Do stroke units need nursing?

Therapeutic and non-therapeutic activities and the relation to functional outcome
and cognition in frail stroke patients who rehabilitate in Dutch nursing homes

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Do stroke units need nursing?

Therapeutic and non-therapeutic activities and the relation to functional outcome and cognition in frail stroke patients who rehabilitate in Dutch nursing homes

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan de Vrije Universiteit Amsterdam, op gezag van de rector magnificus prof.dr. V. Subramaniam, in het openbaar te verdedigen ten overstaan van de promotiecommissie van de Faculteit der Gedrags- en Bewegingswetenschappen op dinsdag 30 oktober 2018 om 15.45 uur in het auditorium van de universiteit, De Boelelaan 1105

door

Helena Catharina Maria Huijben-Schoenmakers

geboren te Bergen op Zoom
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copromotor: dr. A.C.H.J. Rademaker
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Chapter 1

General Introduction
Stroke

Stroke is a common serious worldwide disease that causes disability and death (Donnan et al., 2008; Langhorne et al., 2011). In many countries, stroke is the second or third most common cause of death (Langhorne et al., 2011). In the Netherlands, every year 46,000 persons are affected by stroke and every day 25 patients die due to stroke (Nederlandse Hartstichting, 2016). Approximately 75% of all Dutch stroke patients are older than 65 years (Hersenstichting, 2016).

Most stroke patients survive the first, primary acute illness (Langhorne et al., 2011). Consequently, the largest burden for patients and their relatives usually results from long-term cognitive, social and physical disabilities (Langhorne et al., 2011). Motor impairment is the most common disability caused by stroke and can be considered as a loss or limitation of function in muscle control or in mobility (Langhorne et al., 2009). About 80% of patients suffer motor impairment, which affects the control of movement of arm, leg and face of one side of the body (hemiplegia; Langhorne et al., 2009). In a large percentage, hemiplegia is due to an infarction of the a. cerebri media (Salahuddin et al., 2017). Given that the decline in motor functioning is often severe, limiting daily social and professional functioning in every aspect, it is logical that stroke rehabilitation focuses primarily on the recovery of motor dysfunction. Along with motor impairment, stroke also affects the patient’s cognitive functioning, which itself may have a negative impact on functional outcome and quality of life (Cumming et al., 2013; Henon et al., 2006). The prevalence, frequency, and types of domain-specific cognitive deficits after stroke have been well described in the literature (Ashcraft, 2006; Langhorne et al., 2011; Liu-Ambrose et al., 2007; Zinn et al., 2004). More specifically, all cognitive domains such as language, memory, visuospatial ability, executive function and attention can be affected by stroke (Cummings et al., 2013). During the years following stroke, cognitive deficits may even further aggravate. A 4-year follow-up study showed that after an initial improvement in
global cognitive functioning, measured by the Montreal Cognitive Assessment (MoCA; Dong et al., 2010), stroke patients showed a progressive decline in global cognitive functioning (Mahon et al. 2017). They also reported predictors for a long-term post-stroke cognitive decline, i.e. old age (> 75 years of age), being male, and single, but also suffering from hypertension, high cholesterol, diabetes, and coronary heart disease (Mahon et al., 2017). In addition, subjective cognitive complaints appear to be common in stroke patients (van Rijsbergen et al., 2014). Although subjective cognitive complaints do not always correspond with objective cognitive dysfunctions, they do predict future emotional well-being as well (van Rijsbergen et al., 2014).

In addition to a decline in motor and cognitive functions, stroke may also have a negative effect on emotional functions. Important post-stroke emotional disturbances include depression, anxiety, emotional incontinence (e.g. spontaneous, uncontrolled laughing and crying, without a specific motivation) anger, and fatigue (Kim, 2016). Not surprisingly, motor, cognitive and emotional deficits coincide in stroke patients (Ayerebe et al., 2011; Horner, 1998), due to overlapping neuronal systems in the brain (Mulder et al., 2001). Such a close relationship implies that cognitive, motor, and emotional deficits may predict poor functional outcome and, consequently, poorer quality of life (Buijck et al., 2014; Henon et al., 2006; Lesniak et al., 2008; Nys et al., 2005).

To summarise, stroke severity - as determined by the National Institute for Health Stroke Scale (NIHHS; Brott et al., 1989) that focuses on matters such as senso-motor functioning, and thus on functional outcome, as well as cognitive dysfunction, and emotional deficits such as depression - is closely associated with institutionalization (Ayerbe et al., 2011; Farner et al., 2010; Pasquini et al., 2007), resulting in higher health-care costs (Claessen et al., 2005).
In contrast, factors such as young age, having a spouse and a high level of physical and cognitive functioning showed a positive relationship with discharge at home (Burton et al., 2017; Everink et al., 2016).

**Stroke unit**

To optimize the likelihood of frail, older comorbid stroke patients being able to return to their own home, some nursing homes offer the possibility to continue with the rehabilitation after the hospital stay (Burton et al., 2017). These nursing homes are equipped with a unit, specialized in the rehabilitation of stroke patients. Such a unit is called a ‘Skilled Nursing Facility’ (SNF) or a ‘stroke unit’ (Buijck et al., 2014).

More specifically, about 31% of elderly stroke patients are admitted to a stroke unit (Heynen et al., 2012). It has been suggested that intensive rehabilitation programs in the more traditional rehabilitation centres are less appropriate for these vulnerable older stroke patients. In these traditional rehabilitation centres, the pace of rehabilitation is too fast and therefore less suited to meet their needs (van Heugten, 2005). An alternative to an intensive program in a rehabilitation centre is to transfer the patient to a stroke unit in a nursing home. In this stroke unit, older frail stroke patients perform low-intensity multidisciplinary rehabilitation programs, with the aim still being their discharge to an independent-living situation (Buijck et al., 2012). In the stroke unit, the programs are provided by a multidisciplinary team consisting of e.g. nursing staff, a physician, a physiotherapist, an occupational therapist, a speech therapist and a psychologist (Buijck et al., 2012). Overall, in nursing home stroke units each patient receives multidisciplinary rehabilitation for about 4 hours per week equally divided over five working days (Buijck et al., 2012). Another interesting finding from that study is that patients with a better functional condition participated more in therapeutic activities. This finding points to a
classical pitfall in clinical studies: those who are already active, participate more in activities. The primary focus of studies in this research field however is to stimulate particularly those who are the least active. In any case, the quantity of physical activity during rehabilitation may be too low for some of the patients. In other words, although traditional rehabilitation programs might be too intensive for frail older stroke patients, the intensity of a rehabilitation program on a stroke unit should not be too low.

Rehabilitation intensity in the stroke unit

It has been stated that, irrespective of age, patients with stroke do need to be challenged in those functions that have become vulnerable due to stroke; only such an approach might encourage functional recovery (Langhorne et al., 2011). In this context, it has been suggested that in general a minimal dose of at least 16 hours per week of additional therapeutic activities is needed (Kwakkel, 2009). In other words, the intensity of the program is crucial for its success. Indeed, Johansen and colleagues (2012a) compared the effects of an intensive rehabilitation program with those of a more standard rehabilitation program in older patients; 12% of those patients had had a stroke. Differences between the intensive and the standard program included the training intensity per day (three hours versus two hours, respectively), adjustment of the intervention program to the progress of patients’ functioning (always versus occasional, respectively), the focus on rehabilitation (always versus shift between care and rehabilitation), and the cooperation between the various professionals (e.g. staff, family, patient). The rehabilitation period took 18 months. The results show that after 18 months the patients who participated in the more intensive program achieved a much higher level of independent functioning, compared to those who participated in the standard program. But even after an intensive rehabilitation program of a much shorter duration, i.e. 3 months, elderly stroke patients showed a significant improvement in Activities of Daily Life (Johansen et al., 2012b).
More recent research supports the view that the intensity of the rehabilitation program, i.e. more rehabilitation days within the initial post-stroke period and longer hospitalization, contributes to better cognitive functioning of elderly post-stroke patients (Perez et al., 2015). Interestingly, in that study, improvement in cognitive functioning was associated with functional improvement.

Finding and retaining patients for the stroke unit

Valuable clinical experiences with the implementation of a stroke unit in a nursing home have been described (Heynen et al., 2012). One of the experiences was that some patients refused to come to the stroke unit because they thought that such a transfer meant a long or even a permanent stay in the nursing home. To solve this issue, patients were better verbally informed, supported by a DVD (Heynen et al., 2012). Nevertheless, patients and families may be disappointed that a stroke unit in a nursing home is recommended instead of a rehabilitation centre, hindering the influx of patients due to reluctance on the part of the patients or their families.

Another experience was that the nursing home, rather than the hospital, had to cope with fluctuations in the number of patients that were admitted to the stroke unit. In other words, the nursing home had to reserve extra bed capacity. Such a strategy can result in financial losses. Financial issues have also played a crucial role in the studies of this dissertation.

Summary

For comorbid frail elderly stroke patients, the programs of traditional rehabilitation centres might be too intensive. An excellent solution to this is the establishment of a Specialized Nursing Facility or a Stroke unit, located in a nursing home. Studies on stroke units show that, although less intense, programs should still be challenging, tailored to the functional, cognitive,
and emotional capacities of the patient. When that is the case, elderly comorbid stroke patients will experience a referral to a specialized unit such as a stroke unit as the best choice.

Main goals of the dissertation

Within the scope of the studies discussed above, in particular concerning the quality of the rehabilitation at a stroke unit and its effect on the patient’s functional and cognitive functions, the goals of the present dissertation were to examine:

1. The number of minutes per day/week that are spent on therapeutic activities at a stroke unit.
2. Whether the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009) could increase the total therapy time per day at a stroke unit.
3. Whether cognitive dysfunctions are related to poor functional outcome at baseline.
4. Whether an increase in therapy time has a beneficial effect on cognition, functional outcome, and mood in elderly comorbid stroke patients.

Elaboration of the research questions

1. The first clinical study examined the number of minutes per day/week that were spent on therapeutic activities at a stroke unit.

To measure the accurate time use of older severely disabled and cognitive impaired comorbid stroke patients on a rehabilitation unit of a nursing home, we observed how these patients spent their time. Furthermore, we investigated how much time therapists and nurses spent on therapeutic activities.

A few observations:

“The researcher observed how a female patient spent 6 hours sitting in the living room, of which 3 hours were without any interaction with other people.”
"Patients stare at each other or stare out of the window. When there are visitors they have a coffee together."

"The researcher observed that none of the patients is practicing exercises independently"

It is important to note that this study was intended to be a pilot study and was absolutely not intended as a criticism of the nurses, psychologists, and other related medical staff. Everyone is doing her/his utmost to care for these patients in the best possible way. Despite the high burden of caring for those patients placed on the professional staff, they were all still willing to participate in the following studies.

2. **The second clinical study** focussed on the question of whether the total therapy time per day at a stroke unit could be increased.

Nurses can play a key role in the rehabilitation process at the stroke unit because they are 24/7 active on the ward. Together with the physiotherapist and occupational therapist, they may execute a program that is tailored to the patient’s therapeutic goals. Nurses may initiate interdisciplinary consultation, addressing matters such as the patient’s progress. Furthermore, nurses might motivate family members to contribute to the rehabilitation program. Kirkevold (1997) has described this important, challenging role of the nurse. Furthermore, Hafsteindottir and Schuurmans (2009) developed the Clinical Nursing Rehabilitation Stroke Guideline to encourage nurses to play a more influential role in rehabilitation for the older frail patient on the ward, resulting in an increase in time spent on therapeutic activities. In this way, there could be more focus on task-oriented training on the ward. The task-oriented training was based on the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009) and consisted of a combination of muscle strengthening, sitting balance and reach, getting up from a chair and walking.
3. **The third clinical study** was based on the earlier described co-occurrence of sensory-motor dysfunction and cognitive disturbances in elderly stroke patients.

More precisely, baseline data were used to examine whether cognitive dysfunctions, were related to functional disabilities and if so, which cognitive dysfunctions. A relationship between slowing of information processing, executive dysfunctions, and functional disabilities has been reported before (Cummings et al., 2013). Similarly, executive dysfunctions appeared to be a strong predictor for functional disabilities after stroke (Park et al., 2015). However, in those studies the stroke patients were relatively young, in contrast to the participants in our studies.

4. The goal of the **fourth clinical study** was to examine whether an increase in therapy time might have a beneficial effect on cognition, functional outcome, and mood in elderly comorbid stroke patients.

Physical activity focusing on resistance, balance and aerobics (Clinical Nursing Rehabilitation Stroke Guideline; Hafsteindottir et al., 2009) has proven to be beneficial for significant cognitive gains in stroke rehabilitation (Blanchet et al., 2016; Constans et al., 2016; El-Tamawy et al., 2014; Landi et al., 2010; Landsmann et al., 2016; Liu Ambrose et al., 2015; Marzolini et al., 2012; Moore et al., 2015; Saunders et al., 2016; Teasell et al., 2015; Veldsman et al., 2016). However, these studies consisted, in general, of small sample sizes with younger stroke patients with mild cognitive impairments. The question thus arises as to whether physical activity could have a beneficial influence on cognition in our frail elderly stroke patients. Studies investigating effects of physical activity on cognition in older comorbid stroke patients with poor functional outcome and cognitive decline are scarce (Teassel et al., 2015). There is thus a lack of information relating to patients’ characteristics, comorbidity, functional outcome and cognitive impairment (Pinter et al., 2012).
Chapter 6 presents the results of the single blind controlled study. The results could provide insight into the effects of additional therapeutic activities, as reflected in increased therapy time, on cognition and functional outcome of severely disabled older stroke patients on rehabilitation units of nursing homes. The intervention group received additional therapy based on the evidence-based Clinical Nursing Rehabilitation Stroke Guideline. The control group received care as usual. The question arises as to whether the initially referred intervention, in terms of intensity, content and duration, really took place.

In Chapter 7 the conclusions of the studies are reviewed in a general discussion. The general discussion includes a critical reflection on the studies incorporated in this thesis, including the methodology and the quality of the intervention as applied in the single blind controlled study. Finally, suggestions for future studies will be made.

Thesis outline

Chapter 1 examines some of the literature and studies already conducted in this field in the general introduction.

In Chapter 2 the following question is addressed: “How do stroke patients on a rehabilitation nursing home spend the day”? Up till now, how older stroke patients spent their time in rehabilitation units of nursing homes in the Netherlands was unknown. In this chapter we describe the time use and the interaction between stroke patients and others.

Chapter 3 describes a study that shows that it is possible to increase the total therapy time of elderly stroke patients, by implementing the evidence-based Clinical Nursing Rehabilitation Stroke Guideline.

Through explicit involvement in the rehabilitation process, nurses can contribute more to patients’ cognitive and functional recovery. Nurses can carry out extra exercises related to task-oriented activities on the ward. When nurses stimulate patients, they may train a bit harder and more often, depending on their cognitive and functional possibilities.

Chapter 4 examines the relationship between cognition and functional outcome at baseline when patients were admitted to the stroke unit of the nursing home. This chapter presents an analysis of a stepwise linear regression showing that executive functioning and memory are significantly associated with functional outcome in older comorbid stroke patients.

Chapter 5 describes the protocol of a comparative single blind controlled study aimed at assessing possible effects of increased therapy time on functional and cognitive functions and mood in frail comorbid elderly stroke patients with stroke who rehabilitate on a stroke unit in Dutch nursing homes. Older comorbid patients suffering from stroke were eligible for participation in this study.
**Chapter 6** presents the results of the single blind controlled study. The results could provide insight into the effects of additional therapeutic activities, as reflected in increased therapy time, on cognition and functional outcome of severely disabled older stroke patients on rehabilitation units of nursing homes. The intervention group received additional therapy based on the evidence-based Clinical Nursing Rehabilitation Stroke Guideline. The control group received care as usual. The question arises as to whether the initially referred intervention, in terms of intensity, content and duration, really took place.

In **Chapter 7** the conclusions of the studies are reviewed in a general discussion. The general discussion includes a critical reflection on the studies incorporated in this thesis, including the methodology and the quality of the intervention as applied in the single blind controlled study. Finally, suggestions for future studies will be made.
Montreal cognitive assessment (MoCA) is superior to the mini-mental state.  


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Chapter 2

Filling up the hours: How do stroke patients in a rehabilitation nursing home spend the day?

Huijben-Schoenmakers M, Gamel C and Hafsteindottir TB.

Abstract

Objective: To describe the time use of stroke patients on rehabilitation units of a nursing home focusing on the time spent on therapeutic activities, non-therapeutic activities, interactions and the location wherein these took place.

Design: A descriptive study.

Setting: Rehabilitation units of a nursing home.

Subjects: Seventeen chronic stroke patients, including 9 men, 8 women, with a mean age of 77 years (SD 7.6 years).

Main measures: Daily activities of patients were measured using Behavioural Mapping, including therapeutic activities, non-therapeutic activities, interactions and their location. Functional status was measured with the Barthel Index.

Results: Of the patients 15 (88%) were partly/fully paralysed, with a mean Barthel Index score of 9.4 (SD 4.3). The patients spent 20% of the day on therapeutic activities, whereas 80% of the day was spent on non-therapeutic activities; 9% on therapeutic activities with the nurse. For 60% of the day patients were alone and not interacting with others.

Conclusions: Stroke patients spend only short periods of time during the day on therapeutic activities. For the largest part of the day, the patient is alone and passive. A challenge for nurses is how to activate patients and engage them in purposeful task-oriented training in daily activities.
**Introduction**

Studies have shown that task-oriented training in daily activities is the best way to rehabilitate patients after stroke (van Peppen et al., 2004) and that patients exhibit substantial functional improvement even over one year post stroke (Dobkin, 2004; Page et al., 2004), which indicates that long-term rehabilitation in nursing homes is important to patient outcomes. Based on this, elderly stroke patients in the Netherlands are increasingly being discharged from the hospital and admitted to rehabilitation units in nursing homes, where the pace of rehabilitation is more suitable to their needs (Giesen et al., 2004). A tailored approach to rehabilitation focusing on the needs of each patient is a part of the general approach to coordinated and multidisciplinary programmes to provide effective care to stroke patients (Exel et al., 2005). This trend is growing in order to better accommodate the needs of patients of different ages; to provide patients with continued functional long-term recovery; to combat the growing costs of long-term care (Giesen et al., 2004) and to provide patients with coordinated service along the continuum from the subacute phase through the rehabilitation and chronic phases of stroke (Giesen et al., 2004; Gaugler et al., 2007). Despite the fact that rehabilitation of stroke patients demands that much of their day is devoted to task-oriented training, studies on time use of patients after stroke (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1996; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005) have shown that patients in hospitals and rehabilitation centres only spend between 13% (Bernardt et al., 2004; Tinson, 1989) and 45% (de Weerdt et al., 2000) of the day on therapeutic activities. Little information exists about the time use of stroke patients in the nursing home. Information concerning the activity of patients in the chronic phase of stroke may be used to develop an evidence-based mobilization programme focusing on activating and training patients in everyday activities. Therefore, the aim of this study was to investigate the time use of patients in the chronic phase after stroke in rehabilitation units in a nursing home.
Methods

This descriptive study was conducted in two rehabilitation units in a nursing home in the Netherlands. The study was approved by the local ethics committee of the nursing home.

Patients with a diagnosis of stroke (WHO, 1989) and staying in one of the rehabilitation units were eligible for participation. Patients were excluded from participation if they were too ill to participate.

The following demographic, illness-related and organizational data were collected from the patients’ medical records: age, sex, length of stay on the rehabilitation unit, health history, including diagnosis, arm and leg strength. The functional status was measured with the Barthel Index (Wolfe et al., 1991). (Table 1)

Time use was measured by Behavioural Mapping, (de Weerdt et al., 2000). The Behavioral Mapping technique, which is a standardized and frequently used method for quantifying the amount and nature of patients’ activity, the location (e.g. living room) in which the activities took place, and which other people were present during those activities (e.g. fellow patients, nurses) (Keith et al., 1987; de Wit et al., 2005). The method has exhibited good validity and good interobserver reliability (Bernardt et al., 2004).

Observation of patients took place at 10-minute intervals on weekdays (8:30–17:10), over 17 days. At each time point the observer recorded patient activity, the person attending to the patient and the patient’s location. The assumption was made that the three observation domains remained unchanged between two consecutive observations (Lincoln et al., 1989; de Weerdt et al., 2000; de Wit et al., 2005) (Table 2).
Table 1 Baseline characteristics of the included patients

<table>
<thead>
<tr>
<th>Sociodemographic characteristics</th>
<th>Patients (N=17) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years) (±SD)</td>
<td>77 (±7.6)</td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>9 (53%)</td>
</tr>
<tr>
<td>Women</td>
<td>8 (47%)</td>
</tr>
<tr>
<td>Living situation in nursing home:</td>
<td></td>
</tr>
<tr>
<td>Private room</td>
<td>7 (41%)</td>
</tr>
<tr>
<td>Shared room</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>Living situation at home:</td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>7 (41%)</td>
</tr>
<tr>
<td>Living together</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>Children</td>
<td>13 (76%)</td>
</tr>
<tr>
<td>Illness related variables</td>
<td></td>
</tr>
<tr>
<td>Stroke type:</td>
<td></td>
</tr>
<tr>
<td>Infarct</td>
<td>14 (82%)</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>History of Stroke:</td>
<td>6 (35%)</td>
</tr>
<tr>
<td>Co-Morbidity:</td>
<td></td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Several chronic diseases</td>
<td>12 (70%)</td>
</tr>
<tr>
<td>Strength arm:</td>
<td></td>
</tr>
<tr>
<td>Paralysed</td>
<td>5 (29%)</td>
</tr>
<tr>
<td>Partly paralysed</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>No paralysis</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Strength leg:</td>
<td></td>
</tr>
<tr>
<td>Paralysed</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Partly paralysed</td>
<td>13 (76%)</td>
</tr>
<tr>
<td>No paralysis</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Language problem aphasia:</td>
<td>6 (35%)</td>
</tr>
<tr>
<td>Functional status (Barthel Index)</td>
<td></td>
</tr>
<tr>
<td>Mean BI score, range 0-20 (±SD)</td>
<td>9.4 (±4.3)</td>
</tr>
<tr>
<td>Organisational variables</td>
<td></td>
</tr>
<tr>
<td>Time in nursing home:</td>
<td></td>
</tr>
<tr>
<td>0-4 weeks</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>5-8 weeks</td>
<td>6 (35%)</td>
</tr>
<tr>
<td>9-12 weeks</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>13-16 weeks</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>17 weeks or more</td>
<td>8 (47%)</td>
</tr>
<tr>
<td>Total number of rehabilitation beds for each unit:*</td>
<td>17 (100%)</td>
</tr>
<tr>
<td>Total number of the nursing staff each unit:*</td>
<td>25 (100%)</td>
</tr>
<tr>
<td>Number of nurses each rehabilitation unit:*</td>
<td></td>
</tr>
<tr>
<td>Registered nurses</td>
<td>9</td>
</tr>
<tr>
<td>Practical nurses</td>
<td>13</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>3</td>
</tr>
</tbody>
</table>

*Total number of rehabilitation beds, the total number of nursing staff and the number of nurses was the same on each rehabilitation unit of the nursing home.
Data analysis

Descriptive analysis (i.e. means, medians and percentages) were calculated using SPSS version 14 (SPSS Inc., Chicago, IL, USA).

Results

Of the 21 eligible patients, two patients died and two patients were transferred to another unit or to a hospital, which left 17 patients participating in the study, with a mean age of 77 years (SD ±7.6).  Fifteen patients were partly/fully paralysed and the mean Barthel Index score was 9.4 (SD ±4.3). Eight patients had spent 17 weeks in the nursing home (Table 1).

The mean time spent on therapeutic activities was 20%. Nine percent of the time was spent on nursing care, 4% on physiotherapy, 3% on speech language therapy and 0.1% on medical care. Non-therapeutic activities accounted for 80% of the daytime; 28% of the non-therapeutic time was spent on sitting. For 59% of the day patients were observed not having any interaction with others (Table 2).

Discussion

The findings of this study showed that patients on rehabilitation wards in a nursing home were involved in therapeutic activities only for a small part of the day and for the largest part of the day they spent their time on doing nothing, waiting and without any contact with others. So far the knowledge about time use and physical activity of stroke patients came from rehabilitation centers or hospitals with a much younger and less affected stroke population. The present study population focused on a different group of stroke patients than earlier studies (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1996; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005).

Table 2 Time spent on therapeutic and non-therapeutic activities, location and interaction with others during the day

<table>
<thead>
<tr>
<th>Activities</th>
<th>Mean time in minutes (% of day)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total time therapeutic activities under professional supervision</strong></td>
<td>103.5 (SD±45.7) (20%)</td>
</tr>
<tr>
<td><strong>Mean (SD) (% of day)</strong></td>
<td></td>
</tr>
<tr>
<td>Therapeutic activities:</td>
<td></td>
</tr>
<tr>
<td>Nursing care</td>
<td>46.5 (9%)</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>18.8 (4%)</td>
</tr>
<tr>
<td>Other therapeutic activity</td>
<td>14.7 (3%)</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>13.5 (3%)</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>8.2 (2%)</td>
</tr>
<tr>
<td>Autonomous exercising</td>
<td>1.2 (0.2%)</td>
</tr>
<tr>
<td>Medical care</td>
<td>0.6 (0.1%)</td>
</tr>
<tr>
<td>Neuropsychological training</td>
<td>0.0 (0%)</td>
</tr>
<tr>
<td>Sports activities</td>
<td>0.0 (0%)</td>
</tr>
<tr>
<td><strong>Total time non-therapeutic activities no professional supervision</strong></td>
<td>416.5 (SD±45.7) (80%)</td>
</tr>
<tr>
<td><strong>Mean (SD) (% of day)</strong></td>
<td></td>
</tr>
<tr>
<td>Non-therapeutic activities:</td>
<td></td>
</tr>
<tr>
<td>Sitting</td>
<td>144.1 (28%)</td>
</tr>
<tr>
<td>Eating</td>
<td>39.4 (8%)</td>
</tr>
<tr>
<td>Transport</td>
<td>52.4 (10%)</td>
</tr>
<tr>
<td>Lying and/or sleeping</td>
<td>41.2 (8%)</td>
</tr>
<tr>
<td>Communication</td>
<td>77.1 (15%)</td>
</tr>
<tr>
<td>Dressing and hygiene</td>
<td>11.8 (2%)</td>
</tr>
<tr>
<td>Active leisure</td>
<td>18.8 (4%)</td>
</tr>
<tr>
<td>Passive leisure</td>
<td>19.4 (4%)</td>
</tr>
<tr>
<td>Other activities</td>
<td>12.4 (2%)</td>
</tr>
<tr>
<td><strong>Total time interaction with others</strong></td>
<td>213.5 (SD±90.4) (41%)</td>
</tr>
<tr>
<td><strong>Mean (SD) (% of day)</strong></td>
<td></td>
</tr>
<tr>
<td>Doctors</td>
<td>2.9 (0.6%)</td>
</tr>
<tr>
<td>Therapists</td>
<td>42.4 (8%)</td>
</tr>
<tr>
<td>Nurses</td>
<td>49.4 (10%)</td>
</tr>
<tr>
<td>Other patients</td>
<td>44.1 (9%)</td>
</tr>
<tr>
<td>Visitors</td>
<td>57.1 (11%)</td>
</tr>
<tr>
<td>Other persons</td>
<td>17.1 (3%)</td>
</tr>
<tr>
<td>Total time alone</td>
<td>306.5 (SD±90.4) (59%)</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>97.1 (19%)</td>
</tr>
<tr>
<td>Patients room</td>
<td>27.7 (5%)</td>
</tr>
<tr>
<td>Therapy room</td>
<td>53.5 (10%)</td>
</tr>
<tr>
<td>Corridor</td>
<td>181.8 (35%)</td>
</tr>
<tr>
<td>Living room</td>
<td>9.4 (2%)</td>
</tr>
<tr>
<td>Toilet/bathroom</td>
<td>101.8 (20%)</td>
</tr>
<tr>
<td>Restaurant</td>
<td>14.1 (3%)</td>
</tr>
<tr>
<td>Outside</td>
<td>Other location</td>
</tr>
</tbody>
</table>

*8.30 am - 5.10 pm*
Data analysis

Descriptive analysis (i.e. means, medians and percentages) were calculated using SPSS version 14 (SPSS Inc., Chicago, IL, USA).

