

# The value of the Rehabilitation Activities Profile (RAP) as a quality sub-system in rehabilitation medicine

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## Abstract

**Purpose:** To determine whether interdisciplinary team care, using the Rehabilitation Activities Profile (RAP) as a team tool, results in a better rehabilitation outcome.

**Method:** A multilevel prospective cohort study, with a controlled before and after design. Eighteen rehabilitation teams in eight rehabilitation centres in the Netherlands and Belgium participated. Based on the level of implementation of the RAP, we compared three study groups. Consecutive adult patients ( $n = 933$ ) with stroke, amputation of the lower limb, spinal cord injury, multiple sclerosis, or other neuromuscular disorders, were followed during inpatient or outpatient rehabilitation. Main outcome measures were Barthel Index, RAP-CPM (sum score of the domains communication, personal care and mobility), Nottingham Health Profile (NHP), length of rehabilitation (LOR) and discharge destination (home vs elsewhere).

**Results:** Overall results show that scores on the Barthel Index, the RAP-CPM and the NHP improved, on average, by 18.4%, 12.7%, and 6.7%, respectively. However, treatment from a rehabilitation team that uses the RAP was associated with a significantly lower Barthel score, and small, non-significant effects on the RAP-CPM and the NHP. Partial use of the RAP resulted in non-significant, lower scores on these measures. With respect to discharge destination and LOR, there were also no significant differences between the three study groups,

with the exception of a shorter outpatient rehabilitation period for the group in which partial use was made of the RAP.

**Conclusion:** The RAP, at the current level of implementation, does not improve rehabilitation outcome.

## Introduction

Worldwide, quality of health care is an important issue. In rehabilitation settings, research on quality improvement is challenging, because of the complexity of diseases, the involvement of many disciplines in the rehabilitation process, and the assessment of rehabilitation outcomes.<sup>1, 2</sup>

In the Netherlands, which has more than 16 million inhabitants, there are 26 rehabilitation centres for inpatient and/or outpatient rehabilitation of adult patients. Furthermore, all university hospitals and most general hospitals have an outpatient rehabilitation department. Rehabilitation is an interdisciplinary activity. Professionals from various disciplines work together in rehabilitation teams, and meet regularly in team conferences.<sup>3, 4</sup> The main aim of these conferences is to determine the current functional status and prognosis of a patient, to set rehabilitation goals, and to select ways to achieve these goals.<sup>5</sup>

The central goal of rehabilitation medicine is to prevent or minimize the disabilities of a patient, aiming at optimal functioning of the patient, a role fulfilment which is as normal as possible, and optimal social integration. Therefore, a rehabilitation programme must be initiated and evaluated at the level of ability and partici-

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pation. Furthermore, patient orientation is an important component of the definition of quality of care.<sup>6</sup> Patient orientation means that rehabilitation care should be based on the needs, demands and values of the patient. It also means that the design of the care processes should be focused around the patient and, where possible, care delivery should be tailored to the individual. The involvement of the patient is important in all phases of the rehabilitation process. For instance, active participation in decision-making and in establishing treatment goals seems to have a positive impact on a patient's motivation and on the rehabilitation outcome.<sup>7</sup>

In 1991–1995 the Department of Rehabilitation Medicine at the VU University Medical Center in Amsterdam developed and made an initial evaluation of the Rehabilitation Activities Profile (RAP).<sup>8</sup> The RAP is intended to improve interdisciplinary team care in rehabilitation medicine, and provides comprehensible, relevant (for professional and patient) and concise information for the team conferences. It offers the team a structured method to document patient-specific information about communication, mobility, personal care, occupation and relationships.<sup>9</sup> The RAP is interview-based, and assesses the daily activities of the patient in observable actual behaviours. The RAP provides a unified language to facilitate interdisciplinary team communication and the formulation of common patient-centred rehabilitation goals. Improvement on every item of the activities profile and the perceived problem of the patient can be conceived as a meaningful rehabilitation goal.<sup>9, 10</sup>

The objective of this study was to determine whether goal-oriented team care, using the RAP, resulted in a better rehabilitation outcome, compared to team care without using the RAP. Two research questions were addressed. First: what are the effects of the RAP, as a quality sub-system, on the functional status and perceived health of rehabilitation patients? Second: which factors of the organization structure and care process contribute to the variation in rehabilitation outcome?

