclosure

The authors report no conflicts of interest in this work.

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