Results

Of the 21 eligible patients, two patients died and two patients were transferred to another unit or to a hospital, which left 17 patients participating in the study, with a mean age of 77 years (SD ±7.6). Fifteen patients were partly/fully paralysed and the mean Barthel Index score was 9.4 (SD ±4.3). Eight patients had spent 17 weeks in the nursing home (Table 1).

The mean time spent on therapeutic activities was 20%. Nine percent of the time was spent on nursing care, 4% on physiotherapy, 3% on speech language therapy and 0.1% on medical care. Non-therapeutic activities accounted for 80% of the daytime; 28% of the non-therapeutic time was spent on sitting. For 59% of the day patients were observed not having any interaction with others (Table 2).

Discussion

The findings of this study showed that patients on rehabilitation wards in a nursing home were involved in therapeutic activities only for a small part of the day and for the largest part of the day they spent their time on doing nothing, waiting and without any contact with others. So far the knowledge about time use and physical activity of stroke patients came from rehabilitation centers or hospitals with a much younger and less affected stroke population. The present study population focused on a different group of stroke patients than earlier studies (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1996; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005). Our
European countries (de Wit et al., 2005). The lower therapy time found in our study may partly be explained by the fact that the study concerned more chronic patients; most patients had also been staying for over three months in the nursing home, were older and more fragile than the patients in the other studies. Similar to findings of other studies, (Bernardt et al., 2004; de Weerdt et al., 2000; de Wit et al., 2005) the patients spent most of the day on non-therapeutic activities, such as sitting, doing nothing and not interacting with others for almost 60% of the time.

The findings of the study need to be considered in relation to strengths and limitations. This data was collected in a very small sample size (17 patients). On the other hand the resulting therapy time was the average of seventeen days observation from 8.30 am to 5.10 pm. Patient or staff behaviour may have been altered by the observer's presence and one would expect activity to increase in response to observation. If this was the case, activity levels may be overestimated. Also, the fact that patients were observed only during weekdays may have resulted in information bias. Previous investigations have inferred that behaviour does not change between consecutive observations, (Lincoln et al., 1989; de Wit et al., 2005) yet in this study changes were seen on few occasions which requires further reconsideration. On the other hand, subjectivity was minimized because there was only one observer who used a structured and a reliable coding system and was not intrusive to the patient. Although generalization was not the purpose of this study, replicating the design and method used in other international studies facilitates comparison of findings.

The findings give rise to the question whether stroke patients in nursing homes receive less therapy because they are in the chronic phase of recovery. In general the time spent on rehabilitation is pragmatic, not based on evidence or the time necessary to learn a given skill (Kwakkel, 2006). Studies have shown that recovery of function after stroke continues over one year post stroke due to participation in task-oriented rehabilitation (Dobkin, 2006). Patients were on average 10 years older, had more comorbidities and more physical disabilities than patients in earlier studies. Although these findings were based on a very small sample size (17 patients), it was the first data collected in a nursing home where older frail stroke patients rehabilitate at stroke units which were specially designed to meet the adequate intensity and volume. On the other hand the observed therapy time was the average time coming from seventeen days of observations of time spent by frail older stroke patients. If these data are replicated in a larger study, it may mean that in traditional nursing homes the therapy time could even be less than that found in the present study.

Because of the different settings and populations it makes it somewhat difficult to compare with previous studies but the data and authors’ conclusion do show similarities. In these studies (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1996; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005) data were also collected only at weekdays and in rather small sample sizes. Patients in our study spend 80% of their time on non-therapeutic activities and 60% solitary, roughly the same as in other studies measured in different rehabilitation settings (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1996; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005). Rehabilitation units in Switzerland seems the exception with 3 to 4 hours therapy a day (de Weerdt et al., 2000). The conclusion of the authors (de Weerdt et al., 2000) was that this could not only be explained by more favorable patient-staff ratios in the Swiss setting. Autonomous practice, group therapy sessions and family involvement have to also be considered.

In the present study, only 9% of each day was spent on physiotherapy, speech therapy and occupational therapy together, which is less than that reported in earlier studies (Bernardt et al., 2004; de Weerdt et al., 2000). Also, the patients received physiotherapy for only 4% each day which is much less than the reported 40% found in a study conducted in
European countries (de Wit et al., 2005). The lower therapy time found in our study may partly be explained by the fact that the study concerned more chronic patients; most patients had also been staying for over three months in the nursing home, were older and more fragile than the patients in the other studies. Similar to findings of other studies, (Bernardt et al., 2004; de Weerdt et al., 2000; de Wit et al., 2005) the patients spent most of the day on non-therapeutic activities, such as sitting, doing nothing and not interacting with others for almost 60% of the time.

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patients with rehabilitation in the chronic phase, there is indeed an increasing shortage of staff in Dutch nursing homes.

An important question is how therapy time in daily activities for patients with stroke in nursing homes may be increased. It is important that health care professionals in nursing homes come up with more intensive training programmes provided by a multidisciplinary group of professionals and tailored to each patient’s needs. Traditionally, therapists have given patients rehabilitation within special training facilities and within a fixed time schedule. Task-oriented training is increasingly becoming important, emphasizing training of patients within the daily context of the nursing ward. Multidisciplinary teams need to provide patients with rehabilitation through intensive collaboration between therapists, nurses and others, as multidisciplinary teams with good collaboration showed better patient outcomes (Strasser et al., 2005). In this way training may be given both in special training facilities by therapists and in the form of additional therapy in activities of daily living provided by nurses on the ward. This needs more intensive collaboration between the professional disciplines involved than is currently realized.

In our recent systematic review a wide range of effective task-oriented interventions are described. These are generally given by physiotherapists, but are highly relevant for the daily nursing context and should be provided within the wards (Rensink et al., 2009). They include exercises in balance, sit-to-stand, reaching, walking, bicycling, constraint-induced movement therapy. Effects were found on walking speed, (Dean et al., 2000; Salbach et al., 2004) general condition, muscle strength, (Dean et al., 2000) balance, self-efficacy, (Salbach et al., 2004) arm function (Blennerhassett et al., 2004) and functional performance, reaching and grasping (Lin et al., 2007). Many of these task-oriented interventions need to be integrated into activities of daily living (Rensink et al., 2009) by the various professionals, including physiotherapists, nurses, occupational therapists and others, who need to have closer collaboration in providing
patients with continuous and well-coordinated rehabilitation to benefit patient outcomes (Strasser et al., 2005).

Involving partners in care and training has been found to result in less depression, improved quality of life (Maeshima et al., 2003) and better functional status (Kalra et al., 2004). In our study, families were not involved in the patients’ care. Involving the partner in the care is an opportunity to teach the partner how to assist the patient with, for example, standing up and walking, under professional supervision, which may also be good preparation for the patient’s discharge.

The challenge is how to enable health care professionals to integrate the results of scientific research into the daily rehabilitation of stroke patients when faced with staff shortages. Clinical practice guidelines, such as the recently published evidence-based Clinical Nursing Rehabilitation Stroke Guideline, (Hafsteindottir et al., 2009) which includes recommendations focusing on the daily rehabilitation, care and treatment of stroke patients in line with other multidisciplinary guidelines, provide an ideal means for evidence-based practice. Guidelines like these, however, need to be implemented into the daily care of stroke patients on rehabilitation units in nursing homes. Providing health care professionals with education and training in using new knowledge in an effective and efficient way is highly important.

In conclusion, the findings can be expected to help in developing an evidence-based mobilization programme focusing on activating and training patients in everyday activities and resulting in more therapeutic time provided to patients with stroke. Closer collaboration between health care professionals is needed to provide patients with more therapeutic activities integrated into activities of daily living. Facilitation and financial support from nursing home management and leadership from government organizations are important in enabling health care professionals to provide this level of rehabilitation.
for patients in the chronic phase of stroke.

**Clinical messages**

- Patients with stroke in a nursing home spend little time on therapeutic activities and for the most of the day they sit passively waiting, without any interaction with others.
- Health care professionals in close collaboration need to provide patients with stroke in nursing homes with more task-oriented training integrated into the daily care.

**Acknowledgements**

We thank the patients who participated in the study, partners, family members, the nurses, head nurses, other professionals and the management of the rehabilitation wards of the participating Nursing Home in the Netherlands who assisted with and facilitated the study.
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Chapter 3

‘Can practice undertaken by patients be increased simply through implementing agreed national guidelines?’ An observational study.

Huijben-Schoenmakers HCM, Rademaker A, Scherder EJA

Abstract

Objective: To increase autonomous practice time of patients on the stroke unit of a nursing home.

Intervention: Nurses stimulated and coached patients with the help of four interventions (muscle strengthening, sitting balance and reach, getting up from a chair, walking) from the evidence-based Clinical Nursing Rehabilitation Stroke Guideline.

Design: An observational study. Practice time of elderly stroke patients in this study was compared with the time observed in our previous study in the same setting.

Setting: Rehabilitation units of a nursing home in the Netherlands.

Subjects: Seventeen frail stroke patients, including 8 men, 9 women, with a mean age of 75.8 (SD ± 9) and 17 subjects with the same characteristics who participated in a previous observational study.

Main measures: Time spent on therapeutic activities was measured using the Behavioral Mapping method.

Results: The time spent on therapeutic activities increased significantly from 103.5 minutes measured in our previous study to 156.5 minutes in this study ($Z = 2.86; P < 0.005; d' = 1.09$). The mean Barthel Index score was 8.8 (SD ± 4.1). The patients with more possibilities were more active, resulting in a significant positive Barthel Index–therapy time relationship ($r = 0.73, P \leq 0.001$).
Conclusions: The autonomous practice time of older fragile comorbid stroke patients increased during the weekdays. Patients, stimulated and challenged by nurses, exercise harder and more according to their possibilities. Since this guideline was developed especially for nurses, nurses can stimulate stroke patients to contribute more to autonomous practice and therefore help their recovery.

Keywords: Stroke, rehabilitation, Clinical Nursing Rehabilitation Stroke Guideline, autonomous practice, nursing care
Introduction

In the Netherlands frail, older and comorbid stroke patients rehabilitate on special stroke units in nursing homes. In our previous study on the rehabilitation unit of a nursing home, we found that older comorbid stroke patients only spent 20% of the day on therapeutic activities, as measured by the Behavioural Mapping Instrument (Huijben-Schoenmakers et al., 2009). Thus, non-therapeutic activities accounted for the remaining 80% of the daytime (Huijben-Schoenmakers et al., 2009). It is also known from other studies that in hospitals and rehabilitation units little time per day is spent on therapeutic activities (between 13% and 45% of the day) (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989). Therapeutic activities were activities where professionals were involved in and/or where patients exercised autonomously for rehabilitation purposes (Bernardt et al., 2004; Huijben-Schoenmakers et al., 2009; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989). Non-therapeutic activities were those related to activities other than rehabilitation (e.g. just sitting or gazing) (Bernardt et al., 2004; Huijben-Schoenmakers et al., 2009; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989). Although these findings were based on a small sample size (17 patients), it was the first data collected in a nursing home where older frail stroke patients rehabilitate at stroke units which were specially designed to meet the adequate intensity and volume. On the other hand the observed therapy time was the average time coming from seventeen days of observations of time spend by frail older stroke patients. Although measured in different settings, other studies showed comparable results concerning activities and solitariness of stroke patients (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005). If these data are correct, these findings are alarming as studies have shown that recovery of function after stroke is highly dependent on therapy time and variety and even
continues over one year post stroke with participation in task-oriented rehabilitation (Dobkin, 2004; Kwakkel et al., 2004; Page et al., 2004; van Peppen et al., 2004).

The extent of rehabilitation needed is still a key issue to be solved in rehabilitation medicine. A meta-analysis has shown that for major recovery at least 16 hours or more of high-quality therapy per week is needed (Kwakkel, 2009). Rehabilitation of older stroke patients therefore demands that a large amount of activity during the day should be devoted to task-oriented training within the daily context (Dobkin, 2004; Kwakkel et al., 2004; van Peppen et al., 2004). Multidisciplinary teams can do this by showing better patient outcomes on functional improvement and length of rehabilitation stay (Strasser et al., 2005). To achieve a level of independent living, a tailored approach to rehabilitation focusing on the needs of each individual patient is needed (Exel et al., 2005). Traditionally, therapists rehabilitate these patients within special training facilities and within a fixed time schedule but for a limited time each day (de Weerdt et al., 2000; de Wit et al., 2005).

Since total therapy time is related to rehabilitation outcome, (Kwakkel, 2009) an important question is how an increase in (autonomous) rehabilitation time for frail older patients with stroke can be realized without extra time input from therapists. One possibility is that nurses in nursing homes could play a more dominant role in the training programmes by implementing the patient’s individual therapeutic goals into the daily nursing care of the patient.

These individual therapeutic goals are formulated by physiotherapists and occupational therapists. The recently published evidence-based Clinical Nursing Rehabilitation Stroke Guideline, (Hafsteindottir et al., 2009) which include recommendations focusing on the daily rehabilitation, care and treatment of stroke patients for nurses, provide an ideal means for evidence-based practice. Physiotherapists and occupational therapists together with nurses translate individual therapeutic goals into exercises. One can expect that patients, supported, stimulated and challenged by nurses, will exercise harder and more according to their
possibilities. From our previous study (Huijben-Schoenmakers et al., 2009) we know that patients with higher Barthel Indexes did not spend more time on therapeutic activities. It can be asked whether the altered nurse role may stimulate patients more to use their possibilities, resulting in a high Barthel Index—therapy time ratio.

Based on the above-mentioned studies, we hypothesize that rehabilitation time of frail older stroke patients in nursing homes can be increased when introducing interventions from the Clinical Nursing Rehabilitation Stroke Guideline. The explicit involvement of nurses in the rehabilitation process may lead to a greater contribution from the patient to their own rehabilitation.

**Methods**

The study took place in a Dutch nursing home on two stroke units, where older frail stroke patients rehabilitated after discharge from the hospital.

**Subjects**

Patients with a diagnosis of stroke and staying in one of the rehabilitation units of the nursing home were eligible for participation. Patients were excluded by the nursing home physician if they were due to leave the rehabilitation unit within a short period of time (e.g. one week) or were too ill to participate. Nineteen patients with stroke who were staying on the ward at that time were asked to participate in the study. The researcher used a convenience sample because these selected patients were readily available and the research was conducted only in this nursing home.

The following sociodemographic, illness-related and organizational data were collected from the patients’ medical records: age, sex, stroke type, health history and length of stay at the rehabilitation unit as well as functional status, measured with the Barthel Index (Mahoney et
al., 1965). The same characteristics were collected in our previous research (Huijben-Schoenmakers et al., 2009). (see Table 1).
The local medical ethical committee gave approval for the intervention. All 17 patients gave their informed consent based on veracity, anonymity, privacy, confidentiality and fidelity.

The Barthel Index was used because of its high level of reliability and validity with patients with stroke (Collin et al., 1988; Mahoney et al., 1965). Furthermore, the Barthel Index has been executed in several international studies about Behavioural Mapping in patients with stroke (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989).

The Barthel Index was performed by fully instructed nurses once within a range of two weeks around the observation.

Rehabilitation time was measured by Behavioral Mapping (Huijben-Schoenmakers et al., 2009; de Weerdt et al., 2000; de Wit et al., 2005). This instrument scores time spent on therapeutic activities and non-therapeutic activities. Behavioral Mapping is a time-sampling technique that provides registration of systematic and accurate observations of the patient's daily activities. The inter-rater reliability of therapeutic and non-therapeutic activities is high (k = 0.967) (de Weerdt et al., 2000; de Wit et al., 2005). The observation of patients took place at 10-minute interval on a weekday, from 8.30 am till 5.10 pm. At each time point the observers recorded patient's activity. The observers were not intrusive to the patient. A special reliable coding schedule developed by De Weerdt and De Witt was used (de Weerdt et al., 2000; de Wit et al., 2005). The assumption was made that the observation remained unchanged between two consecutive observations (de Weerdt et al., 2000; de Wit et al., 2005).

### Table 1 Baseline characteristics of the patients

<table>
<thead>
<tr>
<th></th>
<th>Current study**</th>
<th>Previous study**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N= 17 )%</td>
<td>(N= 17)%</td>
</tr>
<tr>
<td><strong>Sociodemographic characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age (years)(±SD)</td>
<td>75.8 ± 9.0</td>
<td>77 ± 7.6</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>8 (47%)</td>
<td>9 (53%)</td>
</tr>
<tr>
<td>Women</td>
<td>9 (53%)</td>
<td>8 (47%)</td>
</tr>
<tr>
<td>Living situation in nursing home</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private room</td>
<td>11 (64%)</td>
<td>7 (41%)</td>
</tr>
<tr>
<td>Shared room</td>
<td>6 (35%)</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>Living situation at home</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>5 (29%)</td>
<td>7 (41%)</td>
</tr>
<tr>
<td>Living together</td>
<td>12 (70%)</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>Children</td>
<td>14 (81.2%)</td>
<td>13 (76%)</td>
</tr>
<tr>
<td><strong>Illness-related variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infarction</td>
<td>10 (59%)</td>
<td>14 (82%)</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>7 (41%)</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>History of stroke</td>
<td>1 (6%)</td>
<td>6 (35%)</td>
</tr>
<tr>
<td>Comorbidity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Several chronic diseases</td>
<td>13 (76%)</td>
<td>14 (81.2%)</td>
</tr>
<tr>
<td>No comorbidity</td>
<td>4 (23%)</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>Strength arm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paralysed</td>
<td>6 (35%)</td>
<td>5 (29%)</td>
</tr>
<tr>
<td>Partly paralysed</td>
<td>9 (53%)</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>No paralysis</td>
<td>2 (12%)</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Strength leg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paralysed</td>
<td>5 (29%)</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Partly paralysed</td>
<td>9 (53%)</td>
<td>13 (76%)</td>
</tr>
<tr>
<td>No paralysis</td>
<td>3 (18%)</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Cognitive problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>11 (64%)</td>
<td>16 (94%)</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3 (18%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>No problems</td>
<td>3 (18%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td><strong>Functional status</strong> (Barthel Index)(mean)(SD)</td>
<td>8.8 (±4.1)</td>
<td>9.4 (±4.3)</td>
</tr>
<tr>
<td><strong>Organizational variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time in nursing home</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4 weeks</td>
<td>11 (64%)</td>
<td>4 (23%)</td>
</tr>
<tr>
<td>5-8 weeks</td>
<td>3 (18%)</td>
<td>4 (23%)</td>
</tr>
<tr>
<td>9-12 weeks</td>
<td>1 (6%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>13-16 weeks</td>
<td>1 (6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>17 weeks or more</td>
<td>1 (6%)</td>
<td>8 (47%)</td>
</tr>
<tr>
<td>Total number of rehabilitation beds</td>
<td>17 (100%)</td>
<td>17 (100%)</td>
</tr>
<tr>
<td>for each unit¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of the nursing staff</td>
<td>25 (100%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td>each unit¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of nurses each rehabilitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of nurses each rehabilitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered nurses</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Practical nurses</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

¹ Total number of rehabilitation beds, the total number of nursing staff and the number of nurses was the same on each rehabilitation unit of the nursing home.  
** P ≤ 0.424
Medical ethical committee

The local medical ethical committee gave approval for the intervention. All 17 patients gave their informed consent based on veracity, anonymity, privacy, confidentiality and fidelity.

Functional status

The Barthel Index was used because of its high level of reliability and validity with patients with stroke (Collin et al., 1988; Mahoney et al., 1965). Furthermore, the Barthel Index has been executed in several international studies about Behavioural Mapping in patients with stroke (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989). The Barthel Index was performed by fully instructed nurses once within a range of two weeks around the observation.

Behavioral Mapping

Rehabilitation time was measured by Behavioral Mapping (Huijben-Schoenmakers et al., 2009; de Weerdt et al., 2000; de Wit et al., 2005). This instrument scores time spent on therapeutic activities and non-therapeutic activities. Behavioral Mapping is a time-sampling technique that provides registration of systematic and accurate observations of the patient’s daily activities. The inter-rater reliability of therapeutic and non-therapeutic activities is high (k = 0.967) (de Weerdt et al., 2000; de Wit et al., 2005). The observation of patients took place at 10-minute interval on a weekday, from 8.30 am till 5.10 pm. At each time point the observers recorded patient’s activity. The observers were not intrusive to the patient. A special reliable coding schedule developed by De Weerdt and De Witt was used (de Weerdt et al., 2000; de Wit et al., 2005). The assumption was made that the observation remained unchanged between two consecutive observations (de Weerdt et al., 2000; de Wit et al., 2005). The time spent on

Table 1
Baseline characteristics of the patients

<table>
<thead>
<tr>
<th>Current study</th>
<th>Previous study</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N= 17)</td>
<td>(N= 17)</td>
</tr>
<tr>
<td><strong>Mean age (years)(±SD)</strong></td>
<td>75.8 ± 9.0</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>8 (47%)</td>
</tr>
<tr>
<td>Women</td>
<td>9 (53%)</td>
</tr>
<tr>
<td><strong>Living situation in nursing home</strong></td>
<td></td>
</tr>
<tr>
<td>Private room</td>
<td>11 (64%)</td>
</tr>
<tr>
<td>Shared room</td>
<td>6 (35%)</td>
</tr>
<tr>
<td><strong>Living situation at home</strong></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>5 (29%)</td>
</tr>
<tr>
<td>Living together</td>
<td>12 (70%)</td>
</tr>
<tr>
<td><strong>Children</strong></td>
<td>14 (81.2%)</td>
</tr>
<tr>
<td><strong>Illness</strong></td>
<td></td>
</tr>
<tr>
<td>Stroke type</td>
<td></td>
</tr>
<tr>
<td>Infarction</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>7 (41%)</td>
</tr>
<tr>
<td><strong>History of stroke</strong></td>
<td></td>
</tr>
<tr>
<td>1 (6%)</td>
<td>6 (35%)</td>
</tr>
<tr>
<td><strong>Comorbidity</strong></td>
<td></td>
</tr>
<tr>
<td>Several chronic diseases</td>
<td>13 (76%)</td>
</tr>
<tr>
<td>No comorbidity</td>
<td>4 (23%)</td>
</tr>
<tr>
<td><strong>Strength arm</strong></td>
<td></td>
</tr>
<tr>
<td>Paralysed</td>
<td>6 (35%)</td>
</tr>
<tr>
<td>Partly paralysed</td>
<td>9 (53%)</td>
</tr>
<tr>
<td>No paralysis</td>
<td>2 (12%)</td>
</tr>
<tr>
<td><strong>Strength leg</strong></td>
<td></td>
</tr>
<tr>
<td>Paralysed</td>
<td>5 (29%)</td>
</tr>
<tr>
<td>Partly paralysed</td>
<td>9 (53%)</td>
</tr>
<tr>
<td>No paralysis</td>
<td>3 (18%)</td>
</tr>
<tr>
<td><strong>Cognitive problems</strong></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>11 (64%)</td>
</tr>
<tr>
<td>Sometimes</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>No problems</td>
<td>3 (18%)</td>
</tr>
<tr>
<td><strong>Functional status (Barthel Index)</strong></td>
<td></td>
</tr>
<tr>
<td>(mean)(SD)</td>
<td>8.8 (±4.1)</td>
</tr>
<tr>
<td><strong>Organizational variables</strong></td>
<td></td>
</tr>
<tr>
<td>Time in nursing home</td>
<td></td>
</tr>
<tr>
<td>0-4 weeks</td>
<td>11(64%)</td>
</tr>
<tr>
<td>5-8 weeks</td>
<td>3 (18%)</td>
</tr>
<tr>
<td>9-12 weeks</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>13-16 weeks</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>17 weeks or more</td>
<td>1 (6%)</td>
</tr>
<tr>
<td><strong>Total number of rehabilitation beds for each unit¹</strong></td>
<td>17 (100%)</td>
</tr>
<tr>
<td><strong>Total number of the nursing staff each unit¹</strong></td>
<td>25 (100%)</td>
</tr>
<tr>
<td><strong>Number of nurses each rehabilitation unit¹</strong></td>
<td></td>
</tr>
<tr>
<td>Registered nurses</td>
<td>9</td>
</tr>
<tr>
<td>Practical nurses</td>
<td>13</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>3</td>
</tr>
</tbody>
</table>

¹ Total number of rehabilitation beds, the total number of nursing staff and the number of nurses was the same on each rehabilitation unit of the nursing home. ** P ≤ 0.424
therapeutic time was compared with the results of our previous study performed in the same nursing home (Huijben-Schoenmakers et al., 2009).

**Intervention**

Four interventions from the Clinical Nursing Rehabilitation Stroke Guideline, focusing on mobility and daily activities were selected: muscle strengthening; sitting balance and reach; getting up from a chair; walking. These four interventions were selected because of their high level of scientific evidence for effective rehabilitation based on the results of meta-analyses and randomized controlled trials (Cheng et al., 2001; Hafsteindottir et al., 2009; Kirkevold, 1997; Peurala et al., 2005; van Peppen et al., 2004; Winstein et al., 2004) and because of easily incorporation into the nurses’ daily activities. The researcher trained the whole multidisciplinary team extensively in advance during clinical lessons about the interventions and how to implement these into daily care before the implementation started.