## Methods

### STUDY DESIGN

The RAP was introduced nationwide in the period 1993–1995, and a manual as well as a software package to support the team became available.<sup>9–11</sup> Therefore, it was no longer feasible to investigate the effectiveness of the RAP as a quality sub-system by carrying out a randomized controlled study. The second best option was to conduct a controlled observational study, comparing three study groups: patients treated by teams using the RAP (RAP group), teams making partial use of the RAP (partial RAP group), and control teams not using the RAP (non-RAP group). Eight rehabilitation centres and 18 teams with and without experience with the RAP participated in this study. One rehabilitation centre, with three participating teams, who had no previous experience with the RAP, and no plans to use the RAP during the study period, was defined *a priori* as a reference centre. Three hierarchically-related levels, with patients at the first level, teams at the second level and rehabilitation centres at the third level, further characterize the design of this study.

On discharge, the effects of the RAP team approach were evaluated on five patient-related outcome measures, i.e. the Barthel Index, the RAP-CPM (sum score of the domains communication, personal care, and mobility), and the Nottingham Health Profile (NHP, part I), as well as length of rehabilitation (LOR) and discharge destination (home vs elsewhere). Table 1 shows the multilevel data structure and variables used in this study. The Medical Ethics Committees of the VU University Medical Center and all participating rehabilitation centres approved the research proposal.

### QUALITY SUB-SYSTEM RAP

The RAP has been developed to systematically analyse the needs of the individual patient and to support the care process, based on a quality cycle where-by rehabilitation teams continuously assess, evaluate,

**Table 1** Multilevel data structure and variables used in the study

Level 3	8 Rehabilitation centres	<i>Determinants:</i> inpatient and outpatient capacity, teaching capacity, quality management
Level 2	18 Rehabilitation teams	<i>Intervention:</i> goal-oriented team care strategy using the RAP <i>Determinants:</i> team functioning, team size, stability of the team, stability of the team leadership, computer network facilities
Level 1	933 Patients	<i>Outcome:</i> functional status, perceived health, length of rehabilitation, and discharge destination <i>Determinants:</i> age, gender, level of education, income, employment status, diagnosis, co-morbidity, social support, health locus of control, inpatient or outpatient rehabilitation, diagnosis-specific rehabilitation, length of pre-admission period

and improve the health outcome of their patients.<sup>10, 11</sup> In the team conferences, information on the current status of the patient is compared with the desired health outcome. If there is any discrepancy between the desired outcome and the actual status, the care strategy and treatment goals should focus on decreasing this discrepancy. The RAP has been designed to facilitate the collaboration of professionals sharing the care for patients in rehabilitation.

To rank the teams with respect to the level of implementation of the RAP, a random sample of written reports of team conferences in which 106 participating patients were discussed, was analysed by a rehabilitation physician and a research physician. The reports were systematically blinded for rehabilitation centre, rehabilitation team, names of health professionals, name and address of the patient, and remarks with respect to consultations. Three 'yes' or 'no' criteria were applied, i.e.: (1) Does the majority of team reports about this patient contain a separate section on activities and participation problems, demonstrating that problem-analysis and goal-setting at the level of activities and participation is an integral part of the team approach?; (2) Are the needs of the patient the explicit starting point of each team conference (patient-centred)?; (3) Are all five RAP domains discussed or scored by the team (comprehensive approach)?<sup>9</sup> Furthermore, one overall criterion was applied to assess the level of implementation of the RAP (implemented, partially implemented, or not implemented). To validate this ranking, the results were compared with the results of a questionnaire that was completed at the start of the study, asking each team member individually about any personal experiences with the RAP in the past, and/or current use of the RAP. This finding was satisfactory (not further reported). The ranking was used to categorize the rehabilitation teams into three study groups: (1) RAP group; (2) partial RAP group; and (3) non-RAP group.

#### PARTICIPANTS AND MEASUREMENTS

##### *Rehabilitation centres*

Seven rehabilitation centres in the Netherlands and one rehabilitation centre in Belgium participated. Each participating centre offered the full range of comprehensive rehabilitation services. To control for determinants that could influence patient outcomes, the following organization characteristics were quantified: inpatient and outpatient capacity (number of beds, number of patients, number of treatments), teaching capacity of

the rehabilitation centre (the ratio of the number of trainees and the number of rehabilitation physicians), and quality management. With regard to quality management, the existence of quality assurance and quality improvement activities in each rehabilitation centre was measured according to the method developed by Wagner *et al.*<sup>12</sup> We focused on three topics: human resource management, process control based on standards, and quality assurance documents. Four development phases are distinguished: (0) orientation; (1) preparation; (2) implementation; and (3) establishment.<sup>12</sup> The data were collected before the start of patient recruitment.