Exercises based on the four interventions were adapted to the individual goals, interests and rehabilitation level of the patient by physiotherapists and occupational therapists in consultation with the responsible nurses. The patients were supported and stimulated by nurses so that patients exercised more frequently and also more autonomously. The prescribed exercises were documented in a exercise map that was with the patient all the time, mostly fixed to the wheelchair of the patient. Because of the fixation of the exercise map to the patient’s bed and/or (wheel)chair, healthcare professionals, family members and the patients themselves knew exactly which exercises had to be performed in a certain time interval. In this way both healthcare professionals (others than therapists) and family members could exercise with the patient at any time. The nurse coordinated and facilitated these exercises within the daily activities and care of the patient, and encouraged each patient to follow their exercise regime closely. Each week the exercise map was updated according to the needs of the patient. Nurses
played an important role in this weekly adjustment by informing the multidisciplinary team about the individual progress of the patient. The researcher checked formally and informally the patients for their adherence to the study. She (MHS) made surprise visits several times a week and made appointments with the whole multidisciplinary teams, boards, doctors and patients to interview them and to assess multiple evaluation meetings. The researcher monitored regularly if the four interventions from the Clinical Nursing Rehabilitation Stroke Guideline, stayed part of the daily nursing routine, if the exercise map was renewed every week by paramedics and if patients were encouraged by the nurses to practise. If necessary, extra training and support was given to the nurses.

The clinical relevance of our study is the emphasis on the therapeutic role the nursing staff could play in the rehabilitation of a stroke patient.

Data analysis

Descriptive analysis on all the patient characteristics was performed. A sign test was used to check for comparability of the two groups. The time spent on therapeutic activities was documented in minutes and percentages in Table 2. Total therapy time was compared with the result from our previous study and tested for significance using a Mann–Whitney U-test. Effect size was determined using Cohen’s d, a small effect = 0.00–0.30, a moderate effect = 0.40–0.70 and a large effect ≥ 0.80. A linear regression analysis was used to test the relationship between the Barthel Index and time spent on therapeutic activities, Level of significance was set at α < 0.05. The SPSS-PC version 14 was used for data-analyses (SPSS Inc., Chicago, IL, USA).
Results

In our current research the total therapy time observed was 8840 minutes, similar to our previous research (Huijben-Schoenmakers et al., 2009).

The mean time spent on therapeutic activities increased significantly by 53 minutes from 103.5 in the previous study (Huijben-Schoenmakers et al., 2009) to 156.5 minutes per day in the current study ($Z = 2.86; P < 0.005; d' =1.09$). The contributions of each separate type of therapeutic activity are presented in Table 2.

Table 2 Minutes per patient and percentage of therapeutic time

<table>
<thead>
<tr>
<th>Therapeutic activities</th>
<th>Minutes per patient</th>
<th>% of Therapeutic time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapy</td>
<td>20</td>
<td>12.78</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>22.35</td>
<td>14.28</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>2.94</td>
<td>1.88</td>
</tr>
<tr>
<td>Nursing care</td>
<td>56.47</td>
<td>36.09</td>
</tr>
<tr>
<td>Medical care</td>
<td>11.18</td>
<td>7.15</td>
</tr>
<tr>
<td>Autonomous exercising</td>
<td>25.29</td>
<td>16.16</td>
</tr>
<tr>
<td>Other activities</td>
<td>18.24</td>
<td>11.66</td>
</tr>
<tr>
<td>Total time spent on therapeutic activities</td>
<td>156.47*</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Statistically significant $p<0.005$ (*)

Data analysis further shows that patients with more physical possibilities were more active during the day, resulting in a significant positive Barthel Index–therapy time relationship ($r = 0.73, P \leq 0.001$, Figure 1).
Discussion

The findings of the present study showed that practice time for older stroke patients in nursing homes can be increased by 50% when nurses are given a more therapeutic role during their daily activities. We found a significant increase in therapy time from 103.5 minutes/day in our previous study to 156.5 minutes/day in the current study in the same setting (Huijben-Schoenmakers et al., 2009). The time spent on therapeutic activities accounted for 30% of the day (between 8.30 am and 5.10 pm) which is an increase of 10% when compared with our previous observation (Huijben-Schoenmakers et al., 2009). In healthcare systems, several studies have shown that there is a mismatch between the recommended time for effective rehabilitation and the time spent on rehabilitation (Huijben-Schoenmakers et al., 2009; Kwakkel et al., 2004; Kwakkel, 2009). Although 70% of the day still accounted for time spent
on non-therapeutic activities, in the present study we have reduced the gap between the recommended time and the time spent on rehabilitation. The 10% decrease in time spend on non-therapeutic activities is essential, because a minimal dose of at least 16 hours rehabilitation a week within the first six months after stroke is recommended for functional outcomes such as ADL and gait speed (Kwakkel et al., 2004; Kwakkel, 2009). We managed to increase time spent on therapeutic activities from 8.6 hours a week to at least 13 hours a week by the explicit involvement of nurses in the rehabilitation process. This was achieved by intensifying rehabilitation with extra exercises carried out by nurses related to task-oriented activities from the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009). Therapists are not present in the weekends and no therapy is provided to the patients (de Wit et al., 2005). Not only therapists are absent in the weekend, the nursing staff is also seriously diminished. If there would be a good balance between nursing staff and number of patients we argue that rehabilitation could partly be continued during the weekends with nurses helping and supporting patients with exercise (Teasell et al., 2017; English et al., 2016).

Another striking finding is that half of the gain in therapy time is the consequence of more autonomous training by the patients. Apparently also patients became more aware of their own contribution to the rehabilitation process, resulting in a higher exercise regime on their own. Both the better notion of the rehabilitation process by the nurses and therefore their role in encouraging the patients to exercise as well as the direct presence of the exercise map may have contributed to this improvement. In this light it would have provided more insight if we had continued monitoring during weekends as well. The observed therapy time could have been underestimated by our measuring protocol.

The presentation of the exercise map at individual patient level forced the whole staff to be aware of patient status and progress in terms of achieving individual exercise goals. De Weerdt
et al. (2000) has shown that intensifying the multidisciplinary cooperation is important because there is evidence that patients recover better and earlier after stroke. Nurses informing the paramedical staff on a weekly basis about the individual progress of the patients and the consequent adaptation of the exercise regime may have given an extra stimulus for the patient. Goal setting on individual patient level might improve outcome (Langhorne et al., 2011). This view is supported by the finding that on average patients in our previous study exercised autonomously for just 1 minute a day; in the present study, they exercised for 25 minutes a day. It remains unclear what the role was of the nurses during this autonomous exercising. Because we did not make any observation in the weekends we only can speculate on the amount of autonomous exercise during the weekends. We believe that these older frail patient groups still needs the presence and stimulation of the nurses to perform their individual tailored exercises.

Patients in the present study also showed a positive correlation between the Barthel Index and therapeutic time. Such a positive correlation was absent in the previous study, (Huijben-Schoenmakers et al., 2009) showing perhaps a lack of challenge or underachievement in the patients. With more practice time these older stroke patients achieve higher self-efficacy with better insight into goals and possibilities, which is very important for prolonged improvement even after they have left the nursing home (Kirkevold, 1997). Creating an enriched environment with more task-oriented challenges for stroke patients is important because of the positive effect on strength, balance and relearning of ADL activities (Dobkin, 2004; Kwakkel et al., 2004; Kwakkel, 2009; Page et al., 2004).

Some limitations of the study should be noted. There may have been some change within the nursing home unrelated to the clinical guidelines e.g. patient or staff behaviour may have been altered by the observer’s presence and one would expect activity to increase in response to observation (Huijben-Schoenmakers et al., 2009; de Weerdt et al., 2000; de Wit et al., 2005). If
this was the case, activity levels may have been overestimated. In this current observational comparative study the observer was unknown to the staff. Previous studies have inferred that behaviour does not change between consecutive observations, (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989) although activity could change within 10 minutes. In addition, subjectivity was minimized because there was only one observer per patient who used a structured and a reliable coding system, the Behavioral Mapping (de Weerdt et al., 2000; de Wit et al., 2005). Although the current and previous studies took place in different years, the observation was provided in the same season, namely wintertime. Family was informed about the intervention and was asked to support therapeutic activities of the exercise map. It is unclear if this resulted in a participation in therapy.

The therapeutic role of the nurse is new and has the potential to increase therapy time. It is important to bear in mind that our study focused on a group of frail comorbid stroke patients with a mean Barthel Index score from 8.8 (SD ± 4.1). We have shown in this study that it is possible even for these patients to spend more time on rehabilitation during the subacute and chronic phase of recovery. Facilitation from nursing home management to give nurses such a role in a multidisciplinary team is important to achieve this level of rehabilitation for elderly stroke patients (Huijben-Schoenmakers et al., 2009; Hafsteindottir et al., 2009).

Although generalization was not the first purpose of this study, replicating the design and method used in other international studies facilitates comparison of findings. The question whether this increase in therapy time also means a quicker discharge of the patients or a higher level of functioning at discharge still remains to be answered.

It is important to bear in mind that our study focused on a group of frail comorbid stroke patients with a mean Barthel Index score from 8.8 (SD ± 4.1). We have shown in our study that it is
possible even for these patients to spend more time on rehabilitation during the subacute and chronic phase of recovery.

The clinical relevance of our study is the emphasis on the therapeutic role the nursing staff, in close cooperation with the paramedical staff, could play in the rehabilitation of a stroke patient.

Acknowledgements

We thank the patients who participated in the study, partners, family members, the nurses, head nurses, all other professionals and the management of the rehabilitation wards of the participating Nursing Home in the Netherlands who assisted and facilitated the study. We thank the professorship of Avans University for Applied Sciences Breda and the Innovation and Knowledge Centre, ROC West-Brabant for facilitating the study.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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Chapter 4

Cognition in relation to independency in older, comorbid stroke patients in a stroke unit.

Marleen Huijben-Schoenmakers, Arno Rademaker and Erik Scherder

Chapter 4

Cognition in relation to independency in older, comorbid stroke patients in a stroke unit.

Marleen Huijben-Schoenmakers, Arno Rademaker and Erik Scherder

Abstract

Objective: The aim of our present study was to examine whether cognition is associated with severe loss of daily activities at the very beginning of the rehabilitation process for older stroke patients at stroke units in Dutch nursing homes.

Design: This is a cross-sectional study.

Subjects: The subjects of this study are patients who have suffered a stroke and who rehabilitated in the nursing homes’ rehabilitation units and patients (n = 160) (mean age: 77; SD: 9.5) with a mean Barthel Index of 11.02.

Method: Demographic, illness-related, functional and cognitive data were selected at baseline.

Main Assessment Measures: Functional abilities were tested using the Barthel Index. Cognitive functions were assessed using a wide variety of neuropsychological tests.

Results: Patients faced cognitive impairments especially in executive functioning and memory. Stepwise linear regression analysis shows that executive functioning (p = 0.050) and memory (p = 0.000; confidence interval -1.255, -0.403) are significantly associated with functional outcome.

Conclusion: From a clinical point of view, we suggest combining physical and cognitive training from the very early phase of recovery.

Key words: stroke; rehabilitation; cognition; executive function; memory and functional outcome
Introduction

Stroke rehabilitation for older comorbid patients is a complex process that starts during acute hospitalization, and especially in the Netherlands, continues at rehabilitation units of nursing homes (Aichner et al., 2002; Giesen et al., 2004). This rehabilitation process is still a key issue to be solved, particularly when patients face cognitive impairments and suffer from poor functional outcome (Cumming et al., 2013). The older patients are characterized by an advanced age, comorbidities and often neuropsychiatric symptoms like depression (Buijck et al., 2012; Huijben-Schoenmakers et al., 2009; Huijben-Schoenmakers et al., 2013). Furthermore, directly following a stroke, many patients may suffer from cognitive impairments, for example, executive dysfunctions like planning and attention problems and disturbances in memory (Nys et al., 2005a; Tang et al., 2005). Cognitive impairments are among the most frequent early outcomes after stroke and may complicate rehabilitation (Cumming et al., 2013; Nys et al., 2005b). Cognition plays an essential role in the subacute phase of stroke rehabilitation, especially when the patient starts to regain competences (Stephens et al., 2005; Tang et al., 2005). Cognitive competences like memory, attention and planning are necessary to execute and relearn activities of daily living (Heruti et al., 2002). In stroke rehabilitation, the focus is more often on normalizing movements and physical training and less on integrating cognitive instructions (Tang et al., 2005; Zinn et al., 2004).

Because of impairment in both motor and cognitive functions, patients suffer from loss of activities of daily living early after stroke and decreasing independent functioning (Nys et al., 2005b; Pasquini et al., 2007). Interestingly, cognitive and motor functioning are in-separable parts belonging to the same functional systems of the brain that determine functional outcome (Mulder et al., 2001). Such a close relationship implies that cognitive impairments, especially executive deficits, appear to be excellent predictors of poor functional outcome and increase...
the possibility of developing dementia (Henon et al., 2006; Lesniak et al., 2008; Nys et al., 2005b).

Up till now, only a few studies have investigated whether cognition as a global concept could predict functional outcome in patients with stroke (Ankolekar et al., 2014; Dong et al., 2013). Dong et al. (2013) showed that in patients with more severe stroke, global cognitive screening is a strong predictor for functional outcome at 3 and 6 months post stroke. Ankolekar et al. (2014) suggested that rehabilitation focused on interventions, which reduce dependency, could also reduce cognitive impairment.

Similarly, only a few studies investigated which type of specific cognitive impairment is particularly related to functional outcome in patients with stroke (Barker-Collo et al., 2010; Cederfeldt et al., 2010; Lesniak et al., 2008; Nys et al., 2005b). Barker-Collo et al. (2010) showed that visuo-perceptual/construction abilities, visual memory and information processing speed were independently associated with poorer functional outcome. A study by Nys et al. (2005b) observed that 7.4 months after the first ever stroke, inattention and perceptual disorders predict long-term poor functional recovery, whereas abstract reasoning and executive functioning are predictors for long-term cognitive impairment. In contrast, Lesniak et al. (2008) showed in their study that 1 year after the patients’ first ever stroke, executive disorders are the strongest cognitive predictors of poor functional outcome. In another study, Cederfeldt et al. (2010) showed that stroke patients with cognitive disorders in the domains of visual memory, logical deductive ability, visuospatial perception, executive functions, speed and attention did not show a significant functional improvement from the acute phase until 6 to 12 months, while patients with no cognitive impairments did.

In sum, a limited number of studies have investigated whether cognitive functions could predict or are associated with functional recovery after stroke. Concerning specific cognitive functions, the results are inconsistent. Specific cognitive predictors are either executive functions or
visuospatial/constructive functions, visual memory and information processing speed. These studies generally concerned the impact of many exclusion criteria, loss to follow-up, relatively high reported levels of global cognitive functioning and high levels of functional outcome in mild stroke populations (Ankolekar et al., 2014; Barker-Collo et al., 2010; Cederfeldt et al., 2010; Dong et al., 2013; Lesniak et al., 2008; Nys et al., 2005b).

In contrast with the aforementioned work, our study involved older, comorbid, cognitively-impaired patients with stroke and pre-existing dependency. In our study, we also included stroke patients suffering severe loss of independence and who therefore had poor functional status at the start of the rehabilitation. In addition, our patients faced severe cognitive deficits covering the entire cognitive spectrum. The aim of our present study was to examine whether cognition is associated with severe loss of daily activities at the very beginning of the rehabilitation process for older stroke patients at stroke units in Dutch nursing homes.

**Methods**

This is a cross-sectional study. We recruited subjects from stroke patients who had been admitted to the rehabilitation units of four nursing homes in the Netherlands between January 2011 and November 2014. We included patients if they had a stroke, comorbid diseases like heart disease, diabetes, transient ischaemic attack or pre-existing depression, and if they were able to undergo the cognitive assessment. Patients were excluded if they were too ill to participate or suffered from dementia (assessed by the physician), if there was a language impairment like aphasia or if the mini-mental state examination (MMSE) score was lower than 13. A score of 13 or higher is namely a prerequisite for cognitive testing (Castro-Costa et al., 2008). Of the total number of patients admitted (n=356), 160 patients were eligible to participate in the study.
All the participants, their relatives or a member of their family provided informed consent. The study was approved by the boards, doctors and head nurses of the participating nursing homes.

**Patient characteristics**

The following patient characteristics were recorded on admission: demographic variables like age, gender and level of education.

**Medical data**

On admission, the following medical data were selected: stroke, transient ischaemic attack, Parkinson’s, disorders of consciousness, brain tumour, epilepsy, alcohol or other abuse and use of medication. Medication use was coded according to the Dutch Pharmacotherapeutic Compass guidelines, for example, in the fields of psychology, neurology and blood (Pharmacotherapeutic Compass).

**Functional status**

In our study, loss of independence in personal activities of daily living (defined as functional status) early after stroke was measured using the Barthel Index (BI) (Mahoney et al., 1965; Post et al., 1995; Wade et al., 1988). In stroke rehabilitation, the BI items represent recovery tasks, which increase in level of complexity; 80% of stroke patients recover following the order of these items (van Hartingsveld et al., 2006; Hafsteindottir et al., 2009). In addition, the BI score at baseline has proven to be a crucial predictor for recovery after stroke (Kwakkel, 2006). The BI has a high level of reliability and validity in patients with stroke (Collin et al., 1988; Wade et al., 1988). This index consists of 10 items, seven of which focus on the activities of daily living such as personal care. The other three items focus on mobility, such as climbing stairs (Mahoney et al., 1965). The total BI score ranges from minimum 0 to maximum 20, whereby scores can be interpreted as follows: 0–4 fully dependent; 5–9 severely dependent; 10–14 needs
help but does a great deal themselves; 15–19 reasonably independent; and 20 fully independent (Post et al., 1995). The BI was measured by nurses within the first week of a patient’s stay in the rehabilitation units.

Cognitive assessment

To assess various cognitive functions, we administered a neuropsychological test battery within the first week of stay. The battery was particularly focused on executive functioning and memory. The test took about 75 minutes. To avoid the patient’s performance being affected by fatigue, the entire test could be performed over two sessions. The performance tests were conducted by experienced psychologists or trained neuropsychology and nursing students. Experienced neuropsychologists completed the administration of the test battery. The assessment of cognition consisted of the neuropsychological tests (Huijben-Schoenmakers et al., 2014) listed in the succeeding discussion.

Global cognitive functioning

- Mini-mental state examination. We assessed global cognitive functioning with the MMSE. MMSE, a brief test, had a reliability of 0.95 in a study with patients suffering from various neurological dysfunctions (Folstein et al., 1975).

Executive functions combined with memory

- Montreal Cognitive Assessment. This test assesses executive functions, attention and concentration, memory, language, orientation, calculation, conceptual thinking and visuoconstructional skills (Nasreddine et al., 2005). The Montreal Cognitive Assessment (MOCA) detects mild cognitive impairment with 90–96% sensitivity and 87% specificity. The maximum score is 30 (Nasreddine et al., 2005).
Executive functions

Behavioural Assessment of Dysexecutive Syndrome.

- **Rule shift card test.** A subtest of the Behavioural Assessment of Dysexecutive Syndrome (BADS) is the rule shift cards (BADS-RS), which assess set-shifting. This subtest discriminates people with an executive dysfunction from healthy people. Participants have to respond to stimuli (red or black playing cards), according to two rules that are presented consecutively. The maximum score is 4 (Wilson et al., 1996).

- **Key search test.** Another BADS subtest is the key search test. This assesses the executive subfunctions of planning and problem-solving. The aim is to choose a systematic and efficient strategy to find a key lost in a field. The inter-rate reliability of the BADS varies from 0.88 to 1.00. Brain-injured patients achieve significantly lower scores in this test, which suggests that its construct validity is as good as established tests. The maximum score is 4 (Wilson et al., 1996).

Executive functions

- **Category fluency.** Set-shifting, one of the executive functions, was assessed with category fluency (Snijders et al., 1962; Luteijn et al., 1983). This test, which requires shifting from one category of names to another, uses the category ‘animals’, test–retest reliability 0.82 and professions, test–retest reliability 0.96.

Verbal and non-verbal memory

- **Eight words test.** The patient is asked to memorize eight words that they have to reproduce in different settings, five consecutive times with different time delays (Kalverboer et al., 1968). The maximum score for this test is 40.

- **Rivermead Behavioural Memory Test.** Episodic memory was tested using the Rivermead Behavioural Memory Test (RBMT) Face and Picture Recognition (Wilson et al., 1993).
et al., 1993). The Face Recognition subtest assesses non-verbal episodic memory; the Picture Recognition subtest assesses both verbal and non-verbal episodic memory. The RBMT has reliability coefficients ranging from 0.57 to 0.86, its inter scorer reliability being 0.9 or higher. The maximum score for the Face Recognition subtest is 20, and for the Picture Recognition subtest, it is 40 (Wilson et al., 1993).

**Mood**

The level of depression and anxiety is assessed using the following questionnaires:

- **Beck Depression Inventory.** The Beck Depression Inventory (BDI) is a 20-item questionnaire to measure the level of depression, with a high reliability (coefficient alpha=0.86) (Beck et al., 1961). A low score indicates a low level of depression (Beck et al., 1961). The maximum score for the BDI is 60.

- **Symptoms checklist 90.** This is a short test to examine anxiety and depression (Ettema et al., 1986). The scale consists of 25 questions about anxiety and depression, with an internal consistency coefficient rating range from 0.79 for paranoid ideation to 0.90 for depression. Higher scores indicate a higher level of depression and anxiety. The maximum score for the Symptoms checklist 90 is 125 (Ettema et al., 1986).

**Statistical analyses**

We carried out statistical analyses using SPSS—PC version no. 20 (SPSS Inc., Chicago, USA). Descriptive analysis was used to characterize the study population (mean, SD, numbers, percentile). A stepwise linear regression analysis evaluated how executive dysfunction and memory deficits are related to functional outcome after stroke. We determined the level of statistical significance at 0.05.
Results

Of the total number of patients admitted (n=356), 160 patients were eligible to participate in our study. Twenty-nine (8.2%) of the patients died, and 26 (7.3%) refused to participate. Furthermore, 106 patients (29.8%) were too ill to participate or suffered from aphasia; and 38 patients (10.7%) were excluded because of too early discharge from the nursing home. In addition, nine patients (2.5%) were excluded because of MMSE <13 (Figure 1).

Demographics and illness-related variables

Table 1 shows the patients’ demographic characteristics. Our patients were older (mean age 76.7; SD 9.5; minimum age 47; maximum age 93), and most of them were women. The majority of the patients finished primary school (35%) and secondary school low level (25.6%), whereas four patients had a master’s degree (2.5%). Some patients’ characteristics were not recorded by the testers (missing values), which could be due to incomplete medical records.

The mean BI for functional status at baseline in our study was 11.02 (SD 5.38) as shown in Table 2. All patients (n=144) used medication coded according to the Dutch Pharmacotherapeutic Compass guidelines. Most patients used blood thinners (78.8%), medication for tractus digestivus (61.3%) and tractus circulatorius (68.8%). All patients suffered from stroke in combination with other diseases like diabetes (n=31, 19.4%) and depression (n=15, 9.4%), as shown in Table 2.

Table 3 shows the mean value of cognitive deficits and depression at baseline. Our study population suffered from deficits of executive functioning and verbal and non-verbal memory, reflected in scores below the cut-off points.
Relationship between cognition and functional status

To examine the relationship between cognition and poor functional status, we carried out a linear regression analysis using a stepwise model: input variables, as shown in Table 4, were global cognitive functioning measured by the MMSE, executive functions and memory using the MOCA, executive functions using the BADS (rule shift cards and key search test) and category fluency (animals and professions), verbal and non-verbal memory using the ‘eight words test’ and RBMT (Face and Picture). The stepwise linear regression analysis showed that executive functioning and memory are significantly associated with functional status in older comorbid patients with stroke: BADS rule shift cards ($\beta=-0.208; p=0.050$) and verbal and non-verbal memory RBMT Face ($\beta = -0.399; p = 0.000; \text{confidence interval (-1.255, -0.403); adjusted R-square = 0.149; F = 14.98; df = 80}$).
Figure 1 Sample recruitment and study population
Table 1. Demographic characteristics of stroke patients (baseline)

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>Number/Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (n=156)</td>
<td>76.7 (9.5)</td>
<td></td>
</tr>
<tr>
<td>Gender (n = 156)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>65 (40.6%)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>91 (56.9%)</td>
</tr>
<tr>
<td>Height (n = 130)</td>
<td>167.5 (9.9)</td>
<td></td>
</tr>
<tr>
<td>Weight (n = 142)</td>
<td>73.5 (15.0)</td>
<td></td>
</tr>
<tr>
<td>BMI (n = 129)</td>
<td>26.7 (4.8)</td>
<td></td>
</tr>
<tr>
<td>Male (n = 55)</td>
<td>26.4 (4.2)</td>
<td></td>
</tr>
<tr>
<td>Female (n = 74)</td>
<td>26.9 (5.2)</td>
<td></td>
</tr>
<tr>
<td>Level of education (n = 144)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td></td>
<td>56 (35.0 %)</td>
</tr>
<tr>
<td>Secondary school low level</td>
<td></td>
<td>41 (25.6 %)</td>
</tr>
<tr>
<td>Secondary school medium level</td>
<td></td>
<td>16 (10.0 %)</td>
</tr>
<tr>
<td>Secondary school high level</td>
<td></td>
<td>3 (1.9 %)</td>
</tr>
<tr>
<td>Medium professional education</td>
<td></td>
<td>19 (11.9 %)</td>
</tr>
<tr>
<td>University for applied sciences</td>
<td></td>
<td>5 (3.1 %)</td>
</tr>
<tr>
<td>University</td>
<td></td>
<td>4 (2.5 %)</td>
</tr>
<tr>
<td>Smoker (n = 150)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstainer (MV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Former (MV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>22 (13.8 %)</td>
<td></td>
</tr>
<tr>
<td>Alcohol (n = 151)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never (MV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Former (MV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>58 (36.3 %)</td>
<td></td>
</tr>
</tbody>
</table>

Data are given as mean (SD) or as number of subjects (%). Age in years, height in centimeters, weight in kilograms, BMI = Body Mass Index. N = 160 Total study population. Some patients’ characteristics were not recorded = missing values (MV)
Table 3. The mean value of cognitive deficits and depression at baseline

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>Max score/Cut-off point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global cognitive functioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td>22.92 (4.92)</td>
<td>30 / 22</td>
</tr>
<tr>
<td>Executive functions and memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOCA</td>
<td>1.73 (5.35)</td>
<td>30 / 21</td>
</tr>
<tr>
<td>Executive functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Shift Cards</td>
<td>1.68 (1.27)</td>
<td>4 / 2</td>
</tr>
<tr>
<td>Key Search Test</td>
<td>1.27 (1.29)</td>
<td>4 / 2</td>
</tr>
<tr>
<td>Category Fluency</td>
<td>11.43 (4.83)</td>
<td>50 / 13</td>
</tr>
<tr>
<td>Verbal and non-verbal memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'Eight words test'</td>
<td>23.90 (7.16)</td>
<td>40 / 23</td>
</tr>
<tr>
<td>'Eight words test' Recall</td>
<td>3.42 (2.36)</td>
<td>8 / 2</td>
</tr>
<tr>
<td>RBMT Face</td>
<td>11.25 (5.96)</td>
<td>20 / 18</td>
</tr>
<tr>
<td>RBMT Picture</td>
<td>32.56 (9.86)</td>
<td>40 / 36</td>
</tr>
<tr>
<td>Mood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI</td>
<td>11.44 (8.79)</td>
<td>0 / 16</td>
</tr>
<tr>
<td>SCL90 total score</td>
<td>39.55 (14.52)</td>
<td>25</td>
</tr>
<tr>
<td>SCL90 anxiety</td>
<td>14.75 (6.00)</td>
<td>10</td>
</tr>
<tr>
<td>SCL90 depression</td>
<td>2.48 (9.30)</td>
<td>15</td>
</tr>
</tbody>
</table>

Cognitive deficits and depression at baseline. Data are given as mean (SD). Cut-off point demonstrates the existence of cognitive deficits. BADS, Behavioural Assessment of Dysexecutive Syndrome; BDI, Beck Depression Inventory; MMSE, Mini-mental State Examination; MOCA, Montreal Cognitive Assessment; RBMT, Rivermead Behavioural Memory Test; SCL90, Symptoms Checklist 90.

Table 2. Medication and comorbidity in stroke patients (baseline)

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>Number/Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Barthel Index (N=136)</strong></td>
<td>11.02 (5.38)</td>
<td></td>
</tr>
<tr>
<td>Medication: (N=144)</td>
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<td></td>
</tr>
<tr>
<td>Psychology</td>
<td>47 (29.4%)</td>
<td></td>
</tr>
<tr>
<td>Neurology</td>
<td>21 (13.1%)</td>
<td></td>
</tr>
<tr>
<td>Blood</td>
<td>126 (78.8%)</td>
<td></td>
</tr>
<tr>
<td>Tractus respiratorius</td>
<td>32 (20.0%)</td>
<td></td>
</tr>
<tr>
<td>Tractus digestivus</td>
<td>98 (61.3%)</td>
<td></td>
</tr>
<tr>
<td>Tractus circulatorius</td>
<td>110 (68.8%)</td>
<td></td>
</tr>
<tr>
<td>Tractus uropoeticus</td>
<td>26 (16.3%)</td>
<td></td>
</tr>
<tr>
<td>Tractus genitalius</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>ENT</td>
<td>1 (0.6%)</td>
<td></td>
</tr>
<tr>
<td>Ophthalmologica</td>
<td>12 (7.5%)</td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>14 (8.8%)</td>
<td></td>
</tr>
<tr>
<td>Hormones</td>
<td>46 (28.7%)</td>
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</tr>
<tr>
<td>Analgesics</td>
<td>57 (35.6%)</td>
<td></td>
</tr>
<tr>
<td>Vitamins and minerals</td>
<td>55 (34.4%)</td>
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</tr>
<tr>
<td>Oncology</td>
<td>1 (0.6%)</td>
<td></td>
</tr>
<tr>
<td>Allergy</td>
<td>2 (1.3%)</td>
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</tr>
<tr>
<td>Diverse</td>
<td>1 (0.6%)</td>
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</tr>
<tr>
<td>Dermatology</td>
<td>9 (5.6%)</td>
<td></td>
</tr>
<tr>
<td><strong>Stroke and other diseases: (N=160)</strong></td>
<td>160 (100%)</td>
<td></td>
</tr>
<tr>
<td>Diabetic</td>
<td>31 (19.4%)</td>
<td></td>
</tr>
<tr>
<td>Parkinson</td>
<td>7 (4.4%)</td>
<td></td>
</tr>
<tr>
<td>Conscious disorder</td>
<td>1 (0.6%)</td>
<td></td>
</tr>
<tr>
<td>TIA</td>
<td>6 (3.8%)</td>
<td></td>
</tr>
<tr>
<td>Brain tumours</td>
<td>2 (1.3%)</td>
<td></td>
</tr>
<tr>
<td>Epilepsy</td>
<td>8 (5.0%)</td>
<td></td>
</tr>
<tr>
<td>Alcohol or other abuses</td>
<td>2 (1.3%)</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>15 (9.4%)</td>
<td></td>
</tr>
<tr>
<td>Psychiatric diseases</td>
<td>7 (4.4%)</td>
<td></td>
</tr>
</tbody>
</table>

Data are given as mean (SD) or as number of subjects (%) N =160 = Total study population. ENT (Ear, Nose and Throat) TIA (Transient Ischaemic Attack) Some patients’ characteristics were not recorded = missing values.
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<td></td>
<td></td>
</tr>
<tr>
<td>MOCA</td>
<td>17.33 (5.95)</td>
<td>30 / 21</td>
</tr>
<tr>
<td><strong>Executive functions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BADS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule Shift Cards</td>
<td>1.68 (1.27)</td>
<td>4 / 2</td>
</tr>
<tr>
<td>Key search test</td>
<td>1.27 (1.29)</td>
<td>4 / 2</td>
</tr>
<tr>
<td><strong>Category Fluency:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>11.43 (4.83)</td>
<td>50 / 13</td>
</tr>
<tr>
<td>Professions</td>
<td>8.17 (4.42)</td>
<td>50 / 13</td>
</tr>
<tr>
<td><strong>Verbal and non-verbal memory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Eight words test’ 1</td>
<td>23.90 (7.16)</td>
<td>40 / 23</td>
</tr>
<tr>
<td>‘Eight words test’ Recall</td>
<td>3.42 (2.36)</td>
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<td><strong>RBMT:</strong></td>
<td></td>
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<td>10</td>
</tr>
<tr>
<td>SCL90 depression</td>
<td>24.88 (9.30)</td>
<td>15</td>
</tr>
</tbody>
</table>

Cognitive deficits and depression at baseline. Data are given as mean (SD). Cut-off point demonstrates the existence of cognitive deficits. BADS, Behavioural Assessment of Dysexecutive Syndrome; BDI, Beck Depression Inventory; MMSE, Mini-mental State Examination; MOCA, Montreal Cognitive Assessment; RBMT, Rivermead Behavioural Memory Test; SCL90, Symptoms Checklist 90.
Discussion

The aim of our present study was to examine whether cognition is associated with severe loss of daily activities at the very beginning of the rehabilitation process for frail older stroke patients in rehabilitation units at Dutch nursing homes. Our study population (mean age 76.7 years) was indeed frail, reflected in a mean BMI above the threshold of 25, a low mean level of education, and alcohol use in 36.3 % (Table 1). Furthermore they suffer from several comorbid diseases and they make use of different types of medication (Table 2).

The main finding is that in our study population, executive functioning (BADS rule shift cards) and non-verbal episodic memory (RBMT Face test) significantly are associated with functional status. These findings imply that set-shifting and memory are related to severe loss of independence in older comorbid and cognitively impaired stroke patients in the very early phase of recovery (Table 4).

The question arises why specifically these functions, that is, set-shifting and episodic memory, appear to be associated with independent functioning. Set-shifting is a prerequisite for cognitive flexibility, and cognitive flexibility appears to be associated with physical activity and muscle strength (Huh et al., 2011). In their cross-sectional study (n = 629), they suggest that reduced cognitive flexibility is related to diminished physical performance and weaker muscle strength, independent of important covariates such as age, gender and comorbidity (Huh et al., 2011). They emphasize that it might be useful to assess domain-specific executive functions and self-efficacy in older people, to predict the decline in physical performance (Huh et al., 2011). We underline this suggestion in order to plan preventive and therapeutic strategies for our stroke patients.

Similarly, a relationship between episodic memory and functional limitations was also observed in the study by Infurna et al. (2011), which revealed that better memory predicts superficial performance (Table 4).

### Table 4 How executive function and memory are related to functional status (Barthel Index)

<table>
<thead>
<tr>
<th>Related variables</th>
<th>Stepwise linear regression analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significance</td>
</tr>
<tr>
<td>Global cognitive functioning:</td>
<td>0.667</td>
</tr>
<tr>
<td>MMSE</td>
<td></td>
</tr>
<tr>
<td>Executive functions and memory:</td>
<td>0.832</td>
</tr>
<tr>
<td>MOCA</td>
<td></td>
</tr>
<tr>
<td>Executive functions:</td>
<td></td>
</tr>
<tr>
<td>BADS:</td>
<td></td>
</tr>
<tr>
<td>Rule shift cards</td>
<td>0.050*</td>
</tr>
<tr>
<td>Key search test</td>
<td>0.426</td>
</tr>
<tr>
<td>Category fluency:</td>
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<tr>
<td>Animals</td>
<td>0.170</td>
</tr>
<tr>
<td>Professions</td>
<td>0.206</td>
</tr>
<tr>
<td>Verbal and non-verbal memory:</td>
<td></td>
</tr>
<tr>
<td>‘Eight words test’</td>
<td>0.383</td>
</tr>
<tr>
<td>‘Eight words test’ Recall</td>
<td>0.634</td>
</tr>
<tr>
<td>RBMT:</td>
<td></td>
</tr>
<tr>
<td>Face</td>
<td>0.000*</td>
</tr>
<tr>
<td>Picture</td>
<td>0.456</td>
</tr>
</tbody>
</table>

Stepwise linear regression analysis: P level α ≤ 0.05; * significant; Confidence Interval 95% / ß ; BADS, Behavioural Assessment of Dysexecutive Syndrome; MMSE, Mini-mental State Examination; MOCA, Montreal Cognitive Assessment; RBMT, Rivermead Behavioural Memory Test.
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Another crucial factor, which should be taken into account, is the complexity of the stroke rehabilitation process. Studies by Counsell et al. (2002), Hsieh et al. (2002), Kwakkel (2009), Lesniak et al. (2008) and Nys et al. (2005b) describe the prognostic value or association of many other variables for predicting functional outcome instead of cognition, for example, age-related and illness-related variables. In our study, we did not screen patients on previous functional dependence, stroke severity or stroke type. It would be of interest for future research to examine if these variables influence the association between cognition and functional status after stroke recovery in a severe disabled study population.

Strengths and limitations

The strengths of our cross-sectional study were the following: working with a clinical population-based sample n = 160, using an extensive neuropsychiatric evaluation in older comorbid patients early after their admission to the nursing homes and the confirmation of the significant association of domain-specific cognitive functions with functional status. Our study also faced some limitations: because of the study’s cross-sectional design, data were selected at baseline, which limited the likelihood of proving causality between executive functioning, verbal and non-verbal memory and functional status. In our follow-up study, we will use a single, blind-controlled study design. This will provide more evidence of the causal value or relationship between cognition and activities of daily living in severely disabled stroke patients.

Conclusion

In our study, we found that in older comorbid stroke patients with severe loss of independence, executive functioning and non-verbal episodic memory are significantly associated with functional status. Our patients faced more functional impairment and cognitive deficits compared with other studies. We have shown that early cognitive screening is feasible for this study population, despite being older and vulnerable. Early cognitive screening creates the increases in functional limitations in the older adults. Infurna et al. (2011) also suggest that memory is a leading indicator of changes in functional limitations, even after adjusting for important confounders such as gender, education, health condition and depression. Moreover, remembering events, persons, locations and strategies is a cornerstone of being able to plan, execute and evaluate significant tasks of everyday life (Infurna et al., 2011).

Poor memory can leave older stroke patients with fewer mental instruments for remembering ways to perform everyday activities. Our findings are also in line with the results of a previous study, which showed that a decline in executive functioning and memory may lead to less physical activity (Lesniak et al., 2008). In reverse, the dependency in daily activities may result in a decline in physical activities, affecting executive functioning and memory in a negative way (Ankolekar et al., 2014; Ferencz et al., 2014; Liu-Ambrose et al., 2010). To offset this detrimental process in our stroke patients, we suggest combining physical and cognitive training. This combination of physical and cognitive training may yield more positive effects than physical or cognitive training applied separately (Tang et al., 2005) and can have a positive impact on the cognitive and functional outcome for severely disabled stroke patients.

It is known that the right and the left hemispheres contribute to cognitive functions in a different way: the left hemisphere processes more verbal information, and the right hemisphere processes more non-verbal information (Ishihara et al., 2013). In addition, right hemisphere lesions have a stronger correlation with functional outcome (Schiemanck et al., 2005). More specifically, lesions of the right hemisphere are related to lower scores on the BI (Rachpukdee et al., 2013). The other cognitive measures of our study, that is, verbal cognitive functions, appeal in particular to the left hemisphere; this hemisphere is less correlated to functional outcome (Schiemanck et al., 2005). We argue therefore that more verbally related tests do not show a significant relationship with functional status.
Another crucial factor, which should be taken into account, is the complexity of the stroke rehabilitation process. Studies by Counsell et al. (2002), Hsieh et al. (2002), Kwakkel (2009), Lesniak et al. (2008) and Nys et al. (2005b) describe the prognostic value or association of many other variables for predicting functional outcome instead of cognition, for example, age-related and illness-related variables. In our study, we did not screen patients on previous functional dependence, stroke severity or stroke type. It would be of interest for future research to examine if these variables influence the association between cognition and functional status after stroke recovery in a severe disabled study population.

Strengths and limitations

The strengths of our cross-sectional study were the following: working with a clinical population-based sample n = 160, using an extensive neuropsychiatric evaluation in older comorbid patients early after their admission to the nursing homes and the confirmation of the significant association of domain-specific cognitive functions with functional status. Our study also faced some limitations: because of the study’s cross-sectional design, data were selected at baseline, which limited the likelihood of proving causality between executive functioning, verbal and non-verbal memory and functional status. In our follow-up study, we will use a single, blind-controlled study design. This will provide more evidence of the causal value or relationship between cognition and activities of daily living in severely disabled stroke patients.

Conclusion

In our study, we found that in older comorbid stroke patients with severe loss of independence, executive functioning and non-verbal episodic memory are significantly associated with functional status. Our patients faced more functional impairment and cognitive deficits compared with other studies. We have shown that early cognitive screening is feasible for this study population, despite being older and vulnerable. Early cognitive screening creates the
opportunity for clinically relevant outcomes. It assists the rehabilitation team to combine cognitive interventions with motor abilities in rehabilitation at the very early phase of recovery.

**Conflict of interest**

None declared.

**Key points**

We suggest screening severely disabled stroke patients within the first week of stay on the rehabilitation ward and to combine physical and cognitive training from the very early phase of recovery.

**Acknowledgements**

We would like to thank the patients who participated in this study, their partners and family members, along with the nurses, head nurses, all other professionals and the management of the rehabilitation wards of the participating Nursing Homes in the Netherlands who assisted and facilitated the study. We also thank the Lectorate of Avans University of Applied Sciences in Breda and the Innovation and Knowledge Centre, ROC West-Brabant for facilitating the study.

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Chapter 5

The effects of increased therapy time on cognition and mood in frail patients with a stroke who rehabilitate on rehabilitation units of nursing homes in the Netherlands: a protocol of a comparative study.

Marleen Huijben-Schoenmakers, Arno Rademaker, Peter van Rooden and Erik Scherder

Chapter 5

The effects of increased therapy time on cognition and mood in frail patients with a stroke who rehabilitate on rehabilitation units of nursing homes in the Netherlands: a protocol of a comparative study.

Marleen Huijben-Schoenmakers, Arno Rademaker, Peter van Rooden and Erik Scherder

*BMC Geriatr.* 2014;23;14:68. (Adjusted for the thesis)
Abstract

Background: Recovery after stroke is dependent on how much time can be spent on rehabilitation. Recently, we found that therapy time for older stroke patients on a rehabilitation unit of a nursing home could be increased significantly from 8.6 to at least 13 hours a week. This increase was attained by the implementation of interventions, focused on strength, mobility and balance. Nurses carried out these exercises with the patients during their daily activities. The aim of the present study is to investigate if increased therapy time has a positive effect on cognition, mood (depression and anxiety), and ADL in stroke patients.

Methods: A comparative single blind controlled study will be applied. Patients suffering from a stroke and staying on one of the rehabilitation units of the nursing homes are eligible for participation. Participants belong to the intervention group if they stay in two nursing homes where four interventions of the Clinical Nursing Rehabilitation Stroke Guideline were implemented. Participants who stay in two nursing homes where therapy is given according to the Dutch Stroke Guidelines, are included in the control group. Clinical neuropsychologists will assess patients’ cognitive functioning, level of depression (mood) and anxiety. Nurses will assess a Barthel Index score on a weekly basis (ADL). These variables are measured at baseline, after 8 weeks and at the moment when participants are discharged from the nursing home.

Discussion: The present study evaluates the effect of increased therapy time on cognition, mood (level of depression and anxiety), and ADL in stroke patients. When positive effects will be found this study can guide policy makers and practitioners on how to implement more therapy time on rehabilitation wards of nursing homes.
**Trial registration:** TNR Our study has been documented in the Dutch Trial Registration, TC = 3871.

**Keywords:** Stroke, Rehabilitation, Cognition, Mood, Activities of daily living, Clinical nursing rehabilitation stroke guideline
The question arises whether an increase in exercise time of approximately 50 minutes a day, during work days, is sufficient to have a beneficial influence on cognition, e.g. executive functions, and mood in frail stroke patients.

It is known that a decline in cognition and mood both relate to more severe functional limitations and less functional recovery (Gainotti et al., 2001; Turner-Stokes et al., 2002). More specifically, the prevalence of cognitive disorders in stroke patients is high and varies from 22% (Tang et al., 2006) to 63% (Hofman, 2001). It has been observed that cognitive impairment after stroke influences recovery of functional outcome and activities of daily living negatively in older stroke survivors (Zinn et al., 2004; Stephens et al., 2005). Concerning mood, the frequency of e.g. depression after stroke is also high (33%) (Hackett et al., 2005). Depressed patients have poorer recovery patterns and need more time to achieve a high level of independence (Lai et al., 2002). Moreover, stroke patients who could not successfully being discharged from nursing homes were more depressed (Buijck et al., 2012).

There is ample evidence that exercise has a beneficial influence on, among others, age related cognitive decline (Bherer et al., 2013). Cognitive functions that respond positively to exercise are executive functions in particular (Guiney et al., 2013). Executive functions include higher-order cognitive functions such as planning, set-shifting, attention, impulse control, and working memory (Ashcraft, 2006). A prerequisite is that these older persons are sedentary at the beginning of the exercise program (Scherder et al., 2013). There is a limited number of studies showing improvement of cognitive functioning in stroke patients as a consequence of exercise. Some cognitive domains related to motor learning, e.g. information processing speed and attention improved by aerobic exercise post stroke (Quaney et al., 2009; Walker et al., 2004). It is interesting to know if other impaired domains of cognition in stroke patients can be influenced by exercise, e.g. executive functions and memory as particularly these functions are crucial for independent functioning (Nys et al., 2005).

**Background**

Recovery from stroke is highly dependent on intensive therapy executed by a multidisciplinary team (Dobkin, 2004; Exel et al., 2005; Kwakkel et al., 2004; Kwakkel, 2009; Page et al., 2004; van Peppen et al., 2004; Strasser et al., 2005). Surprisingly, in a previous study we found that time spent on non-therapeutic activities still accounted for 80% of the daytime, of which 28% was spent on sitting (Huijben-Schoenmakers et al., 2009). These undesirable results are supported by other studies examining the amount of time a patient actively participates in rehabilitation on a stroke unit and in hospitals (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005).

In a recent study we showed that therapeutic activities at a rehabilitation unit of a nursing home can be increased with more than 50 minutes a day when nurses are taught how to built in and consequently use exercises during their daily routines (Huijben-Schoenmakers et al., 2013). In this way patients perform 50% more therapeutic activities during the day compared to what is prescribed by the Dutch Stroke Guidelines i.e. approximately 4 hours per week (Giessen et al., 2004; Veerbeek et al., 2014). The guideline development team recommends that patients with limitations in activities of daily living (<19 points on the BI) should be activated to exercise for at least 45 min a day, whether or not under supervision of a physical therapist and/or occupational therapist. The treatment sessions should be coached by a physical therapist who has the skills and knowledge to treat stroke patients, or be delegated to another therapist who is supervised by a well-experienced physical therapist. Furthermore if the patient’s condition and the available facilities allow this, patients should ideally be stimulated to do their exercises outside the scheduled therapy hours, for example integrated in nursing care (Veerbeek et al., 2014).
The question arises whether an increase in exercise time of approximately 50 minutes a day, during work days, is sufficient to have a beneficial influence on cognition, e.g. executive functions, and mood in frail stroke patients.

It is known that a decline in cognition and mood both relate to more severe functional limitations and less functional recovery (Gainotti et al., 2001; Turner-Stokes et al., 2002). More specifically, the prevalence of cognitive disorders in stroke patients is high and varies from 22% (Tang et al., 2006) to 63% (Hofman, 2001). It has been observed that cognitive impairment after stroke influences recovery of functional outcome and activities of daily living negatively in older stroke survivors (Zinn et al., 2004; Stephens et al., 2005). Concerning mood, the frequency of e.g. depression after stroke is also high (33%) (Hackett et al., 2005). Depressed patients have poorer recovery patterns and need more time to achieve a high level of independence (Lai et al., 2002). Moreover, stroke patients who could not successfully being discharged from nursing homes were more depressed (Buijck et al., 2012).

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In sum, the primary goal of the present study is to investigate whether an increase in therapy time has a beneficial influence on the various dimensions of cognition of frail stroke patients at discharge of rehabilitation units of nursing homes. The secondary goal is to examine whether an increase in therapy time improves mood, resulting in an improvement in activities of daily living (ADL).

Methods

Study design

The design of the study is a single blind controlled study with a quasi-experimental design in which two patients groups coming from nursing homes with two different therapy regimes are compared. The study consists of an effect evaluation of therapy time at a stroke unit for older frail comorbid patients on cognitive and physical outcome measures. The study will be carried out in four nursing homes following two different therapy regimes. Two nursing homes in which rehabilitation is only performed by therapists and based on the Dutch Stroke Guidelines (Giessen et al., 2004; Veerbeek et al., 2014) will form the control group. According to those guidelines, therapy time for the patients will be limited to approximately 4 hours a week, provided during work days (Giessen et al., 2004; Veerbeek et al., 2014). Two other nursing homes will form the intervention group. In the intervention group additional therapy time was created outside the scheduled therapy hours, integrated in nursing care (see below for further details). The nursing homes are situated in the south of The Netherlands and will be asked to participate in the study by the researcher.

Intervention

During their stay, patients in the intervention group, get additional therapy based on the Clinical Nursing Rehabilitation Stroke Guideline: muscle strengthening, sitting balance and reach,
getting up from a chair and walking (Hafsteindottir et al., 2009). Nurses instruct the patient to perform these exercises during their daily activities with the patients, including weekends. We estimated on the basis of a previous study that it should be possible to enhance therapy time to 150 min a day without extra input from therapists (Huijben-Schoenmakers et al., 2013). These exercises are adapted to the patient’s individual goals, need and rehabilitation level by physiotherapists and occupational therapists in consultation with the responsible nurses. Exercises will be documented in an exercise map which is fixed to the bed or wheelchair of the patient. Nurses coordinate the weekly adjustment exercises by informing the multidisciplinary team about the patient’s progress.

**Training of staff**

The researcher will train the whole multidisciplinary team extensively in advance during clinical lessons about the interventions and how to implement this into daily care before the implementation will start. The researcher will check formally and informally the patients for their adherence to the study. She will make surprise visits several times a week and make appointments with the whole multidisciplinary teams, boards, doctors and patients to interview them and to assess multiple evaluation meetings. The researcher monitors regularly if the four interventions of the Clinical Nursing Rehabilitation Stroke Guideline remain part of the daily nursing routine, if the exercise map is renewed every week by the therapists and if patients are encouraged by the nurses to practise. If necessary, extra training and support will be given to the nurses.

The Medical Ethical Committee of the Free University Amsterdam, The Netherlands, approved this study.
**Study population**

A convenience sample will be taken of patients who rehabilitate in the selected nursing homes in the period of April 2012 until April 2015 and are willing to participate. Patients suffering from a stroke will be eligible for participation, even if they suffer from co-morbid diseases such as heart disease, recurrent stroke or pre-existing depression. Patients will be excluded if they will leave the rehabilitation unit within two weeks, when they are too ill to participate, if there is a language problem, like aphasia, or when a Mini-Mental State Examination (MMSE) (Folstein et al., 1975) score is lower than 13. A score of 13 or higher is a prerequisite for a neuropsychological assessment. Patients will be recruited by the head of the nursing staff, working on the rehabilitation unit of the nursing homes. Oral and written information about the study is given to the patients and/or their legal representatives. Prior to their participation in the study oral and written informed consent will be acquired from all the participants, their family or legal representatives. Informed consent will be based on veracity, anonymity, privacy, and confidentiality.

**Single-blind**

The nursing homes, patients, caregivers, and the multidisciplinary teams who are participating in the study are not blinded for the treatment. Trained clinical neuropsychologists, collecting the data, do not belong to the permanent staff of the nursing homes and are not informed about the study objectives. Research assistants involved in the data analyses are blinded for the patients treatment background.

**Sample size**

The sample size has been calculated by using the statistically power analysis program G Power. The estimated effect-size comes from a study reporting the effect of physical activity on...
cognition in patients with stroke (d’ = 0.30) (Tang et al., 2006). Taking into account a type one error of 0.05 (\( \alpha = 0.05 \)), a power of 0.80 (\( \beta = 0.08 \)), three repeated measurements and two groups, a sample size of 138 patients is required, i.e. 69 persons in each group. Taken a dropout of 10% into account, a sample size of 81 persons in each group is required. It is expected that this number of participants can be derived from the two experimental and control nursing homes.