##### *Rehabilitation teams*

A rehabilitation team was broadly defined as all team members in a department who are involved in any way in the patient care process. Each team member, including the entire nursing staff, was interviewed at four points in time to assess individual perception of the team environment. We used the Dutch version of the Group Environment Scale (GES), developed by Moos *et al.* in 1974 and revised in 1981.<sup>13, 14</sup> The GES contains 90 true/false statements that assess a team member's perception with regard to team cohesion, leader support, expressiveness, independence, task orientation, self-discovery, anger and aggression, order and organization, leader control, and innovation (10 domains). Higher scores on the GES are usually deemed more favourable, except for the domains of order and organization and leader control. This scale has been validated in different task-oriented, social recreational, psychotherapy and mutual support groups.<sup>13, 14</sup> The studies carried out by Halstead *et al.*<sup>15</sup> and Strasser *et al.*,<sup>16</sup> provide comparison data on rehabilitation teams. Other explanatory variables included were the size of the team, the stability of the team, the stability of team leadership during the study period of 2.5 years, and the availability of computer network facilities.

##### *Rehabilitation patients*

Per rehabilitation team, the aim was to prospectively follow 50 consecutive adult patients admitted to inpatient or outpatient rehabilitation during the 2-year recruitment period (November 1997–December 1999). Inpatient rehabilitation is generally indicated if the patient is not yet able to live at home or to attend outpatient rehabilitation, but is expected to be able to return home after some weeks of rehabilitation.<sup>17</sup> Patients were eligible for participation if they were admitted with one

of the following diagnoses: stroke, amputation of the lower limb, spinal cord injury (SCI), multiple sclerosis (MS), Guillain-Barré Syndrome, or postpoliomyelitis syndrome. A further inclusion criterion was the need to be treated by a rehabilitation team consisting of rehabilitation medicine and at least two other disciplines. For prognostic reasons, patients with an amputation or an SCI caused by a malignant process were excluded. Patients who could not be interviewed because of severe cognitive or language difficulties were also excluded.

The most important patient characteristics and outcomes in this study were functional status, perceived health, length of rehabilitation, living arrangements on admission and on discharge, time from diagnosis to admission (i.e. length of pre-admission period), specific disease characteristics, co-morbidity, social support, and health locus of control. Functional status was assessed by means of the Barthel Index and the Rehabilitation Activities Profile (RAP-21 items).<sup>18–22</sup> The RAP-21 version was used to assess the difficulty in performance and amount of help needed with regard to 21 activities in five domains: communication, mobility, personal care, occupation, and relationships.<sup>9</sup> Evidence has been found for its use as a predictive, discriminative, and evaluative index.<sup>21, 22</sup> Perceived health was assessed with the Nottingham Health Profile (NHP).<sup>23</sup> The NHP consists of two parts. Part I contains 38 yes/no statements describing six domains, i.e. energy, physical mobility, sleep, pain, emotional reactions, and social isolation.<sup>23</sup> In the pain and physical mobility domains, many questions refer to standing and walking activities.<sup>24</sup> Therefore, nine additional statements applicable to wheelchair-users were added.<sup>25</sup> Part II of the NHP measures social functioning, based on seven items about problems with daily activities and social life. The amount of social support experienced was measured with the Social Support List-Interaction.<sup>26–28</sup> This instrument consists of 34 items measuring social-emotional support and instrumental type support, with a total score ranging from 34 to 136. The Multidimensional Health Locus of Control Scale (MHLCS) was used to determine health locus of control beliefs.<sup>29–31</sup> The MHLCS consists of three dimensions of six items: internally oriented, oriented on powerful others, oriented on chance or luck (score range for each dimension: 6–36).

The patients were interviewed at two time-points. The first (baseline) interview was held within 1 week of admission to inpatient or outpatient rehabilitation, and the second interview took place within a period of 1 week before or after the date of discharge. The interviews had an average duration of 45 min, and were carried out by independent researchers employed at

the Department of Rehabilitation Medicine of the VU University Medical Center in Amsterdam, who visited the participating rehabilitation centres on a weekly basis. Information on sociodemographic variables (age, level of education, vocational status, income and living arrangements), disease characteristics, and co-morbidity were obtained by means of interviews with the patients and by data-extraction from their medical records. Length of rehabilitation was determined from the financial records of each participating centre.

#### STATISTICAL ANALYSES

In this study, patient variables are assumed to be not fully independent of team variables and institutional variables. Therefore, to determine whether the observed variation in rehabilitation outcome was attributable to individual differences between patients (case-mix), and/or to the influence of centre or team characteristics, multilevel regression modelling was performed.<sup>32, 33</sup> For all tests the level of significance was set at 0.05.