**Assessment**

**Measurement of extra therapy time**

The difference between the intervention and the control nursing homes is the input of nurses resulting in extra exercises. In this way patients can increase their time spent on therapeutic activities. The data will be derived via a Behavioral Mapping technique, which is a standardized and frequently used method for quantifying the amount and nature of patients’ activity, in which setting the activities take place (e.g. living room) and with whom the activities are performed, e.g. nurses, fellow patients (Keith et al., 1987; de Weerdt et al., 2000; de Wit et al., 2005). The method has exhibited good validity (Kramer et al., 2013) and good interobserver reliability (Bernardt et al., 2004). Observation of patients take place at 10- minutes intervals on weekdays (8:30–17:10). At each time point the observer records patient activity, the person attending to the patient and the patient’s location. In accordance to other studies the assumption is made that between two consecutive observations the three observation domains remain unchanged (Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Tinson, 1989; de Weerdt et al., 2000; de Wit et al., 2005).

**Outcome measures**

The most prominent clinical consequence of a stroke is a disturbance in sensorimotor activity which occurs in almost half of the patients (Urban et al., 2010). Also cognition plays an essential
role in the subacute phase of stroke rehabilitation, especially when the patient starts to regain competences. Cognitive functions like memory, and executive functions such as attention, and planning are especially necessary to relearn and perform activities of daily living (Ashcraft, 2006). The close relationship between cognition and functional abilities may emerge from the premise that both are considered inseparable parts belonging to the same functional neuronal systems of the brain (Walker et al., 2004). This suggestion implies that an enhancement of daily physical activities may have a positive effect on patients’ cognitive functioning and vice versa. We hypothesize that patients in the intervention nursing homes will improve more on cognitive functioning and functional abilities. Because of the wide scope of cognitive functions we have chosen to measure the total domain of cognitive functioning as well as functional abilities under the two conditions.

Patient characteristics

The following background characteristics are measured in both patient groups: age, gender, level of education, marital status, living situation, smoking and drinking alcohol.

Medical history data

Type of stroke, TIA, Parkinson, disorders of consciousness, brain tumor, epilepsy, alcohol or other abuse, depression and or psychiatric problems and medication. Medication use is coded according to the guideline of the Dutch Pharmacotherapeutic Compass (http://www.fk.cvz.nl/bladeren/n/node2.asp ).

Effect evaluation

Primary outcome measures cognition

Assessment of cognition will be assessed by the following neuropsychological tests:
Global cognitive functioning

Mini-mental state examination

Global cognitive functioning will be assessed by the Mini-Mental State Examination (MMSE). MMSE is a brief screening test and has been developed to screen for cognitive impairment, which has a joint reliability of 0.95 in a study of patients with various neurological disorders (Folstein et al., 1975).

Executive functions

Behavioural assessment of dysexecutive syndrome

Rule Shift Cards A subtest of the BADS (Wilson et al., 1996) is the Rule Shift Cards (BADS-RS), which is meant to assess set-shifting. This subtest discriminates people with an executive dysfunction from healthy people. Participants have to respond to stimuli (red or black playing cards) according to two rules that are presented consecutively. The maximum score is 4.

Key-search test Another subtest of the BADS is the Key-search test. This test assesses the executive sub functions planning and problem-solving. The goal is to choose a systematic, and efficient strategy to find a key lost in a field. The inter-rate reliability of the BADS varies from 0.88-1.00. Brain injured patient achieve significant lower scores on the test which suggest that construct validity of these tests is as good as that of established tests (Wilson et al., 1996). The maximum score is 4.

Category fluency

Set-shifting, one of the executive functions, will be assessed by Category Fluency (Luteijn et al., 1983; Snijders et al., 1962). This test requires shifting from one category of names to another category. This test uses the category ‘animals,’ test re-test reliability 0.82, and professions, test re-test reliability 0.96.
Verbal and non-verbal memory

‘Eight words test’

The patient is asked to memorize 8 words which have to be reproduced by the participant in different settings at 5 consecutive times with different time delays (Kalverboer et al., 1968). The maximum score of the Eight words test is 40.

Rivermead behavioural memory test

Episodic memory will be tested by the Rivermead Behavioural Memory Test (RBMT) Face and Picture Recognition (Wilson et al., 1993). The Face Recognition subtest is meant to assess non-verbal episodic memory; the Picture Recognition subtest is meant to assess both verbal and nonverbal episodic memory. The RBMT has reliability coefficients ranging from 0.57 to 0.86, with the inter scorer reliability of the RBMT being 0.9 or higher. The maximum score of the Face Recognition subtest is 10. The maximum score of the Picture Recognition subtest is 20 (Wilson et al., 1993).

Executive functions combined with memory

Montreal cognitive assessment

Montreal Cognitive Assessment (MOCA) assesses executive functions, attention and concentration, memory, language, orientation, calculation, conceptual thinking, and visuoconstructional skills (Nasredinne et al., 2005). The MOCA detects mild cognitive impairment with 90%-96% sensitivity and 87% specificity (Nasredinne et al., 2005).

Secondary outcome measure

Mood

The level of depression and anxiety will be assessed by the following questionnaires:
Beck depression inventory (BDI)

The BDI is a 20-item questionnaire used to measure the level of depression, with a high reliability (Coefficient Alpha = .86) (Beck et al., 1961). A low score indicates a low level of depression (Beck et al., 1961). The maximum score of the BDI is 60.

Symptoms checklist 90 (SCL90)

This test is a short test to examine anxiety and depression (Ettema et al., 2004). The scale exists of 25 questions about anxiety and depression, with an internal consistency coefficient rating range of .79 for paranoid ideation to .90 for depression. A higher score indicates a higher level of depression and anxiety. The maximum score of the SCL90 is 125 (Ettema et al., 2004).

Activities of daily life

Activities of daily life are measured by the Barthel Index (Wade et al., 1988).

Barthel index

The Barthel Index consists of 10 items, all focused on ADL activities. The total score of the Barthel Index ranges between 0 and 20 points. The Barthel Index has a high level of reliability and validity in patients with stroke (Wade et al., 1988).

Procedure

Within the first week of stay at the stroke units, eligible patients are tested by clinical neuropsychologists. They assess patient’s cognition and mood. These variables are measured at baseline, after 8 weeks and at discharge from the nursing home where the patient rehabilitates. In practice the moment of discharge can vary depending on the patient’s condition and personal situation. Therefore when patients are discharged earlier than 8 weeks the moment of discharge is selected as post measurement.
Discussion

The present protocol paper describes the design of a single blind controlled study. The aim of our study is to investigate whether additional therapy time focused on muscle strengthening, sitting balance and reach, getting up from a chair and walking has a positive effect on cognition, mood and activities of daily living (ADL) in stroke patients who rehabilitate on rehabilitation units of nursing homes. The study gives insight into how the care of elderly stroke patients in nursing homes might be improved so that patients have a better chance of independent living. When positive effects will be found this study can guide policy makers and practitioners on how to implement higher quality care on rehabilitation wards of nursing homes.

The strength of the study is that 1) interventions from the evidence based Clinical Nursing Rehabilitation Stroke Guideline are implemented in the rehabilitation care of older stroke patients. This implementation will significantly increase the time spent on therapeutic activities without extra therapists needed, 2) the role of nurses can shift towards a more therapeutic one, 3) we examine if an increase in therapeutic time has a beneficial effect on cognition, mood, and ADL. These factors are of great importance for rehabilitation success in stroke patients.

Possible limitations of our study are 1) the high rate of drop-out due to illness or death of this frail patient group, 2) the convenience sample causing a possible selection bias, 3) the limited intervention time before patients are discharged from the rehabilitation units.

Competing interests

The authors declare that they have no competing interests.

Nursing staff collects patients background characteristics at entry of the study and assesses a Barthel Index score every week. A geriatric physician collects medical history data. The control group receives exercise therapy provided by physiotherapists or occupational therapists, once a day during 30 minutes on weekdays, but not in weekends. The intervention group receives the same therapy as the control group. Additionally, patients in the intervention group are stimulated, helped and controlled by nurses to carry out exercises from their exercise map every day including weekends. This results in approximately 10 to 20 extra exercise moments a day for these patients.

Data-analysis

Statistical Package for the Social Sciences (SPSS version 20) will be used (SPSS Inc., Chicago, USA). If data are normally distributed, independent t-tests between the intervention and control group are used to compare baseline characteristics. The Mann-Whitney U test will be used if data are not normally distributed. For dichotomous variables e.g. gender and comorbidities, Chi square tests will be executed.

We will use a repeated measures Multivariate Analysis of Variance (MANOVA) to assess possible effects of the intervention between the intervention and control group on cognition, functional abilities, and mood: Time ( 2 levels: pre – post) is the within subject factor and Group is the between-subjects factor (2 levels) (intervention versus control group). Included patients who did not follow our study protocol will also be involved in the statistical analysis. The partial eta squared $\eta^2$ was used as an indication of an effect size: small effect: partial $\eta^2 =0.01$; moderate effect: partial $\eta^2 =0.06$; large effect: partial $\eta^2 = 0.14$. The level of significance will be set at $p < .05$. 
**Discussion**

The present protocol paper describes the design of a single blind controlled study. The aim of our study is to investigate whether additional therapy time focused on muscle strengthening, sitting balance and reach, getting up from a chair and walking has a positive effect on cognition, mood and activities of daily living (ADL) in stroke patients who rehabilitate on rehabilitation units of nursing homes. The study gives insight into how the care of elderly stroke patients in nursing homes might be improved so that patients have a better chance of independent living. When positive effects will be found this study can guide policy makers and practitioners on how to implement higher quality care on rehabilitation wards of nursing homes.

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**Competing interests**

The authors declare that they have no competing interests.
Authors’ contributions

MH-S has drafted the manuscript and performs the study. AR critically revised the manuscript and analyses data with SPSS. PvR has described the neuropsychological tests. Finally ES has designed the study and critically revised the manuscript. All authors read and approved the final version of the manuscript. MH-S, AR and ES revised the final version of the manuscript.

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We are grateful to the patients, partners, family members, the nurses, head nurses, all other professionals and the management of the rehabilitation wards of the participating Nursing Homes in the Netherlands who participate, assist and facilitate the study. In addition we thank the patients, partners, family members, the nurses, head nurses, all other professionals and the management of the rehabilitation ward of the nursing homes of the control groups who participate in this study. We thank ROC West- Brabant for making this study possible.
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Chapter 6: Therapy time, cognition, and functional outcome of severe disabled older stroke patients on rehabilitation units of Dutch nursing homes; a quasi-experimental single blind controlled study

Marleen Huijben-Schoenmakers, Arno Rademaker and Erik Scherder
Chapter 6

Therapy time, cognition, and functional outcome of severe disabled older stroke patients on rehabilitation units of Dutch nursing homes; a quasi-experimental single blind controlled study

Marleen Huijben-Schoenmakers, Arno Rademaker and Erik Scherder

Submitted
Abstract

Background: To study the effects of increased therapy time on cognition and functional outcome in older comorbid cognitively impaired stroke patients with poor functional outcome, who rehabilitate on rehabilitation units of nursing homes.

Method: In a quasi-experimental single blind controlled study, possible effects of an intervention that is derived from the evidence-based Clinical Nursing Rehabilitation Stroke Guideline on cognition, functional abilities, and mood was examined in severe disabled older stroke patients (n=61). This intervention was added to a standard rehabilitation program, that is based on the Dutch Stroke Guidelines. The standard program was applied to the control group (n=45). Cognitive functions were assessed by means of neuropsychological tests. The Barthel Index was applied to assess functional abilities.

Results: No significant differences between both groups were found concerning cognitive functioning, functional abilities, and mood.

Discussion: Negative findings will be addressed within the scope that the original intervention appeared not to be feasible, due to among others, patients who probably were too ill. Also, a high workload and a change in legislation and financial structures initiated by the government might have had an effect on the outcomes of the study.

Key words: Cognition, functional outcome, increased therapy time, older severe comorbid stroke patients, rehabilitation
Introduction

The most prominent clinical consequence of a stroke is a disturbance in sensorimotor activity which occurs in almost half of the patients (Urban et al., 2010). In their study, 42.6% suffered from spasticity, with a higher prevalence of spasticity in the upper extremity, compared to the lower extremity. Furthermore, those with spasticity showed a lower level of activities of daily life and quality of life (Urban et al., 2010).

In view of severe motor disturbances, characteristic for many stroke patients, it is strongly recommended to participate in a specialized stroke program, that is provided by a team of specialists and takes place at a stroke unit (Hebert et al., 2016). They recommend more intensive rehabilitation after the first 24 hours, in a way that is an intensification and extension of the therapy during the hospital stay.

At the background of a need for an intensive rehabilitation program that is focused at an optimal recovery of disturbances in motor functions, cognitive functions, and mood, it is the more striking that severe disabled older frail stroke patients only spent 20% of working days (103.5 min/day) on therapeutic activities at a stroke unit (Huijben-Schoenmakers et al., 2009). In that study, assessment of therapy time took place by applying the Behavioural Mapping Instrument. Similar results were found in other studies in hospitals and rehabilitation settings where therapeutic time ranged from 13% to 45% of the day (Bernardt et al., 2004; Keith et al., 1987; Lincoln et al., 1989; Miller et al., 1973; Sjöholm et al., 2014; Tinson, 1989). In the weekends and evenings, stroke patients are involved in even less or no therapeutic activities (de Wit et al., 2005). In sum, stroke patients in a post-acute stage, may lead a physical inactive life, hampering their recovery.

Rehabilitation programs of such a low intensity are in contrast to strong evidence, indicating that a longer and more intensive physical and cognitive training on specialised multidisciplinary stroke units of nursing homes (Tang et al., 2005; Kwakkel, 2009) may lead to better stroke
outcome. Indeed, for stroke survivors, rehabilitation should be structured to provide as much scheduled therapy (occupational therapy and physiotherapy) as possible, with a minimum of three hours a day ensuring active task practice is maximised during this time (Lohse et al., 2014).

For stroke survivors, group circuit class therapy should be used to increase scheduled therapy time (English et al., 2015). Stroke survivors should be encouraged to continue with active task practice outside of scheduled therapy sessions. This could include strategies such as self-directed, independent practice, semi-supervised, and assisted practice involving family/friends, as appropriate.

Next to functional disabilities, stroke is characterized by a decline in cognitive functions. Cognition plays an essential role in the subacute phase of stroke rehabilitation especially when the patient starts to regain competences (Stephens et al., 2005; Tang et al., 2005). Cognitive functions like memory, and executive functions such as attention, and planning are especially necessary to relearn and perform activities of daily living (Heruti et al., 2002). Another executive function, i.e. set-shifting, was found to be significantly related to independent functioning in older comorbid stroke patients who rehabilitate at a stroke unit (Huijben-Schoenmakers et al., 2017). Set-shifting is a prerequisite for cognitive flexibility, a function that appears to be associated with physical activity and muscle strength (Huh et al., 2011).

In view of the above mentioned important contribution of cognitive function to a successful recovery process after stroke, it is unfortunate that cognitive impairments are among the most frequent early outcomes after stroke and may complicate rehabilitation (Cumming et al., 2013; Nys et al., 2005). Cognitive impairment after stroke may express itself in e.g. executive dysfunctions like planning and attention problems, and disturbances in memory (Nys et al., 2005; Tang et al., 2006). Deficits in executive functions and memory may have an adverse
influence on functional recovery in mild and severe disabled stroke patients (Cederfeldt et al., 2010; Lesniak et al., 2008).

The close relationship between cognition and functional abilities may emerge from the premise that both are considered inseparable parts belonging to the same functional neuronal systems of the brain (Mulder et al., 2001). This suggestion implies that a decline in daily physical activities may have a detrimental effect on patients’ cognitive functioning and vice versa (Ferencz et al., 2014; Liu-Ambrose et al., 2010).

A third domain that may show a deterioration after stroke is mood. Stroke patients may suffer from depression and anxiety (Gurr et al., 2011). More than half of the patients in that study were confronted with distress, irrespective of gender. Even when a depression is absent at the moment the patients left the hospital, at a 12-month follow-up, 16.5% of the stroke patients did develop a depression (Limampal et al., 2017). Similarly, anxiety might occur in 2 days to 7 years in 9.8% in post-stroke patients (Mitchell et al., 2017).

To enhance the recovery of older comorbid stroke patients on these three domains, i.e. functional ability, cognition, and mood, we have applied in the present study therapeutic activities that are additional to the standard rehabilitation program, that takes place at stroke units of nursing homes (Huijben-Schoenmakers et al., 2013). The additional therapeutic activities are derived from the Clinical Nursing Rehabilitation Stroke Guideline. These therapeutic activities are focused on muscle strengthening, sitting balance and reach, getting up from a chair, and walking (Huijben-Schoenmakers et al., 2013).

Stroke survivors with reduced strength in their arms or legs should be offered progressive resistance training (Ada et al., 2006; Harris et al., 2010). For stroke survivors who have difficulty sitting, practising reaching beyond arm’s length while sitting with supervision/assistance should be undertaken (Veerbeek et al., 2014a). Those who have difficulty in standing up from a chair, standing up should be practised (French et al., 2007;
Pollock et al., 2014). Finally, tailored repetitive practice of walking (or components of walking) should be trained by those who experience problems when walking (French et al., 2007). The aim of our present quasi-experimental single blind controlled study was to examine if there is a beneficial effect of these additional therapeutic activities, reflected in increased therapy time, on cognition, functional outcome and mood of severe disabled older stroke patients on rehabilitation units of Dutch nursing homes.

**Methods**

*Participants*

Stroke patients who were admitted to one of the stroke units of participating nursing homes were eligible for participation. Patients were recruited by the heads of the nursing staff, or by the psychologists who were working on the rehabilitation wards of the participating nursing homes. Five nursing homes situated in the south and in the middle part of the Netherlands participated. The sample consisted of patients who rehabilitated on the wards of the participating nursing homes and who were willing to participate, during the period of January 2011 until November 2016.

*Patient characteristics.*

The following sociodemographic and illness-related characteristics were collected from the patients’ medical records: age, and gender. Level of education determined on a seven point scale: less than 6 classes primary school: score 1, primary school completed: score 2, lower vocational education 1 year: score 3, lower vocational education completed: score 4, higher professional education: score 5, high school completed: score 6, and university: score 7 (Verhage, 1964).
Design.
A single blind controlled quasi experimental study. The participating nursing homes, the multidisciplinary teams, the patients and their relatives were not blinded for the treatment. Trained nursing students and trained neuropsychologists who gathered the data were not informed about the study objectives (single blind). They did not belong to the permanent staff of the nursing homes.

Sample size.
In the protocol of this single blind controlled study, the sample size of n = 162 (n=81 for each group) was calculated with a power analysis based on a study that reports a moderate effect size of d’=.030 of physical activity on cognition in patients with stroke (Tang et al., 2006; Huijben-Schoenmakers et al., 2014). However, the sample size in the present study was 106 participants, n= 61 in the intervention group (25 males, 36 females) and n= 45 in the control group (20 males, 25 females). Gender did not differ significantly between both groups (We will further address this issue in the Discussion).

Inclusion criteria.
Stroke patients, with co-morbid diseases such as heart disease, recurrent stroke or pre-existing depression (Huijben-Schoenmakers et al., 2014). Next, patients were included if they would stay approx. 8 weeks at the stroke unit.

Exclusion criteria.
Patients were excluded if they were too ill to participate, if they suffered from aphasia, or when the Mini-Mental State Examination (MMSE) (Folstein et al., 1975) score was lower than 13. The MMSE measures global cognitive functioning, with a maximum score of 30. A score of 13
or higher is a prerequisite for a reliable neuropsychological assessment (Castro-Costa et al., 2008).

**Comorbidity**

The following comorbidities were selected from the medical records: diabetes mellitus, Parkinson, disturbances in consciousness, Transient Ischaemic Attack (TIA), brain tumor, epilepsy, and a history of psychiatric disorders (e.g. institutionalization for depression). Score 1 for the presence of the comorbidity.

**Informed consent.**

The Medical Ethical Committee of the Free University Amsterdam, The Netherlands, approved this study. Furthermore the boards, physicians and head nurses of the participating nursing homes gave their approval. Oral and written information about the study was given to the patients and/or their legal representatives. Before their participation in the study oral and written informed consent based on veracity, anonymity, privacy, confidentiality and fidelity was attained from all the participants, their family or legal representatives.

**Materials and procedure**

**Functional abilities**

The Barthel Index (BI) (Mahoney et al., 1965; Post et al., 1995; Wade et al., 1988) was applied to assess the level of independence in activities of daily living (Mahoney et al., 1965; Post et al., 1995; Wade et al., 1988). The total BI score consists of ten items that range from 0 to 20 (maximum). BI scores can be defined as: 0-4 fully dependent; 5-9 severely dependent; 10-14 needs help but does a great deal themselves; 15-19 reasonably independent; 20 fully
independent (Post et al., 1995). During the study the BI was weekly filled in by fully instructed nurses.

**Cognition**

**Global cognitive functioning**

The Mini-Mental State Examination (MMSE) was applied to assess global cognitive functioning (Folstein et al., 1974). More specifically, the MMSE includes items that appeal to, among others, memory, visuoconstructive capacities, orientation in time and place. Maximum score: 30.

**Executive functions**

*The Montreal Cognitive Assessment (MOCA)* (Nasreddine et al., 2005) was used to assess executive functioning combined with memory (Nasreddine et al., 2005). The maximum score is 30. The test detects mild cognitive impairment with 90%-96 % sensitivity and 87 % specificity.

*The Behavioural Assessment of the Dysexecutive Syndrome (BADS) Rule Shift Card Test and Key Search Test* (Wilson et al., 1996) were applied to assess executive functions such as inhibition and planning. The maximum score of the Rule Shift Card Test is 4. The maximum score of the Key Search Test is 4.

*Category Fluency (Animals and professions)* (Luteijn et al., 1983; Snijders et al., 1962) were used to assess cognitive flexibility. This test requires shifting from one category of names to another category. This test uses the category ‘animals’, test re-test reliability 0.82, and professions, test re-test reliability 0.96.
**Verbal and nonverbal episodic memory**

*The Eight Words Test* measures verbal and nonverbal long-term memory (Kalverboer et al., 1968). The patient is asked to memorize 8 words which has to be reproduced by the participant in different settings at 5 consecutive times with different time delays (Direct Recall; maximum score: 40). After 10 minutes delay, the patient has to reproduce the eight words (Delayed Recall; maximum score: 8). Subsequently the patient has to recognise the eight memorised words out of a list of 16 words (Recognition; maximum score: 16).

*The Rivermead Behavioural Memory Test (RBMT) (Faces and Pictures)* (Wilson et al., 1993). The RBMT face and pictures tested episodic memory. The Face Recognition subtest is meant to assess nonverbal episodic memory; the Picture Recognition subtest is meant to assess both verbal and nonverbal episodic memory. The RBMT has reliability coefficients ranging from 0.57 to 0.86, with the inter scorer reliability of the RBMT being 0.9 or higher. The maximum score for RBMT face is 20 and for RBMT pictures is 40.

**Mood**

Mood was assessed using the Beck Depression Inventory (BDI) (Beck et al., 1961) and the Symptoms Checklist 90 (SCL90) (Ettema et al., 1986). The BDI is a 20-item questionnaire used to measure the level of depression. The test has a high reliability (Coefficient Alpha = .86). The maximum score is 60. A low score indicates a low level of depression. The SCL 90 test is a short test to examine depression and anxiety. The scale exists of 25 questions about depression and anxiety. The test has an internal consistency coefficient rating range of .79 for paranoid ideation to .90 for depression. The total maximum score of the SCL90 is 125, whereas depression counts for a maximum score of 75 and anxiety for a maximum score of 50. A higher score indicates a higher level of depression and anxiety. A domain Mood was calculated, resulting in a Cronbach’s alpha of .90.
Intervention

Experimental group. The study investigated the effect of a therapy program, based on the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009), on functional abilities, cognition, and mood. This guideline was especially developed for nurses (Hafsteindottir et al., 2009). The four interventions (muscle strengthening, sitting balance, getting up from a chair and walking) took place in close cooperation with the physiotherapist and were adapted to the individual level and interest of the patient. The nurse incorporated without additional staff and without extra healthcare costs these exercises into the daily activities on the ward. In this way the therapy time increased significantly to an extra 50 minutes (see for further details the discussion) a day of exercises for the patients, compared to our previous study (Huijben-Schoenmakers et al., 2009; Huijben-Schoenmakers et al., 2013). The therapy program was applied to participants in the experimental group, in addition to a standard rehabilitation program. The target was a total therapy time per day of 150 minutes, i.e. 12.5 hours a week. The standard rehabilitation program is based on the Dutch Stroke Guidelines (Giessen et al., 2004; Veerbeek et al., 2014b).

Control group. The control group received only this standard program. Patients received traditional rehabilitation executed by different therapists e.g. speech therapist or physiotherapists for a maximum of approximately 4 hours a week (Giessen et al., 2004; Veerbeek et al., 2014b). Nursing care was not part of the rehabilitation program (Giessen et al., 2004).

Procedure

The researcher checked formally and informally the intervention and control group for their adherence to the study. She made surprise visits several times a week and made appointments
Moments of measurement

In our protocol article we described three moments of cognitive testing namely at baseline within the first week of stay on the rehabilitation ward of the nursing home (pre), after 8 weeks (post) and before discharge after 3 to 4 months (delayed) (Huijben-Schoenmakers et al., 2014). However in the last few years of our study patients were discharged earlier from the hospital to the rehabilitation unit of the nursing home. In this way patients were more severe ill and were unable to go through a cognitive assessment within the first week of stay. In other words the first moment of testing varied depending on patient’s condition. The second measurement (post) did not took place after 8 weeks as originally planned, but after 3 to 8 weeks after the first moment of measurement. The reason for this unexpected and undesirable earlier discharge will be addressed in the Discussion section. When possible, the third moment of measurement (delayed) took place in the nursing home, dependent of the final destination. Unfortunately,
the delayed moment of measurement was only possible for a few patients, as the moment of discharge was often unannounced and the patient already left the stroke unit. The administration of the test battery took about 75 minutes. The total test session could be split up in two sessions, when the patient indicated to feel tired during the administration of the tests and questionnaires.

**Statistical Analysis**

Statistical Package for the Social Sciences (SPSS version 20) were used (SPSS Inc., Chicago, USA). If data were normally distributed, independent t-tests between the intervention and control group were used to compare baseline characteristics. The Mann-Whitney U test was used if data were not normally distributed. For dichotomous variables e.g. gender and comorbidities, Chi square tests were executed.

We used a repeated measures Multivariate Analysis of Variance (MANOVA) to assess possible effects of the intervention between the intervention and control group on cognition, functional abilities, and mood: Time (2 levels: pre – post) was the within subject factor and Group was the between-subjects factor (2 levels) (intervention versus control group). Patients who did not follow our study protocol were also included in the statistical analysis. The partial eta squared $\eta^2$ was used as an indication of an effect size: small effect: partial $\eta^2 =0.01$; moderate effect: partial $\eta^2 =0.06$; large effect: partial $\eta^2 = 0.14$.

**Results**

**Recruitment of participants**

We recruited 737 stroke patients from 5 nursing homes during the period of January 2011 until November 2016 (intervention group n= 451; control group n= 286). Four hundred and fifty patients were excluded from our study because of illness, suffering aphasia, death, refusal to
participate, or a MMSE score lower than 13. In this way we collected data from and executed
the first neuropsychological assessment of 287 patients (intervention group n= 162; control
group n= 123). Subsequently 179 patients were lost for a follow-up screening (intervention
group n= 101; control group n= 78), because of acute illness, death, earlier discharge to long
stay units or at home, or refusal to participate. Finally 106 patients went through a second
neuropsychological assessment (intervention group n= 61; control group n= 45) (for a flow
chart, see figure 1).
Recruitment 737 patients from five nursing homes between January 2011 and November 2016
intervention group: 451
control group: 286

Figure 1. Flow chart: sample recruitment and study population
### Treatment period

The mean number of weeks between measurement moment 1 and 2 in the intervention group consisted of 5.18 weeks (SD 1.52) (n=61) and for the control group of 5.07 weeks (SD 1.60) (n=45). Furthermore we present data concerning time use from some randomly selected patients from the control and intervention groups of the last period (2015-2016) of our study (by use of Behavioural Mapping technique). The mean time in minutes (the SD and the minimum and maximum scores) spent on therapeutic and non therapeutic activities was for the **control group** (n=9): therapeutic activities: 106.7(SD58.7)(40-200) and non therapeutic activities: 413.3(SD58.7)(320-480) and for the **intervention group** (n=8): therapeutic activities: 111.3(SD38.3)(40-150) and non therapeutic activities: 407.5(SD39.6)(370-480). For further details see table 1.

---

<table>
<thead>
<tr>
<th>Activities</th>
<th>Mean (SD) (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intervention group (n=8)</strong></td>
<td></td>
</tr>
<tr>
<td>Total time therapeutic activities</td>
<td>111.3 (SD38.3) (40-150)</td>
</tr>
<tr>
<td>Therapeutic activities:</td>
<td></td>
</tr>
<tr>
<td>Nursing care</td>
<td>45.0 (SD24.5) (0-80)</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>23.8 (SD37.0) (0-100)</td>
</tr>
<tr>
<td>Other therapeutic activity</td>
<td>0</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>10.0 (SD28.3) (0-80)</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>20.0 (SD23.3) (0-60)</td>
</tr>
<tr>
<td>Autonomous exercising</td>
<td>0</td>
</tr>
<tr>
<td>Medical care</td>
<td>6.3 (SD14.1) (0-40)</td>
</tr>
<tr>
<td>Neuropsychological training</td>
<td>6.3 (SD17.7) (0-50)</td>
</tr>
<tr>
<td>Sports activities</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total time non-therapeutic activities</strong></td>
<td>407.5 (SD39.6) (370-480)</td>
</tr>
<tr>
<td>Non-therapeutic activities:</td>
<td></td>
</tr>
<tr>
<td>Sitting</td>
<td>151.3 (SD69.8) (100-320)</td>
</tr>
<tr>
<td>Eating</td>
<td>63.8 (SD32.9) (20-100)</td>
</tr>
<tr>
<td>Transport</td>
<td>11.3 (SD9.9) (0-30)</td>
</tr>
<tr>
<td>Lying and/or sleeping</td>
<td>81.3 (SD33.1) (20-120)</td>
</tr>
<tr>
<td>Communication</td>
<td>42.5 (SD39.6) (0-110)</td>
</tr>
<tr>
<td>Dressing and hygiene</td>
<td>13.8 (SD15.1) (0-30)</td>
</tr>
<tr>
<td>Active leisure</td>
<td>23.8 (SD35.4) (0-90)</td>
</tr>
<tr>
<td>Passive leisure</td>
<td>15.0 (SD29.8) (0-80)</td>
</tr>
<tr>
<td>Other activities</td>
<td>5.0 (SD7.6) (0-20)</td>
</tr>
<tr>
<td><strong>Total time interaction with others</strong></td>
<td>305.0 (SD53.7) (250-410)</td>
</tr>
<tr>
<td>Doctors</td>
<td>6.3 (SD14.1) (0-40)</td>
</tr>
<tr>
<td>Therapists</td>
<td>52.5 (SD48.0) (0-150)</td>
</tr>
<tr>
<td>Nurses</td>
<td>57.5 (SD35.4) (0-120)</td>
</tr>
<tr>
<td>Other patients</td>
<td>137.5 (SD85.0) (0-270)</td>
</tr>
<tr>
<td>Visitors</td>
<td>48.8 (SD48.5) (0-130)</td>
</tr>
<tr>
<td>Other persons</td>
<td>2.5 (SD4.6) (0-10)</td>
</tr>
<tr>
<td><strong>Total time alone</strong></td>
<td>215.0 (SD53.7) (110-270)</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
</tr>
<tr>
<td>Patients room</td>
<td>267.5 (SD53.1) (150-310)</td>
</tr>
<tr>
<td>Therapy room</td>
<td>40.0 (SD49.0) (0-120)</td>
</tr>
<tr>
<td>Corridor</td>
<td>18.8 (SD18.1) (0-60)</td>
</tr>
<tr>
<td>Living room</td>
<td>138.8 (SD88.1) (40-340)</td>
</tr>
<tr>
<td>Toilet/bathroom</td>
<td>17.5 (SD18.3) (0-50)</td>
</tr>
<tr>
<td>Restaurant</td>
<td>26.3 (SD38.9) (0-90)</td>
</tr>
<tr>
<td>Outside</td>
<td>0</td>
</tr>
<tr>
<td>Other location</td>
<td>11.3 (SD18.1) (0-40)</td>
</tr>
<tr>
<td><strong>Total time outside</strong></td>
<td>277.8 (SD58.0) (180-360)</td>
</tr>
</tbody>
</table>

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Table 1 Time spent on therapeutic (under professional supervision) and non-therapeutic activities (no- professional supervision), location and interaction with others during the day during the last period of the study (2015-2016) of some randomly selected patients.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Mean time in minutes (min-max)</th>
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<td></td>
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<tr>
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<tr>
<td>Restaurant</td>
<td>26.3 (SD 38.9) (0-90)</td>
</tr>
<tr>
<td>Outside</td>
<td>0</td>
</tr>
<tr>
<td>Other location</td>
<td>11.3 (SD 18.1) (0-40)</td>
</tr>
</tbody>
</table>

*8.30 am- 5.10pm*
Patient characteristics at baseline

At baseline no differences were found between the control and intervention group concerning age, gender (see Methods-section), and level of education (for means, standard deviations, and statistics, see table 2).

Table 2. Age and education of participants in the intervention and control group at baseline.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Intervention group</th>
<th>Control group</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>Age</td>
<td>76.85</td>
<td>8.82</td>
<td>61</td>
</tr>
<tr>
<td>Education</td>
<td>2.22</td>
<td>1.53</td>
<td>58</td>
</tr>
</tbody>
</table>

Comorbidities

Both groups did not differ significantly concerning comorbidities (for Fisher Exact tests, see table 3). Disturbances of consciousness were not present.

Table 3. Comorbidities of the experimental and control group. TIA: Transient Ischemic Attack. Psychiatric disorders, only when one or more disorders were present in the history of the patient.

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>Experimental group</th>
<th>Control group</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Diabetes</td>
<td>16</td>
<td>15.2</td>
<td>11</td>
</tr>
<tr>
<td>Parkinson</td>
<td>3</td>
<td>2.9</td>
<td>0</td>
</tr>
<tr>
<td>TIA</td>
<td>1</td>
<td>1.0</td>
<td>2</td>
</tr>
<tr>
<td>Brain tumor</td>
<td>1</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>4</td>
<td>3.8</td>
<td>2</td>
</tr>
<tr>
<td>Psychiatric disorders</td>
<td>5</td>
<td>4.8</td>
<td>6</td>
</tr>
</tbody>
</table>
Intervention

Cognitive functioning

Repeated measures multivariate analyses of variance (MANOVAs) showed no significant Time x Group interaction effect concerning both global cognitive function (MMSE) and specific cognitive functions (MOCA, specific neuropsychological tests) (for means, standard deviations, and statistics, see table 4).

Functional abilities

A repeated measures multivariate analysis of variance (MANOVA) showed that the interaction Time x Group concerning the Barthel Index appeared not to be significant (see table 4 for means, standard deviations, and statistics).

Mood

Concerning the BDI, a repeated measures analysis of variance showed no significant interaction Time x Group (see table 4 for means, standard deviations, and statistics). Concerning the SCL-90, a repeated measures analysis of variance did not show a significant interaction Time x Group for both Anxiety and Depression.
Table 4. Results of the multivariate analyses of variance (MANOVA) for all cognitive functions, the functional abilities, and mood of the experimental and control group. BDI: Beck Depression Inventory; SCL-90: Symptom Check List; RBMT: Rivermead Behavioural Memory Test; 8 WT: 8 Words Test; BADS: Behavioural Assessment of Dysexecutive Syndrome; MMSE: Mini-Mental State Examination; MOCA: Montreal Cognitive Assessment.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Experimental Group</th>
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<td>3.12</td>
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<td>12.11</td>
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It is a key issue to note that the Behavioural Mapping technique counts therapy time as all the activities under professional supervision (de Weerdt et al., 2000; de Wit et al., 2005). However, it is important to consider that the Behavioural Mapping technique aims to improve patient care by offering individualized, intensive, and continuous therapy sessions. Despite these setbacks, we decided to analyse the collected data, to show that for frail comorbid and cognitively impaired patients, the additional therapeutic activities between the experimental and control group. Moreover, the time spent on therapeutic activities decreased in the intervention group, e.g. due to fast staff turn-over or workload to approximately 100 to 110 minutes a day. The therapy time per day of 150 minutes. Shortly after the start of the study, the government changed the combination of the two rehabilitation programs, during a period of at least 8 weeks, with a total of 100 minutes per day. This in turn reduced the contrast of time spent on therapeutic activities between the experimental and control group. Despite these setbacks, we decided to analyse the collected data, to show that for frail comorbid and cognitively impaired patients, the additional therapeutic activities between the experimental and control group.
Discussion

The goal of the present single blind controlled study was to examine if there was a beneficial effect of therapeutic activities, that were added to the standard rehabilitation program, on cognition, functional outcome, and mood of severe disabled and cognitively impaired older sub-acute stroke patients on rehabilitation units of Dutch nursing homes. In contrast to our expectations we did not find any significant effect of the additional therapeutic activities, that were based on the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009), on the above mentioned variables.

There are several explanations for these negative findings. Perhaps the most important one is that during the study period, it became impossible to execute the original intervention, i.e. a combination of the two rehabilitation programs, during a period of at least 8 weeks, with a total therapy time per day of 150 minutes. Shortly after the start of the study, the government changed legislation and financial structures (http://wetten.overheid.nl/BWBR0034431/2014-01-01; https://www.actiz.nl/ouderenzorg/zorg/benut-winst-van-geriatrische-revalidatie-door-snelle-en-zorgvuldige-doorontwikkeling; Vat et al., 2016). This change in policy might have violated our program.

Moreover, the time spent on therapeutic activities decreased in the intervention group e.g. due to fast staff turn-over or workload to approximately 100 to 110 minutes a day. The therapy time in the control group increased to approximately maximum 80 to 100 minutes per day, due to a shortening of the rehabilitation period. This in turn reduced the contrast of time spent on therapeutic activities between the experimental and control group. Despite these setbacks, we decided to analyse the collected data, to show that for frail comorbid and cognitively impaired elderly patients such a short period of rehabilitation is not relevant.

It is a key issue to note that the Behavioural Mapping technique counts therapy time as all the activities under professional supervision (de Weerdt et al., 2000; de Wit et al., 2005). However
in the control group nursing care was not involved as a target in rehabilitation (Giesen et al., 2004), but we did counted in as rehabilitation time. In this way we might have overestimated the time spent on rehabilitation in the control group. So in fact the total time spent on rehabilitation in the control group was approximately 50 minutes per day, executed by therapists. On the other hand, nursing care based on the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009) was involved as a rehabilitation goal in the intervention group. Consequently, the total time spent on therapeutic activities for rehabilitation was approximately 111 minutes per day.

Indeed, in a number of studies, therapy duration was much longer (Blanchet et al., 2016; El-Tamawy et al., 2014; Landsmann et al., 2016; Liu-Ambrose et al., 2015; Marzolini et al., 2012; Moore et al., 2015). For example, in the quasi-experimental study of Blanchet, Richards, Leblond, Olivier and Maltais (2016), fourteen cognitively impaired chronic stroke patients went through an 8 week intervention (aerobic exercise alone and aerobic exercise and cognitive training combined). The results suggest that attention improved following the training program.

In another randomised, single blinded cross-over study, twenty-eight chronic, mild cognitive impaired stroke patients participated in a 6-months community-based structured programme including two sessions exercises and one leisure activity a week (Liu-Ambrose et al., 2015). Executive functioning, especially selective attention and conflict resolution, improved significantly. Finally, forty stroke patients were included in a randomised controlled trial, in which a three times-a-week exercise program, during a period of 19 weeks, was applied (Moore et al., 2015). The training program significantly improved walking ability, balance, and cognition in favour of the exercise group.

Taken together, a longer and more intensive physical and cognitive training on specialised multidisciplinary stroke units of nursing homes (Tang et al., 2005; Kwakkel ., 2009) may lead to better stroke outcome. After all, rehabilitation outcome such as, e.g. an improvement in
functional abilities, need not to stabilize after some weeks to months of rehabilitation (Teassel et al., 2015). Based on the above mentioned studies, we suggest that most of the patients in the present study, were discharged too early. Support for this suggestion arises from our own data. For example, the scores on the Barthel Index increased to 14 points during the treatment period, both in the experimental and control group. However, such a score implies that our patients still need help in daily activities and are depending on the support of other people at the moment of discharge. Similarly, at the moment of discharge, the scores on the majority of the neuropsychological tests were below the cut-off points (Table 4). This implies that most patients at the moment of discharge face cognitive impairment.

If patients are discharged at home at a too early stage of the rehabilitation process, the question arises if there is adequate specialised stroke support at home. Intensifying the rehabilitation program of older comorbid stroke patients with the use of the exercise map intervention, might be feasible (Huijben-Schoenmakers et al., 2013). If substantial effort is put into the optimal individually tailored rehabilitation care of these patients it should be possible that older frail stroke patients can be discharged to an independent living situation (Buijck et al., 2012). An important question is how the patients themselves perceive returning home at a relatively early stage of the rehabilitation process. Results of a recent ‘interview study’ suggest that the feelings are mixed, ranging from uncertainty about own capacities in daily life to expectations of a more challenging live, that facilitates recovery (Nordin et al., 2015). To enhance the success of returning home in a relatively early stage post-stroke, at least two approaches might be useful. For example, training at home by a multidisciplinary team, a training that starts already during hospitalization (Rasmussen et al., 2016). Subsequently, when discharged home, the patients should be further coached by that same team, in executing the exercise program with which they were familiar during hospitalization (Rasmussen et al., 2016). The effects on functional abilities were most promising (Rasmussen et al., 2016).
Another approach might be an exercise program, that has also started in the hospital, but that is provided at home by a caregiver (van den Berg et al., 2016). Patient and caregiver were supported by e-Health, i.e. tele-rehabilitation. Interestingly, this caregiver-mediated exercise program, with tele-support, resulted in an extra 1000 minutes of practising. Of note is that this additional practice time did not result into an improvement in mobility (van den Berg et al., 2016). The success of a rehabilitation program for stroke patients at home, that is controlled via telecommunication, has also been observed by others (Bernocchi et al., 2016).

A second explanation for our negative findings might be that our participants were too ill to profit maximally from the rehabilitation program. Indeed, in those studies that reported positive effects of physical training on cognition and functional outcome, the patients were less ill, younger and mild cognitively impaired (Blanchet et al., 2016; El-Tamawy et al., 2014; Landsmann et al., 2016; Liu-Ambrose et al., 2015; Marzolini et al., 2012; Moore et al., 2015).

A third explanation might be that the (nursing) staff find it hard to provide exercises at the right level. Further research on this topic should be of interest.

Limitations

The most crucial limitation is that our original intervention (combination of therapeutic activities based on the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009), and the Dutch Stroke Guidelines (Giessen et al., 2004)), during a period of 8 weeks, with a total rehabilitation time of 150 minutes per day, appeared not to be feasible. In the second place, the high drop-out rates could have confounded results, although we did not found differences between the groups regarding the characteristics of the patients at baseline. Unfortunately information about discharge destination at the end of the rehabilitation trajectory is lacking. Consequently, we could not track down the reason for dropping out of the study. In the third place, we did not control for lesion site, size and stroke type. For example, this might have influenced the results of some cognitive tests because the left hemisphere of the brain
processes more verbal information and the right hemisphere focuses more on non-verbal information (Ishihara et al., 2013). Finally, our study was not powered to control for all potential confounding factors.

**Conclusion**

A rehabilitation period at a stroke unit of a nursing home that ranges from 3 – 8 weeks, in combination with a rehabilitation time per day that lies below 150 minutes, will yield no beneficial effects on cognition, functional abilities, and mood in frail, comorbid elderly stroke patients.

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**Conflict of interest statement**

All the authors declare that there is no conflict of interest.

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Chapter 7

General Discussion
General discussion

The goals of this thesis were fourfold: 1) to assess how much time per day an older comorbid stroke patient spent on therapy, which is focused on the rehabilitation of post-stroke impairments in motor and cognitive functioning; 2) to examine whether it is possible to increase the therapeutic time per day, by having the nurses more involved in the execution of the rehabilitation program; 3) to assess whether cognitive (dys)functions are related to post-stroke physical disabilities at the start of the rehabilitation at the stroke unit; and 4) to examine whether, compared to the standard rehabilitation program, based on the Dutch Stroke Guidelines, a combination of this program with a rehabilitation program based on the Clinical Nursing Rehabilitation Stroke Guideline, would yield more beneficial effects on motor activity, cognition, and mood in elderly, frail comorbid stroke patients.

Outline

First, a summary of the main findings will be presented. Subsequently, a critical review of the methodology used in the various studies will be addressed. Next, implications and recommendations for the medical staff, including nurses and nursing students, multidisciplinary teams, boards of health organizations, policy makers and researchers are discussed. Finally, suggestions to improve the effectiveness of stroke rehabilitation at home will be made.

Summary and brief discussion of the main findings

In Chapter 2 we described the time spent on therapeutic and non-therapeutic activities by severely disabled comorbid older stroke patients (Huijben-Schoenmakers et al., 2009). The findings of this study showed that patients in the stroke units of nursing homes spent 20% of
their waking hours, i.e. 103.5 minutes per day, on therapeutic activities. For the remaining part of the day, patients spent their time on doing nothing. For 59% of the day, i.e. 306.5 minutes per day, patients were just sitting and waiting, without any contact. In the present study, only 8% of each day was spent on physiotherapy, speech therapy, and occupational therapy together, i.e. 40.5 minutes a day.

The findings of this study gave rise to the question of why frail older stroke patients receive such a low level of therapy per day. In general, the time spent on therapeutic activities is pragmatic and not based on evidence or the time needed to relearn daily activities (Kwakkel, 2006). If there is a minimum level of therapeutic impulses a day, it is important that a multidisciplinary team performs more intensive training programmes, tailored to each patient’s need in which nurses play a bigger role and patients are constantly stimulated to do self-training. Intensive collaboration between all the therapists, nurses and doctors has shown to provide better patient outcomes (Strasser et al., 2005). The challenge is how to enable stroke professionals to integrate the results of scientific evidence into the daily rehabilitation and how to convince professionals to move from their traditional roles towards a closer involvement in the multidisciplinary team.

Consequently, the findings of this study (Huijben-Schoenmakers et al., 2009), challenged us to examine whether it would be possible to increase the number of ‘therapeutic’ minutes per day (Chapter 3). In fact, thanks to the efforts of the nursing staff in stimulating the execution of the rehabilitation program, the therapeutic minutes increased from 103.5 minutes to 156.5 minutes per day. Interestingly, not only the nurses participated more actively in the rehabilitation program, but the patients also became more aware of their condition and, consequently, became more motivated to exercise.

Although precise evidence is missing in determining the exact level, it has been suggested that to obtain major functional recovery, at least 16 hours or more of high-quality therapy per week
is needed, and that intensive task-oriented training improves recovery in the first six months after stroke (Kwakkel, 2009). Others have confirmed that cognitively impaired and functionally dependent older stroke patients should focus on high-intensive, repetitive task-specific exercising with feedback (Pinter et al., 2012). In other words, a rehabilitation period of approx. 5 weeks with less than 150 minutes therapy time per day (one of the results of our quasi-experimental single blind controlled study) seems to be much too little.

On the one hand, there is a lack of evidence concerning the intensity and duration of the rehabilitation interventions to promote functional and cognitive recovery in older comorbid patients (Pinter et al., 2012). On the other hand, findings about the effectiveness of rehabilitation programs concerning cognitive and motor recovery are also inconsistent, as is indicated in the following literature. A systematic review of Pollock et al. (2014) showed that physical rehabilitation selecting different approaches of training has proven to be effective for functional outcome after stroke. Further evidence emerges from a meta-analysis (Bindawas et al., 2016) showing that inpatient programs focused on rehabilitation have beneficial effects on functional outcome for older stroke patients. In contrast, two systematic reviews concluded that there is still only limited evidence to support the effectiveness of rehabilitation on cognition (Das Nair et al., 2016; Loetscher et al., 2013). This lack of evidence is due to poor methodological quality of studies, inconsistency in outcome measures and small sample sizes (Das Nair et al., 2016; Loetscher et al., 2013).

Based on these studies and motivated by our findings, from the first pilot study (Huijben-Schoenmakers et al., 2009), that an increase in therapy time of approx. 50%, is feasible, the next logical step was to examine whether the increase in therapy time is also of clinical relevance. More precisely, the question arose as to whether a therapy time of approx. 150 minutes would be sufficiently high to improve motor activity, cognitive functions, and mood in
older, frail, comorbid stroke patients. The focus of such an intervention should be on motor and cognitive functioning as a close relationship between the two in stroke patients has been widely described in literature (Liu-Ambrose et al., 2010; Mulder et al., 2001; Pahlman et al., 2012; Tang et al., 2005).

A related question is whether a relationship between functional status and cognitive functioning in stroke patients would also apply to our group of frail and comorbid older stroke patients (Chapter 4). This question has not been answered as yet, since in most studies into the relationship between cognition and motor activity, the stroke patients were much younger (Ankolekar et al., 2014; Barker-Collo et al., 2010; Cederfeldt et al., 2010; Dong et al., 2013; Lesniak et al., 2008; Nys et al., 2005). However, the question is relevant, because at the moment of admission to the nursing home our study population suffered from cognitive deficits concerning the whole cognitive spectrum and showed poor functional status. If in this frail population cognition can predict functional outcome in this specific population, it supports the implementation of the best evidence-based interventions from the very beginning of the rehabilitation process. In our study, a stepwise linear regression analysis showed that executive functioning and memory are significantly associated with functional outcome (Huijben-Schoenmakers et al., 2017). These findings imply that set-shifting - one of the executive sub functions - and non-verbal episodic memory are associated with severe loss of independency in the very early phase of rehabilitation. The question arises as to why especially set-shifting and episodic memory appear to be related to independent functioning in our study population. Set-shifting appears to be a prerequisite for cognitive flexibility and poor cognitive ability is related to diminished physical performance and muscle strength (Huh et al., 2011). Remembering strategies, persons, and locations is a cornerstone of being able to plan, to perform and to evaluate significant tasks of daily living (Infurna et al., 2011). Patients with poor memory after stroke do not have sufficient strategies to remember how to execute daily activities.
Furthermore, dependency in daily activities can show a decline in physical activities, which can affect executive functioning and memory in a negative way (Ankolekar et al., 2014; Liu-Ambrose et al., 2010). To offset this harmful process for our vulnerable patients, we suggest combining physical and cognitive training. Combined physical and cognitive training may yield more positive effects (Tang et al., 2005) and may have a positive impact on cognitive and functional outcome for frail stroke patients. It is therefore important to screen the frail stroke patient in the very early phase of recovery to inform the team about what is needed for the patient (Gurr et al., 2015). Nurses play a crucial role in collecting data for screening outcomes.

Before starting our final step, we first wrote a study protocol that is presented in **Chapter 5**. In that protocol, we describe a single-blind controlled study, during which the possible beneficial effects of a rehabilitation program that consisted of two programs based on the Clinical Nursing Rehabilitation Stroke Guideline and the Dutch Stroke Guidelines, were examined for motor activity, cognitive functions, and mood in frail older comorbid stroke patients (**Chapter 6**). Contrary to our expectations we did not find any significant effect of the combined rehabilitation programs on cognition and functional outcome between the intervention and control group. The most obvious explanation of these negative findings is related to a violation of the methodology (see below).

**Methodology of the quasi-experimental single-blind controlled study; a critical review**

**Duration of the treatment period**

Although our study population consisted of seriously ill, cognitively disabled, comorbid older stroke patients, patients were discharged to a long stay unit or to home much earlier than described in the protocol. A rehabilitation period of a minimum of 8 weeks was planned in the original rehabilitation program. The mean number of weeks between measurement moment 1 and moment 2 (a few days or 1 day before discharge) in the intervention group was 5.18 weeks and for the control group 5.07 weeks. This decreased the duration of the rehabilitation considerably, minimizing the chance of beneficial effects.

It is possible that a treatment period of just 4 months, as observed in our pilot study (Huijben-Schoenmakers et al., 2009) might be too short, considering that a period of spontaneous recovery in humans lasts at least three months (Coleman et al., 2017). Recovery from post-stroke neurological consequences may even continue until 2 years post-stroke (Seitz et al., 2010). Intuitively, rehabilitating patients in a period of positive changes in the central nervous system might be the most effective period. The studies of Lee et al. (2012) and Foley et al. (2012) showed that a prolonged inpatient rehabilitation program of 6 months or longer achieved functional improvements in older stroke patients. Post-stroke rehabilitation periods of even 12 months or 18 months are not unusual (Horgan et al., 1996; Johansen et al., 2012).

One of the potential reasons that it became almost impossible to complete an 8-week rehabilitation period or longer at the stroke unit was a change in legislation and financial structures, incentivized by the government (http://wetten.overheid.nl/BWBR0034431/2014-01-01; https://www.actiz.nl/ouderenzorg/zorg/benut-winst-van-geriatrische-revalidatie-door-snelle-en-zorgvuldige-doorontwikkeling; Vat et al., 2016).
(week 1 or 2 after admission) and moment 2 (a few days or 1 day before discharge) in the intervention group was 5.18 weeks and for the control group 5.07 weeks. This decreased the duration of the rehabilitation considerably, minimizing the chance of beneficial effects.

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**Treatment time per day**

In the first ‘pilot’ study (Huijben-Schoenmakers et al., 2009), one nursing home participated. The total therapeutic time per day amounted to 103.5 minutes. It should be noted that this finding cannot be generalized to other stroke units. It was an observation that invited us to examine whether the therapeutic time could be increased with the same staff. Indeed, the nurses and medical staff were able to increase the therapy time to 156.5 minutes a day. The next
question was whether this increase was indeed of clinical relevance, i.e. had a beneficial effect on motor activity, cognitive functioning, and mood (single-blind controlled study). Unfortunately, the most ideal therapy time of 156.5 minutes (Huijben-Schoenmakers et al., 2013) appeared not to be feasible in the single-blind study due to staff shortage and staff turnover and other matters. An additional factor that might have contributed to a reduction in therapy time per day in the experimental group is that the professional staff may have felt somewhat insecure about the intensity of the program at times; the patients were frail and old, with a number of comorbidities. Clinical lessons, coaching, education of the professional staff might prevent a too cautious attitude. Another consequence of the above mentioned change in financial policy was that the shortening of the rehabilitation period coincided with an increase in the treatment time per day. This increase in treatment time concerned particularly the control group, who only participated in a rehabilitation program based on the Dutch Stroke Guidelines, i.e. approx. 50 minutes of treatment per day.

One might wonder whether therapy might have taken place at other times of the day, e.g. after 5.00 pm, or in the weekend, to compensate for missing therapy time during the day. However, after 5.00 pm, and during the weekend, a continuation of the rehabilitation program was not possible, due to a shortage or even absence of nurses and therapists. The patients were hardly able to exercise as they were frail, old and in too poor condition. It should not be forgotten that these patients already leave the hospital as soon as they are ‘stable’, from a medical point of view. One of the consequences might be that over the weekend, the patient could lose the progress he/she made before the weekend. Some support for this suggestion emerges from studies that show that therapy during the weekend may predict the length of stay, i.e. therapy during the weekend was related to a shorter stay, due to a larger improvement in function (English et al., 2016; Teasell et al., 2017).
Summarising, the increase in therapy time in the control group and the decrease in therapy time in the experimental group reduced the difference in therapeutic time per day between the experimental group and the control group, while the opposite is needed to determine potential recovery (Blanchet et al., 2016; El-Tamawy et al., 2014; Huijben-Schoenmakers et al., 2013; Landsmann et al., 2016; Liu Ambrose et al., 2015; Marzolini et al., 2012; Moore et al., 2015).

**Randomization and blinding**

When we measured the time spent on therapeutic activities in our first study (Huijben-Schoenmakers et al., 2009), we decided together with the professional team of the nursing home involved to develop and implement four interventions from the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009), the so-called Exercise Map therapy. We measured the time use of the stroke patients again (Huijben-Schoenmakers et al., 2013). The time spent on therapeutic activities increased significantly from 103.5 minutes as measured in our previous study (Huijben-Schoenmakers et al., 2009) to 156.5 minutes in this study ($Z = 2.86; P < 0.005; d' = 1.09$) (Huijben-Schoenmakers et al., 2013). We then decided to design our protocol study to see whether the increased therapy time affects functional outcome, cognition and mood (Huijben-Schoenmakers et al., 2014). This first nursing home, where the exercise map therapy was implemented based on the four interventions of the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009), became our first intervention group. The researcher then searched for a new nursing home to participate in our study as control group, based on convenience sampling and willingness to participate. This search process was based on coincidence: Where could we find a nursing home that would participate. The nursing home would need to have a rehabilitation unit where older comorbid frail stroke patients rehabilitate. The request to participate was made by the researcher without any prejudice and/ or any pre-knowledge concerning the quality and quantity of the stroke care of this new nursing home.
When the nursing home agreed to participate, we measured the time spent on therapeutic and non-therapeutic activities by the use of Behavioural Mapping in order to ascertain that the control group received care according to the Dutch Stroke Guidelines (Giessen et al., 2004). When this proved to be the case, this new nursing home became the control group. Based on our sample size of 81 persons in each group (Huijben-Schoenmakers et al., 2014) and on the number of the patients in the participating nursing homes, the researcher had to find more control and intervention groups. When asked by the researcher, the first control group was very willing to become intervention group. This nursing home was asked because of their adherence to our study. The process of implementing the exercise map therapy, based on the four interventions, into daily practice on the stroke unit, took some months and when the time spend on therapeutic activities increased to 150 minutes a day this nursing home became an intervention group as well. During this period the control patients of this first control group were excluded to avoid bias. In the meantime the researcher searched for a new nursing home to add to the study. She then asked a new nursing home to participate as control group in our study. This search strategy again was based on coincidence, willingness and without any prejudice and pre-knowledge about the quality and quantity of the stroke care of this new nursing home. After this new nursing home indicated its willingness to participate, we measured the time use again by Behavioural Mapping and when this was in line with the Dutch Stroke Guideline (Giessen et al., 2004) this new nursing home became control group 2. However based on our protocol study, we expected that the number of patients of four groups of nursing homes (two intervention groups and two control groups) would be sufficient to attain our sample size of 81 persons in each group and to attain power in our study (Huijben-Schoenmakers et al., 2014). Due to too many drop outs we had to ask another new nursing home to participate as control group in the same way as described above. So finally five nursing homes participated in our study, two intervention groups and three control groups. (See Flow Chart Chapter 6).
These nursing homes are located in different localities in the south and in the middle of the Netherlands.

The intervention groups of the participating nursing homes, their multidisciplinary teams, the patients and their relatives were informed about the type of treatment. The control groups were asked to participate in the study; however only the management boards, the manager and the physicians knew the true study objective. The multidisciplinary team, patients and their relatives were not informed about the type of treatment. They did not know that they belonged to the control group. The way in which stroke care was performed remained the same for them (according to the Dutch Stroke Guidelines). Neuropsychologists, trained neuropsychology students, nursing students (they did not belong to the permanent staff), and nurses from the control nursing homes, who collected the data, were blind for the study objectives. In addition the research assistants who helped entering data into SPSS were blinded for the group participation.

**Power**

We recruited 737 patients from different nursing homes, 451 patients belonged to the intervention group and 286 patients to the control group. We had to exclude 452 patients because of serious illness, aphasia, death, refusal or an MMSE < 13. This impressive dropout rate of participants illustrates the very poor condition the patients are in, when admitted to the nursing home. A first assessment was conducted on 285 patients and ultimately 106 patients were given a second assessment. Again, there was a dramatic loss of 179 patients to a follow up screening, due to illness, death, refusal or early discharge to home or to a long-stay unit. In the end, we were able to include 106 patients in our single-blind controlled study, 61 participants in the experimental group and 45 participants in the control group. Our power-
analysis showed that we had to include 81 patients in each group; in other words, our single-blind controlled study is underpowered.

The main reason why we finally stopped including new patients was that, despite all initiatives and efforts to realize a rehabilitation period of 8 weeks, the policy of the nursing homes did not change. On the other hand, our group of participants was large enough to consider our study as a feasibility study and show that a rehabilitation program that is of too short duration and with too low intensity, even for frail old, comorbid stroke patients, is not effective. In that sense, we feel that the failure to apply our rehabilitation program as originally planned really contributes to the clinical field.

**Assessment instruments**

In our study we used several assessment instruments that have been used in previous studies on stroke.

*Behavioural Mapping*

Time spent on therapeutic activities, non-therapeutic activities, location and social interaction was measured using the Behavioural Mapping technique (De Weerdt et al., 2000; De Wit et al., 2005). This technique provides registration of accurate and systematic observations that allowed us to study the daily activities of the stroke patient (De Weerdt et al., 2000; De Wit et al., 2005). The interrater reliability is high $k=0.97$ for therapeutic and non-therapeutic activities, $k=0.99$ for location and $k=0.96$ for interaction (de Weerdt et al., 2000). The observation of patients took place at 10-minute interval on weekdays (8.30 am-5.10 pm). The assumption was that the three observation domains remained unchanged between two consecutive observations (De Weerdt et al., 2000; De Wit et al., 2005). This assumption could have caused an over-or underestimation of the time spent on therapeutic or non-therapeutic activities, of where the
patient was or of whom he was with during these 10 minutes. Time spend on activities, location and social interaction can change within 10 minutes (De Weerdt et al., 2000; De Wit et al., 2005).

It is important to note that the Behavioural Mapping technique counts therapy time as a total of all activities under professional supervision (de Weerdt et al., 2000; de Wit et al., 2005). Nevertheless, in the control group, nursing care was not the subject of a goal in rehabilitation (Giesen et al., 2004), whereas the time was considered 'rehabilitation time’. In this way we might have overestimated the time spent on rehabilitation in the control group. If nursing care is not considered as a rehabilitation goal then in fact the total time spent on rehabilitation executed by therapists in the control group was approximately 50 minutes per day. On the other hand, nursing care based on the Clinical Nursing Rehabilitation Stroke Guideline (Hafsteindottir et al., 2009) was the subject of a rehabilitation goal in the intervention group. Thus, the total time spent on therapeutic activities for rehabilitation was approximately 156 minutes per day at the beginning of our study (Huijben-Schoenmakers et al., 2013) and decreased to approximately 111 minutes during the last period of the study (Chapter 6).

Our observations took place during weekdays. Accordingly to studies by De Weerdt et al. (2000) and De Wit et al. (2005) we assumed that even fewer therapeutic activities are undertaken during weekends and evenings when no therapists are available. In addition, during evenings and in weekends there are certainly fewer nurses available as well. Fully trained nursing students who were not involved on the specific stroke unit administered the Behavioural Mapping assessments.
**Recommendations**

In view of the tendency to discharge stroke patients as soon as possible to home or to a long-stay unit of a nursing home, the question that arises is how to optimize rehabilitation of stroke patients in a nursing home setting and at home. In the latter situation, the contribution made by the patients themselves and their family/caregivers to the continuation of the rehabilitation program will become more and more important.

**‘Nursing the stroke unit’**

One of the conclusions of this thesis is that it is very difficult to achieve and subsequently maintain a high standard in terms of a rehabilitation program at a stroke unit. Perhaps the first patient who needs nursing is the stroke unit itself. Which ‘non-pharmacological treatments’ are necessary for a stroke unit to obtain a Barthel Index of 20? Below, some suggestions are presented in a random order:

- **First:** more frequent use of the Behavioural Mapping Instrument to measure the time-use of the patients (De Weerdt et al., 2000; De Wit et al., 2005). This instrument provides insight into the professional’s input in the rehabilitation program. Such an approach should stimulate all team members to reflect on their own contribution to increase the therapy time for the patients. It is therefore recommended that this instrument should be used on a regular basis e.g. once a month to encourage professionals to focus on the effectiveness of the rehabilitation program. Furthermore, this instrument can stimulate professionals to invent new rehabilitation strategies for how to operate as a multidisciplinary team.

- **Second:** nursing homes with stroke units should participate in the Stroke Knowledge Network Netherlands (Kennisnetwerk CVA Nederland) (Heijnen et al., 2012). The Stroke Knowledge Network Netherlands might help other nursing homes with stroke

**Functional outcome**

The Barthel Index was used to measure functional outcome and was carried out by fully instructed nurses. The Barthel Index has a high level of reliability and validity with patients with stroke (Post et al., 1995). It measures exactly how patients perform on ADL activities and not what they could do.

**Cognition and mood**

The assessment of cognitive functioning was executed by fully instructed nursing students, neuropsychology students and psychologists who were not involved in the daily work on the ward in the nursing homes. In addition, the test battery was administered over two sessions to minimize the possibility that fatigue could affect patient’s performance.

The MMSE measures global cognitive functioning and has a reliability of 0.95 in patients with various neurological disabilities (Folstein et al., 1975). The MOCA assesses mild cognitive impairment with 90-96% sensitivity and 87% specificity (Nasreddine et al., 2005). The Behavioural Assessment of the Dysexecutive Syndrome (BADS) has an inter-rate reliability ranging from 0.88-1.00; the construct validity is as good as that of established tests (Wilson et al., 1996). The test-retest reliability of Category Fluency for animals is 0.82 and for professions 0.96 (Luteijn et al., 1983; Snijders et al., 1962). The reliability of the Rivermead Behavioural Memory Test (RBMT) ranges from 0.57 to 0.86, with the inter-scorer reliability being 0.9 or higher (Wilson et al., 1993). The Beck Depression Inventory (BDI) has a high reliability of 0.86 (Beck et al., 1961). The internal consistency of the Symptom Check List (SCL-90) ranges from 0.79 to 0.90 (Ettema et al., 1986). In general, the validity and reliability of the tests used for cognitive screening and mood are high. However, we do not know if these psychometric qualities also hold for older comorbid seriously ill stroke patients. Future research should focus on this issue.
Recommendations

In view of the tendency to discharge stroke patients as soon as possible to home or to a long-stay unit of a nursing home, the question that arises is how to optimize rehabilitation of stroke patients in a nursing home setting and at home. In the latter situation, the contribution made by the patients themselves and their family/caregivers to the continuation of the rehabilitation program will become more and more important.

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units to optimize the functioning of a multidisciplinary team. Multidisciplinary working requires clarity on how stroke professionals fulfil their roles (Clark, 2013). Indeed professionals need to work together and clarify what they are doing and why. Indeed, a closer involvement of all members in a well-functioning multidisciplinary team improves rehabilitation outcomes (Clarke, 2013; Langhorne et al., 2011). Members of the network may visit each other to learn how to implement, for example, the exercise map training and how to cope with unforeseen problems. The lessons learned, the accumulated knowledge and the skills acquired might facilitate the implementation trajectory.

- Third: nurses should play a more prominent role in the rehabilitation of stroke patients (Henderson, 1980; Kirkevold, 1997; Kirkevold, 2010). More specifically, it has been suggested that nursing care is an essential component of the total rehabilitation process (Henderson, 1980). This suggestion is intensely highlighted by the studies of Kirkevold (1997; 2010). She labelled nurses’ ‘functions as ‘interpretive, consoling, conserving and integrative’ (Kirkevold, 1997; Kirkevold, 2010). In her interpretive function, the nurse helps the patient and his/her family to understand the lesions caused by stroke. Furthermore, she helps the patient to form realistic expectations and goals, 24/7, which is essential for maintaining hope for improvement (Kirkevold, 1997; Kirkevold, 2010). The consoling function is closely related to the interpretive function and is based on setting up a faithful relationship to facilitate a normal grieving process, to advance hope and to prevent depression (Kirkevold, 1997; Kirkevold, 2010). In the conserving role, the nurse helps the patient to prevent complications such as a contracture and to maintain the basic needs (e.g. personal hygiene, mobility, energy conservation) (Kirkevold, 1997; Kirkevold, 2010). This role supports the patient to participate in and benefit from intensive therapies (Kirkevold, 1997; Kirkevold, 2010). In the integrative function, the
nurse helps the patient to integrate the newly learned activities from the therapists into their daily life on the ward. This role also focuses on assisting the patient back into his previous life at home by helping him to regain basic social functions and roles (Kirkevold, 1997; Kirkevold, 2010).

However, there is a shortage of well-educated nursing staff in nursing homes while the complexity of nursing care has increased enormously (Backhaus et al., 2016; De Brouwer et al., 2017). We suggest expanding the nursing staff to include educated nurses (at least degree level), and with nurses who have experience in working with stroke patients. They are very competent and able to encourage the vocationally trained registered nurses and certified nurse assistants to fully participate in the rehabilitation team.

Using the interventions from the exercise map provides nurses with the opportunity to fulfil these important roles. During evaluation moments of the implementation process of the exercise map, nurses often emphasized how enthusiastic they felt and good it was to be able to contribute to the rehabilitation process of their patients.

- Fourth: restore the stroke units. During the last few years of our project specialised stroke units ceased to exist as separate wards. Nowadays, frail elderly patients are admitted, for example after hip or knee surgery, heart surgery, amputation and stroke for geriatric rehabilitation to the same rehabilitation unit in the nursing home. The question is whether, in particular, the frail stroke patients with cognitive deficits do meet the best conditions for recovery on these new wards. Teasell et al. (2015) suggested in their study that the intensity of the rehabilitation should be dictated by the needs of the individual older patient and not by preconceived notions about the amount of therapy.

- Finally, prevent budget differences between individual stroke services (Vat et al., 2016).
The patient

Each patient deserves a hopeful but realistic perspective. The implementation of the exercise map therapy might be a tool to achieve such a perspective.

It has been suggested that empowered ‘self-belief’ of stroke patients resulted in better functional outcome (Sit et al., 2016). These authors observed that empowerment improves self-efficacy, which makes older stroke patients able and willing to play an active role in their exercising program and in managing their own health.

A prerequisite for this hopeful approach is, of course, the condition of the patients. This applies to both their admission to the stroke unit as well as to when they are discharged to home. So, the question arises: What is the condition of the patient? Below, some suggestions for a full assessment of patients’ functioning will be made:

- Focus the assessment on both functional abilities and cognitive functions. If the multidisciplinary team takes functional outcome as a measure for eligibility for discharge (e.g. visiting the toilet or dressing or walking stairs, with support or independently), they risk overlooking patients with a poor cognitive outcome. Cognition is directly related to functionality (Ankolekar et al., 2014; Cumming et al., 2013; Mulder et al., 2001; Nys et al., 2005; Park et al., 2015). We found in our study (Chapter 4) that executive functions and episodic memory are significantly related to functional outcome in the very early phase of recovery (Huijben-Schoenmakers et al., 2017). A decline in executive functioning and memory leads to impaired physical activity (Lesniak et al., 2008). It is also known that a decline in physical activities affects executive function and memory (Ankolekar et al., 2014; Ferencz et al., 2014; Liu-Ambrose et al., 2010). Thus combining cognitive and functional interventions in a manner that is tailored to the individual needs and goals in the very beginning of the rehabilitation may stop or
even improve this detrimental process. We therefore suggest that the patient’s functional and cognitive outcome should be assessed within the first week following admission. We have shown that early assessment is feasible (Huijben-Schoenmakers et al., 2013). The results of this assessment help professionals to develop and implement the best training program for the patient.

- Be critical on the level of physical and cognitive functioning of the patient when discharge to home is being considered. In Table 1, the results of the cognitive tests and mood questionnaires around the moment of discharge show that our patients left the stroke units in a poor cognitive condition. Most cognitive test scores were around or below cut-off points, e.g. executive functions. Particular executive functions like cognitive flexibility and planning are crucial for independent functioning (Grigsby et al., 1995). Forty per cent of the patients in the MMSE tests did not progress. Furthermore, 38% of the patients in the Eight Words test and 31% of the patients in the Eight Words Recall test did not improve, neither did 10% of the patients in the BDI test. In addition, their Barthel Index around the moment of discharge was 14.08, implying that the patients still needed care and support in daily activities e.g. washing, dressing, and climbing the stairs. Thirty-eight per cent of the patients did not improve in functional outcome (BI). The question therefore is: Can we do our utmost to rehabilitate the patient in such a way that, after discharge, the patient is able to continue his rehabilitation process successfully at home? The study by Vanroy (2016) showed that patients at home performed more steps; however they spent significantly less time on therapy compared to a rehabilitation centre. Furthermore, stroke rehabilitation in a nursing home is associated with higher proportions of stroke patients who receive physiotherapy compared to stroke survivors who live at home (Francois et al., 2017). Moreover, the studies of Lee et al. (2012) and Foley et al. (2012) showed that a
prolonged inpatient rehabilitation program of 6 months or longer achieved functional improvements in older stroke patients. In other words, an early discharge to home may not be positive for the further rehabilitation of the patient.

Table 1. The mean value of cognitive deficits and mood around the moment of discharge

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean (SD)(min-max)</th>
<th>Max score/ Cut-off point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global cognitive functioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td>24.18 (4.23) (13-30)</td>
<td>30/22</td>
</tr>
<tr>
<td>Executive functions and memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOCA</td>
<td>18.55 (5.40) (7-29)</td>
<td>30/21</td>
</tr>
<tr>
<td>Executive functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule shift cards</td>
<td>1.80 (1.40) (0-4)</td>
<td>4/2</td>
</tr>
<tr>
<td>Key search test</td>
<td>1.35 (1.34) (0-4)</td>
<td>4/2</td>
</tr>
<tr>
<td>Category Fluency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>12.83 (4.85) (0-27)</td>
<td>50/13</td>
</tr>
<tr>
<td>Professions</td>
<td>9.51 (4.59) (0-24)</td>
<td>50/13</td>
</tr>
<tr>
<td>Verbal and non-verbal memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Eight words test’ 1</td>
<td>25.75 (6.86) (6-40)</td>
<td>40/23</td>
</tr>
<tr>
<td>‘Eight words test’ Recall</td>
<td>4.06 (2.37) (0-8)</td>
<td>8/2</td>
</tr>
<tr>
<td>RBMT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face</td>
<td>12.42 (6.27) (-2-20)</td>
<td>20/18</td>
</tr>
<tr>
<td>Picture</td>
<td>35.00 (7.35) (0-40)</td>
<td>40/36</td>
</tr>
<tr>
<td>Mood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI</td>
<td>9.58 (7.12) (0-40)</td>
<td>0/16</td>
</tr>
<tr>
<td>SCL90 total score</td>
<td>37.88 (13.16) (25-91)</td>
<td>25</td>
</tr>
<tr>
<td>SCL90 anxiety</td>
<td>13.99 (4.89) (10-34)</td>
<td>10</td>
</tr>
<tr>
<td>SCL90 depression</td>
<td>23.88 (8.97) (15-57)</td>
<td>15</td>
</tr>
</tbody>
</table>

Cognitive deficits and depression at the moment of discharge. Data are given as mean (SD). Cut-off point demonstrates the existence of cognitive deficits.
Rehabilitation at home

Day-care centre

After the discharge to home, a number of patients will visit a day-care centre. Also some of the participants in our study went to the day-care centre for some days each week to continue the training that was based on the exercise map. In this way, the rehabilitation process continued at home as well, which is an important switch in the chain of stroke care (Heijnen et al., 2012). After all, more frequent and intensive training might improve the patient’s outcome (Constance et al., 2016; Liu-Ambrose et al., 2015). In addition, a study showed that a feasible and effective home-based telesurveillance and rehabilitation program over a 3-month period improved physical performance and maintained the benefits attained during hospital rehabilitation (Bernocchi et al., 2016).

The randomised controlled pilot study conducted by Koc (2015) (mean age 67) showed that an exercise program over 12 weeks focused on flexibility, strength, balance, endurance and upper-limb function at home significantly improved activities of daily living, as measured by the Barthel Index. The study showed that the exercise program is feasible for patients at home in order to continue their rehabilitation process (Koc, 2015). In chronic stroke patients (65-85 years) balance and comfortable walking speed significantly improved after a 3-month exercise program at home (Vahlberg et al., 2017). However, patients with poor balance and functional outcome needed more support to perform this exercise program (Vahlberg et al., 2017). In addition, visiting the day care centre to continue rehabilitation with professionals might support family caregivers to avoid becoming overburdened (Bastawrous et al., 2015; Menon et al., 2017; Oliva- Moreno et al., 2018). Furthermore, the study by Chang et al., (2015) showed that caregivers’ satisfaction and functional levels and health perception of older stroke patients improved when they participated in a 12-week rehabilitation program in day-care centres.
**Final conclusions**

The final conclusions of the thesis are as follows:

1) It was possible to assess the amount of time per day that an older comorbid stroke patient spent on rehabilitation in a stroke unit of a nursing home. However, considering the small group of participants (n=17), the study should be replicated with a larger number of patients, before firm conclusions can be drawn (Chapter 2).

2) It appeared to be possible to increase the therapeutic time per day, thanks to the extra effort of the nurses who were willing to get more involved in the rehabilitation program (Chapter 3).

3) A relationship between specific cognitive (dys)functions (executive functions, memory) and functional status (Barthel Index) of older comorbid stroke patients at the start of the rehabilitation at the stroke unit could be observed (Chapter 4).

4) We were not able to demonstrate the (in)effectiveness of a combination of a standard rehabilitation program, based on the Dutch Stroke Guidelines, and a rehabilitation program based on the Clinical Nursing Rehabilitation Stroke Guidelines, on motor activity, cognition, and mood in old, comorbid frail stroke patients (Chapter 6).

**Family/caregiver participation**

At home, a stroke care chain is not yet available 24/7 for all patients (Vat et al., 2016). Similarly, no specialized multidisciplinary team consisting of specialised stroke physiotherapists, occupational therapists, speech therapists, psychologists, geriatric physicians and specialised nurses is continuously at their disposal.

During our study, we additionally involved family members or relatives to assist the patients with their exercises e.g. exercises that focus on muscular strengthening e.g. upper arm movements or playing games e.g. playing cards etc. Relatives reported that it felt good to stimulate the patient to practice. In an earlier study, it has been observed that high levels of social support are related to greater functional gains; also social interaction improved (Teasell et al., 2015). In addition, caregivers who provided more personal care to stroke patients reported more psychological well being (Cameron et al., 2014). It is also important to bear in mind that stroke also affects the spouse and changes the relationship into one of being caregiver as well as partner (Satink et al., 2018). Spouses can feel burdened or sad and guilty. They often feel lonely and unprepared when their partners come home (Lutz et al., 2017; Satink et al., 2018;). They learn how to coach their partners by trial and error, without much professional support (Satink et al., 2018). Therefore spouses should be involved in stroke rehabilitation and this should be continued at home post-discharge. Spouses need support in their own emotional and role management (Satink et al., 2018). A family-centred approach can identify caregivers’ needs and can facilitate caregiver preparation (Lutz et al., 2017). We suggest this process in which family/relatives are actively involved in the rehabilitation process should be continued.
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Chapter 8

Summary / Samenvatting
Summary

Rehabilitation in older severe disabled, cognitive impaired co morbid stroke patients. The effects of increased therapy time on cognition and functional outcome.

The aim of the present thesis is to examine the time older severe ill stroke patients spend on rehabilitation at specialized rehabilitation units of nursing homes. Subsequently, it was examined if and how this rehabilitation time could be increased. In addition, in this thesis, the question will be answered whether functional outcome is associated to specific cognitive domains. Subsequently, the effect of increased therapy time on cognition and functional outcome is investigated by using the exercise map. Specific attention is paid to the role of the nurse in the rehabilitation process and in the multidisciplinary team.

Chapter 1 introduces the central concepts of the present thesis, e.g. physical and cognitive deficits after stroke, rehabilitation wards of nursing homes, older severe disabled stroke patients and the role of the nurse. Furthermore it presents the key objectives of the thesis.

Chapter 2 describes the time older severe disabled stroke patients spend on rehabilitation at the specialized rehabilitation unit of a nursing home. Literature suggests that being inactive for a long time is detrimental for recovery after stroke. The findings of this study show that patients on the rehabilitation unit in a nursing home spent only 103.5 minutes per day (20%) on therapeutic activities. Patients filled up their hours with sitting and waiting, without any interaction with others, for a large part of the day (80%).

In chapter 3, the results of the development and implementation of the exercise map, which is based on four interventions from the evidence based Clinical Nursing Rehabilitation Stroke Guidelines, are reported. The time spent on therapeutic activities increased significantly from 103.5 minutes measured in our first study (chapter 1) to 156.5 minutes in the present study. The
patients with higher scores on the Barthel Index, were more active, resulting in a significant positive Barthel Index–therapy time relationship. Nursing care in this nursing home intervention group changed from performing care as usual based on the Dutch Stroke Guideline into a more dominant involvement in the rehabilitation process of the patient and multidisciplinary team. Nurses stimulated, encouraged and helped the patient to do exercises. Indeed she is 24/7 on the ward and she can closely follow the patient during his/her recovery. She informs the multidisciplinary team about the patients’ progress. In this way therapists, psychologists, physicians can use this information to adapt their interventions and treatments to the individual needs of the patient. There is strong evidence from reviews that close multidisciplinary cooperation and integrated nursing care improves stroke patients outcome.

The aim of our cross-sectional study reported in chapter 4 is to ascertain if cognition is associated to functional outcome in this older study population. The study showed that executive functioning, especially set-shifting, and memory are significantly associated with functional outcome. Set-shifting is a necessary condition for cognitive flexibility which appears to be associated with physical activity. Reduced set-shifting may lead to less cognitive flexibility and to diminished functional performance. Furthermore being able to remember events, locations, persons is fundamental to plan, execute and evaluate everyday activities. Poor memory leaves these stroke patients with less mental instruments to perform significant tasks of daily life. All the stroke patients in this study suffered from severe cognitive deficits and functional dependency. It is therefore crucial to assess patient’s cognition and functional outcome in the very early phase of recovery in order to implement and execute straight ahead the best available combination of cognitive and functional interventions. Nurses can, after training, assist therapists and other professionals in collecting cognitive, functional and other illness related data because they are 24/7 available on the ward.
According to literature reviews, cognition and functional ability are strongly related in stroke rehabilitation. This knowledge might help to improve rehabilitation outcomes by combining evidence based functional and cognitive interventions. Most literature includes younger less severe disabled stroke patients with mild cognitive deficits. However evidence in literature is scarce regarding rehabilitation needs for cognitive and functional recovery in older severe disabled, co-morbid and cognitive impaired stroke patients. Therefore a single blind controlled study was designed to study the effect of increased therapy time on cognition and functional outcome in this frail study population in nursing homes. The study protocol is presented in chapter 5.

**Chapter 6** contains the results of our single blind controlled study. Between January 2011 and November 2016 we have examined if there is a beneficial effect of the intervention, reflected in increased therapy time, on cognition and functional outcome of these severe disabled stroke patients. Contrary to our expectations we did not find any significant improvement on cognition and functional outcome between the intervention and control group. Unfortunately we could not follow our original study protocol program. Patients were, in general, discharged after 5 weeks, instead of the programmed 8 weeks, due to decision making on the ward and legislation. Around the time of discharge they still suffered from cognitive deficits and poor functional outcome. Moreover, in the intervention group, patients received less than 150 minutes therapy per day. Indeed literature showed that a prolonged inpatient rehabilitation program from 6 months or longer improves functional outcome in older stroke patients. Furthermore at home there is no supply chain of stroke care 24/7 available for all patients. Consequently, we suggest to intensify and lengthen the inpatient rehabilitation program for a much longer period of time, at least up to a 6 month period if necessary.
Chapter 7 summarizes the main findings of this thesis. In addition this chapter discusses methodological considerations related to the used assessment instruments e.g. cognition and Behavioural Mapping, to randomisation and blinding, and to missing values. Moreover practical objectives e.g. rehabilitation of older stroke patients in nursing homes, multidisciplinary team and the role of the nurse are discussed as well. Finally the chapter presents the clinical relevance and recommendations of this thesis. To obtain better functional and cognitive outcomes it is recommended to renew the stroke unit as a skilled unit where the work of the specialised multidisciplinary stroke team leads to a higher quality of rehabilitation for older frail stroke patients. To ensure that nurses can execute their worthwhile rehabilitation role, they should be empowered by the other professionals and boards of the nursing homes. Furthermore as a role model, baccalaureate- educated registered nurses or other well experienced nurses should perform over and over again their contribution to the rehabilitation process even if other professionals do not expect them to act like that. Nurses certainly can improve patients rehabilitation outcomes and indeed there is strong evidence from meta-ethnographic and meta analytical reviews that intensive multidisciplinary cooperation involved with rehabilitation nursing care improves outcomes as well. Furthermore it is recommended that to reach a 24/7 therapeutic climate, it would absolutely be necessary that therapists and psychologists, together with nurses, work during evenings and in the weekend. Finally future studies should further explore how cognition and functional outcome can improve in older severe ill, comorbid and cognitively impaired stroke patients during their rehabilitation process.
Samenvatting

Revalidatie van oudere, functioneel afhankelijke en cognitief aangedane co-morbide patiënten met een beroerte. De effecten van toegenomen tijd besteed aan therapie op cognitie en functionaliteit.

In dit proefschrift is onderzocht hoeveel tijd oudere, functioneel afhankelijke en cognitief aangedane co-morbide patiënten met een beroerte besteden aan therapie wanneer zij revalideren op een revalidatieafdeling in een verpleeghuis. Vervolgens is onderzocht of de therapie tijd verhoogd kan worden door middel van een nieuw instrument (de oefenkaarttherapie) en of er verbeteringen aantoonbaar zijn op het gebied van cognitie en functionele afhankelijkheid. Ook is onderzocht of specifieke cognitieve domeinen en functionele uitkomst aan elkaar zijn gerelateerd. Speciale aandacht is besteed aan de rol die de verpleegkundige kan spelen binnen de revalidatie van patiënten met een beroerte en wat haar rol is binnen het multidisciplinaire team.

Het eerste hoofdstuk geeft een beschrijving van de centrale concepten zoals de revalidatieafdeling in het verpleeghuis, de lichamelijke en cognitieve verschijnselen na een beroerte, de patiënt populatie en de rol van de verpleegkundige. Daarnaast worden de onderzoeksvragen gepresenteerd.

In het tweede hoofdstuk wordt beschreven hoeveel tijd oudere, functioneel afhankelijke en cognitief aangedane co-morbide patiënten met een beroerte besteden aan therapeutische activiteiten wanneer zij revalideren op een revalidatieafdeling in een verpleeghuis. In de literatuur is beschreven dat inactiviteit schadelijk is voor de voortgang in het revalidatieproces. Aangetoond is dat patiënten slechts 103,5 minuut per dag (20%) aan therapeutische activiteiten besteden. Voor een groot deel van de dag, 80%, zitten patiënten te wachten en hebben geen contact met anderen.
De resultaten van de ontwikkeling en implementatie van de oefenkaarttherapie staan beschreven in het derde hoofdstuk. De oefeningen van de oefenkaarttherapie zijn gebaseerd op vier interventies die afgeleid zijn van de Verpleegkundige Revalidatierichtlijn Beroerte. De tijd die besteed werd aan therapeutische activiteiten is significant gestegen van 103,5 minuten (hoofdstuk 2) tot 156,5 minuten. Daarnaast is er een significante positieve relatie tussen de Barthel Index en therapietijd gevonden. Patiënten met een hogere Barthel Index waren actiever.

In de nieuwe situatie is de verpleegkundige zorg in de interventiegroep niet langer gebaseerd op inzichten van de Nederlandse Richtlijn voor Beroerte waarbij verpleegkundige zorg geen onderdeel van de revalidatie is. Bij de oefenkaarttherapie krijgt de verpleegkundige juist een sleutelrol binnen de revalidatie. Ze begeleidt en stimuleert de patiënt bij zijn oefeningen en volgt van dichtbij de patiënt in zijn revalidatieproces. Ze is immers 24/7 aanwezig op de afdeling en kan zo het multidisciplinaire team informeren over de voortgang. De behandelaars kunnen met deze informatie aan de slag zodat zij hun eigen interventies beter kunnen afstemmen op de persoonlijke behoeften en doelen van de patiënt. Er is meta-etnografisch en meta-analytisch bewijs dat intensieve multidisciplinaire samenwerking met geïntegreerde verpleegkundige revalidatiezorg de uitkomsten van patiënten met een beroerte verbeteren.

Het doel van de cross-sectionele studie, die beschreven staat in hoofdstuk vier, is om vast te stellen of in onze oudere doelgroep cognitie gerelateerd kan zijn aan functionele afhankelijkheid. Aangetoond is dat executieve functies, met name set-shifting, en geheugen significant zijn gerelateerd aan functionele afhankelijkheid. Set-shifting is een voorwaarde om cognitief flexibel te zijn en deze flexibiliteit is gerelateerd aan lichamelijke activiteit. Functionele afhankelijkheid neemt toe naarmate je minder cognitief flexibel bent. Daarnaast speelt geheugen een belangrijke rol bij revalidatie van oudere ernstig zieke patiënten. Om dagelijkse activiteiten te kunnen plannen en uit te voeren, moeten patiënten gebeurtenissen, plaatsen en personen kunnen herinneren. Wanneer je geheugen je in de steek laat, dan is het
nog moeilijker om dagelijkse activiteiten uit te kunnen voeren. Alle geïncludeerde patiënten in ons onderzoek lijden aan verschillende cognitieve problemen en zijn functioneel afhankelijk. Omdat dit een groot probleem is, zouden alle patiënten in de vroege fase van hun revalidatie een cognitieve en functionele screening moeten ondergaan, zodat zo vroeg mogelijk gestart kan worden met cognitieve en functionele interventies. Omdat verpleegkundigen 24 uur per dag aanwezig zijn op de afdeling kunnen zij, na extra scholing, een belangrijke rol spelen bij het verzamelen van deze screeningsdata zodat behandelaars hun interventies zo vroeg mogelijk kunnen inzetten.

Volgens systematische reviews uit de literatuur zijn in de revalidatie bij een beroerte cognitie en functionele afhankelijkheid sterk aan elkaar gerelateerd. Revalidatie uitkomsten met betrekking tot cognitie en functionele afhankelijkheid kunnen verbeteren wanneer gecombineerde cognitieve en functionele interventies worden ingezet. Deze wetenschappelijke kennis is echter vooral gebaseerd op onderzoeken die een jongere minder ernstig zieke populatie bevatten. Het blijkt dat wetenschappelijk onderzoek waarin oudere ernstig zieke patiënten met een beroerte werden geïncludeerd, schaars is. Om meer te weten te komen of in deze populatie meer tijd besteed aan therapie ook leidt tot betere uitkomsten op cognitief en functioneel gebied, is een single blind controlled study ontworpen. Het protocol van deze studie staat beschreven in hoofdstuk vijf.

Het zesde hoofdstuk bevat de resultaten van de single blind controlled study. Tussen januari 2011 en november 2016 is in de populatie onderzocht of de toegenomen therapietijd door de oefenkaarttherapie een gunstig effect heeft op cognitie en functionaliteit. Er is geen verbetering gevonden. Dit is mogelijk veroorzaakt doordat door wetgeving en ontslagbeleid het originele studie protocolprogramma niet meer gevolgd kon worden. De patiënten werden na gemiddeld 5 weken ontslagen. Het blijkt echter dat patiënten rondom het moment van ontslag nog veel
cognitieve problemen hebben en een Barthel Index van gemiddeld 14. Daarnaast ontvingen de patiënten in de interventiegroep minder dan de 150 minuten aan therapie. Uit de literatuur is gebleken dat een revalidatieperiode op een revalidatieafdeling van ten minste 6 maanden, uitgevoerd door het gespecialiseerde multidisciplinaire revalidatieteam, leidt tot betere functionele zelfstandigheid voor deze oudere patiënten. Hoewel de ketenzorg in opkomst is, is er op dit moment nog geen gespecialiseerde multidisciplinaire 24/7 zorg thuis aanwezig voor deze oudere kwetsbare patiënten met een beroerte. Dit revalidatieteam is wel aanwezig op de afdeling. Het verdient aanbeveling om hier veel beter gebruik van te maken door de revalidatieperiode in het verpleeghuis te intensiveren en te verlengen tot 6 maanden of langer afhankelijk van de behoefte van de patiënt.

In hoofdstuk 7 worden de belangrijkste bevindingen van het onderzoek beschreven, zowel inhoudelijk als methodologisch. De belangrijkste aanbevelingen zijn dat de duur en intensiteit van de revalidatie voor deze kwetsbare populatie door het gespecialiseerde team in het verpleeghuis moet worden uitgebreid. De verpleegkundigen kunnen vanuit hun competenties hier een belangrijke rol spelen. Om hun revalidatietaken goed uit te kunnen voeren moeten verpleegkundigen wel gesteund worden door het team, de Raden van Bestuur en de politiek. Verpleegkundigen moeten ook hun revalidatietaken op zich nemen en laten zien dat zij revalidatie uitkomsten ten goede kunnen beïnvloeden. De inzet van HBO verpleegkundigen of van zeer ervaren verpleegkundigen als rolmodel op de afdeling kan hierbij helpen. Om een goed 24/7 therapeutisch klimaat te bereiken, is het zeer wenselijk dat therapeuten en psychologen ook tijdens de avonduren en in het weekend werkzaam zijn. Ten slotte wordt aanbevolen meer onderzoek te doen naar wat er nodig is om oudere kwetsbare patiënten met een beroerte beter te laten herstellen op cognitief en functioneel gebied, omdat wetenschappelijk bewijs hierover in deze populatie nog erg schaars is.
Chapter 9

Biography and Acknowledgements
Biography

Marleen Huijben-Schoenmakers was born on 22 October 1958 in Bergen op Zoom, The Netherlands. After highschool at the Norbertuscollege in Roosendaal (Atheneum α, including mathematics and Latin), she studied Nursing at the “Vronestein” University for Applied Sciences” in Voorburg. She married in January 1982 and was a community nurse for 18 years, first full time and after birth of their four children part-time. During these 18 years she followed a number of courses for her work including counselling for healthcare for patients at the Wageningen University. In 1998 she finished her bachelor of education in nursing at the Avans University for Applied Sciences in Breda. After this, she started as a teacher at the Gradatim University for Applied Sciences for psychosocial work and from 1998 to 2013 she was a teacher at community college ROC West- Brabant where she educated certified nurse assistants and vocationally-trained registered nurses. In 2007 she completed her master degree of Nursing Science at the University of Utrecht and was offered a membership of Rho Chi part of Sigma Theta Tau International. In 2008 she became a researcher at the lectoraat of Gerontology at the Avans University for Applied Sciences in Breda. She amongst others developed and implemented the exercise map training based on four interventions of the Clinical Nursing Rehabilitation Stroke Guidelines. In 2011 her part-time post academic study “Ethics in healthcare” was completed at the Scientific Institute for Quality of Healthcare at the Radboud University Nijmegen. In 2011 she started her PhD trajectory as a part-time external PhD candidate at the department of Clinical Neuropsychology of the Free University of Amsterdam. During her PhD she presented her work at several national and international conferences. In 2013 she became a lecturer at the Avans University for Applied Sciences in Breda. She is also member of the Lectoraat of Active Aging and of the Nursing Science Alumni Society.
**Publications**

**Journal articles**


Work in progress

- Huijben-Schoenmakers M, Rademaker A, Scherder E: Therapy time, cognition, and functional outcome of severe disabled older stroke patients on rehabilitation units of Dutch nursing homes; a single blind controlled study.
  Submitted

Conference contributions

- The Future Direction of European Nursing and Nursing Research. Oral Presentation Malmö Sweden, 4 t/m 5 July 2017.
- Caring for older people: How can we do the right things right? Poster Presentation De Doelen Rotterdam. 4 t/m 7 October 2016.
- 3rd European Regional Conference Sigma Theta Tau International, 2 Oral Presentations, Utrecht 6 t/m 8 June 2016.
- Conference in verpleeghuis RIVAS Leerdam, sprekers: Professor Dr Erik Scherder, Dr Arno Rademaker, Marleen Huijben, MSc Leerdam, 18 April 2016.
- 25th European Stroke Conference, Oral Presentation, Venice, Italy 13 t/m 15 April 2016.

• International Parkinson Congress: Parkinson Disease & Movement Disorder. Oral Presentation Frankfurt, Germany, 11-13 August 2015.

• Care 4 International Scientific Nursing and Midwifery Congress; Oral and Poster Presentation, Universiteit van Antwerpen, Antwerpen, België, 4-6 February 2015.


• 2nd European Regional Conference, Sigma Theta Tau International (STTI), Oral Presentation held at the Wallenberg Conference Centre, Gothenburg, Sweden, 16 – 18 June, 2014.

• St Fransiscus Ziekenhuis afdeling neurologie, Oral Presentation, Roosendaal, 14 May 2014.

• Refresher Courses concerning screening of cognition and daily activities for students from the Avans University for Applied Sciences, professionals from Anbarg, Rivas, Wiekendael and Elisabeth Nursing Homes, 2011, 2013, 2014.


• Directors of nursing homes from Sweden, England, Germany, Oral Presentation, Verpleeghuis Wiekendael Roosendaal, 9 October 2013.

- International Safe Care Project, Oral Presentation to lecturers from Finland, Germany and Belgium, ROC West- Brabant, Roosendaal, 29 November 2012.


- Sigma Theta Tau International Honor Society. European Regional Conference Diversity across Europe: Implications for Nursing. Two Poster Presentations Cardiff Wales, UK 12-14 July 2012.


- Organisation of a symposium and Oral Presentation over onderzoek en de oefenkaarthand therapie voor zorginstellingen, ROC’s in Nederland en Raden van Bestuur, Trivium, Etten Leur, 5 October 2011.

- Oral Presentation aan Raden van Bestuur; uitnodiging via Raad van Bestuur Stichting Groenhuysen: Roosendaal, 18 February 2010.


dagbesteding van een patiënt met een beroerte op een revalidatieafdeling van een verpleeghuis. AMC Amsterdam, 30 November 2007.

Other Outputs

- Conferentie georganiseerd voor verpleeghuis RIVAS, 18 students of the Avans University for Applied Sciences joined the conference, Leerdam, 18 April 2016.
- Conferenties georganiseerd voor Wiekendael, Stichting Groenuysen, Roosendaal, Het Anbarg, Stichting Avoord, Etten Leur, Het Elisabeth te Breda. Sprekers, Professor Dr Erik Scherder, Dr Arno Rademaker, Marleen Huijben, MSc.
- Hoe maken we de gezondheidszorg gezond? Naar meer kwaliteit en minder onnodige kosten, Deelname, Concertgebouw de Vereeniging, Nijmegen 7 September 2012.
- Landelijk Moreel Beraad: Deelname February 2012.
Hoeven, mei 2018

Hartelijk dank voor de bijzondere reis die we samen hebben mogen maken. Hartelijk dank dat jullie deze reis met mij gingen maken, omdat ik uit dankbaarheid iets terug wilde geven aan onze samenleving. Tijdens de reis heb ik vele bijzondere hoogtepunten en vergezichten mogen zien, af en toe was er een klein dal. Bijzonder waren ook de close ups van aangrijpende momenten die ons steeds weer lieten zien hoe intensief de zorg is voor kwetsbare oudere mensen die revalideren in het verpleeghuis na het doormaken van een hersenberoerte. Hoe de reis begon? Ik mocht tijdens mijn afstuderen voor verplegingswetenschappen aan de Universiteit van Utrecht onderzoek doen naar de dagbesteding van CVA patiënten op een revalidatie-afdeling in een verpleeghuis. Samen met mijn toenmalige begeleiders Dr. Thora Hafsteindottir en Dr. Claudia Gamel schreven we na mijn afstuderen ons eerste artikel, dat gepubliceerd werd. Dat hebben we gevierd met koffie en gebak. Thora en Claudia, zonder dat we het toen wisten, hebben jullie mij geholpen met de eerste stappen naar mijn promotie. Heel bijzonder dus en dank je wel daarvoor.

De gevonden resultaten uit het eerste onderzoek waren voor de professionals van de afdeling reden om me te vragen iets te gaan doen aan de therapietijd en zo ontstond het idee om de oefenkaarttherapie te gaan ontwikkelen. Met veel inzet en enthousiasme zijn we toen bezig geweest met de ontwikkeling en implementatie. Wat heel leuk was dat op de afdeling leerlingen stage liepen waar ik ook les aan gaf. Ondertussen dacht ik wel dat het goed zou zijn de wetenschap te betrekken in het onderzoek. Ik zocht op internet en kwam toevallig uit op de Avans Hogeschool bij het lectoraat Gerontologie van Dr. Arno Rademaker. Ik zocht contact en mocht komen en zonder dat er nog sprake was van een promotietraject mocht ik steeds overleggen met Dr. Rademaker. Het toeval wilde ook dat ik een presentatie mocht geven op het ‘Fourth European Nursing Congress. Older Persons: the Future of Care’. Ik vond het zo leuk dat ik voor de eerste keer in mijn leven een presentatie mocht geven in het Engels. Heel toevallig sprak die middag Professor Dr. Erik Scherder in de grote zaal en tot mijn grote verbazing had Professor Scherder het over mijn eerste publicatie. Ik was zo verbaasd dat ik na afloop snel naar voren liep om de professor een hand te geven en te bedanken. We moesten er beiden om lachen.

Daarna gingen we rustig verder met het invoeren en verder ontwikkelen van onze oefenkaarttherapie. Tot onze oudste dochter Boukje zei: "mam weet je wat jij aan het doen bent? Nee? Je bent in je eentje aan het promoveren! Neem maar eens contact op met die professor van het congres". Dat duurde zeker nog 6 maanden want zomaar een professor benaderen dat was echt een brug te ver. Enfin Boukje bleef aandringen en ik belde dus uiteindelijk op en tot mijn grote verbazing mocht ik afspreken met de professor! Onze zoon Aert en mijn man Kees brachten me weg naar Amsterdam en daar sprak ik een uur met Professor Scherder. Ik deed er ook een uur over om "jij" te zeggen, iets wat professor Scherder graag wilde. Vol verwondering was ik dat ik mocht blijven om verder te werken aan wat dit onderzoek werd. En zo werd de samenwerking geboren tussen de wetenschap, het onderwijs en de praktijk. Maar liefst vijf verpleeghuizen van grote zorginstellingen, het ROC West-Brabant, de Avans Hogeschool en de VU gingen participeren in ons onderzoek. En ik vond het geweldig om alle mensen bij elkaar te mogen brengen.
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mensen bij elkaar te mogen brengen.

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bedanken.

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het onderzoek. Ik herinner me nog heel goed het antwoord van een van de eerste patiënten die
meedeed: “Mevrouw misschien helpt het niet meer voor mij, maar dan toch zeker voor alle
mensen die na mij deze ziekte krijgen”. Ongelooflijk zo ziek en nog steeds denkend aan anderen
die hetzelfde zou kunnen overkomen. Van vele patiënten kreeg ik soortgelijke antwoorden en
wanneer het voor sommige patiënten te moeilijk was om toestemming te geven dan gaven
partners en familieleden deze reden vaak aan. Met veel respect denk ik ook aan alle patiënten
terug die zo hun best deden om extra te oefenen en dat ook heel fijn vonden. Een meneer zei:
“Ik kwam als zwaar zieke patiënt binnen en dankzij alle goede zorg en het oefenen voel ik me
weer een beetje mens geworden”. Alle patiënten ondergingen ook alle neuropsychologische
testen. Deze testen hebben zoveel inzage gegeven in hoe een CVA impact kan hebben op het
brein en dan speciaal in deze zeer kwetsbare groep mensen die revalideren in het verpleeghuis.
Dank u wel dat u dat allemaal heeft gedaan om ons te helpen inzicht te krijgen in de manier
waarop we het revalidatietraject verder zouden kunnen verbeteren.

Alle zorgprofessionals bestaande uit zorghulpen, helpenden, verzorgenden, mbo
verpleegkundigen, hbo verpleegkundigen, ergotherapeuten, logopedisten, fysiotherapeuten,
diëtisten, psychologen, artsen, managers en Raden van Bestuur van alle vijf de instellingen die
participeerden in het onderzoek wil ik bijzonder bedanken. De vele momenten van overleg om
de oefenkaarthandtest te implementeren staan nog helder op mijn netvlies. Met veel inzet en
enthousiasme gingen we aan de slag en steeds probeerden we het beste uit de patiënten te halen
door hen te stimuleren extra te oefenen. De professionals van de controle instellingen werkten
graag mee aan dit wetenschappelijk onderzoek om te helpen inzicht te krijgen in hoeveel tijd er
nu werkelijk besteed wordt aan therapeutische activiteiten en hoe deze activiteiten de cognitie
kunnen beïnvloeden. Helaas bleek dat in de loop van 2015-2016 er vele veranderingen kwamen
in de zorg, ook op revalidatieafdelingen in de verpleeghuizen. Vaak verdween de aparte unit
voor de CVA revalidatie en werden de patiënten op de algemene revalidatieafdeling opgenomen
tezamen met mensen die revalideren na een heupoperatie, hartinfarct, buikoperatie etcetera.
Ook verdween vaak de dagbesteding als aparte afdeling. De werkdruk nam toe door de enorme bezuinigingen op de zorg. De bezetting in de zorg werd geminimaliseerd met veel wisselend personeel. Zorgprofessionals die goed op de hoogte waren van het werken met de oefenkaarttherapie, maar ook andere professionals verdwenen vaak naar andere instellingen zoals de ziekenhuizen. Hoewel hierdoor het onderzoek zeer onder druk kwam te staan, vergeet ik nooit hoe jullie met zoveel enthousiasme in al jullie drukte hebben geholpen en inzet hebben getoond om te proberen de zorg te verbeteren.

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hebben mij altijd alle ruimte gegeven mijn ambities waar te maken. Hedzer dank je wel dat je mij nu helpt om een PostDoc te creëren met Professor Scherder. Jullie geloven in mijn ambitie en dat is reden voor veel dankbaarheid en dat is ook bijzonder leuk.

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Marleen Huijben- Schoenmakers