#### *Model specification*

For each of the five outcome measures a separate model was specified, with the outcome measure on discharge as the dependent variable, the RAP implementation measure (two dummy variables to identify the three study groups) as the predictor of interest, and the other variables as potential confounders or effect modifiers (see table 1). For each individual, scores on the continuous explanatory variables were transformed by subtracting the grand mean of the total group. Thus, for the admission score of the Barthel Index, the RAP-CPM, the NHP, age, social support, and health locus of control, we used grand mean centred scores. The practical purpose of centering an explanatory variable is to simplify the interpretation of the intercept and the random terms, and to facilitate the estimation procedure.<sup>33</sup> All analyses were performed in MLwin, version 1.10.007.<sup>34</sup>

*Functional status and perceived health.* Before starting the modelling approach, scores on the Barthel Index, the RAP-CPM and the NHP were scaled with a minimum is 0 and a maximum is 100. The linear regression model was started with a random intercept, two dummy variables for the team approach (RAP group, respectively partial RAP group, relative to the non-RAP group), the grand mean centred admission score and other explanatory patient characteristics (level 1). To test whether the effects of the RAP team approach were

modified by diagnosis or admission score, interaction terms between RAP team approach and diagnosis and admission score were included in each model. The next step was the inclusion of explanatory team variables (level 2). The group mean of the admission score was also introduced into the model as a level 2 variable. Finally, explanatory variables about the rehabilitation centres (level 3) were added. Explanatory variables were added to the model one at a time, and all explanatory variables were used with fixed slopes. However, the admission score also had a random parameter at patient level. Differences in model deviances were used to test the additional value of (sets of) explanatory variables. The Iterated Generalized Least Squares (IGLS) algorithm was used to estimate the coefficients of each model. In order to produce less biased estimates, the Restricted IGLS algorithm was used for the final model.<sup>33</sup>

*Discharge destination.* Logistic multilevel regression analysis with discharge destination as a dichotomous outcome (whether or not the patient was discharged to home) was performed to estimate the influence of the RAP team approach on the probability of being discharged to home. In the model specification phase, the parameter estimates were based on the second order penalized quasi-likelihood method (PQL). The (multivariate) Wald test was used to assess the additional value of each explanatory variable.<sup>32, 33</sup>

*Length of rehabilitation (LOR).* To compare the length of rehabilitation (in days) of the three study groups, only patients who were discharged to home (665 inpatients and 152 outpatients) were included in the analysis. We did not perform a survival analysis, because patients who are not discharged to home but, for instance, to a hospital for medical reasons, cause informative loss-to-follow-up censoring.<sup>35</sup> Only five patients were still in rehabilitation at the end of the study (end-of-study censoring). Length of rehabilitation was transformed to near normality by taking the natural logarithm. The linear regression model was specified in the same way as described for functional status and perceived health.

#### *Validity of the models*

Assumptions of the linear regression models (i.e. all residuals have the same variances in all groups, do not depend on explanatory variables, and are normally distributed) were checked by performing residual analyses and examining the residual plots.<sup>34</sup> Residual

analyses may suggest model improvements. In this study, outlying observations at patient level were excluded from the model (two patients or less), whereas variables not yet included in the model, and showing a relationship with the residuals, were added to the model.

## **Results**

### CHARACTERISTICS AND FUNCTIONAL STATUS ON ADMISSION

In total, 933 patients were followed during their rehabilitation period. Four rehabilitation teams, treating 214 participating patients, used the RAP in their treatment strategy. Five teams, treating 282 participants, made partial use of the RAP, and 437 patients were treated by nine teams not using the RAP (controls). Tables 2–4 present the baseline characteristics of the participating patients, teams and rehabilitation centres, for each study group separately as well as for the total group.

The patients had an average age of 56 years (SD 13.8), and 61% were male. Fifty per cent of the patients were admitted because of a stroke, 17% because of amputation of the lower limb, 14% had an SCI, 15% had multiple sclerosis, and 4% had some other diagnosis. Most of the patients (83%) were treated in an inpatient department. Sociodemographic variables show that 24% of the participants were living alone, and 76% were living with other people. Sixty-five per cent had a low or basic level of education, 35% were retired, 21% received a disability pension, and 27% were in part-time or full-time employment or studying.

The functional status on admission is shown in table 4. For the total group of rehabilitation patients, the mean score on the Barthel Index was 62.8%, or 12.6 points on the 20-point scale, with a standard deviation (SD) of 26.4%, or 5.3 points. The mean score on the RAP-CPM was 47.5% (SD 17.2%), and on the NHP it was 29.7% (SD 18.1%). A score of 100% on the Barthel Index represents a good functional status, whereas a score of 100% on the RAP-CPM and the NHP represents a bad outcome.

The most remarkable difference between the three study groups at baseline concerns the percentage of outpatients (0, 3.2, and 34.8% in the RAP group, partial RAP group, and non-RAP group, respectively, table 4). Patients in the non-RAP group had a better initial functional status, compared to patients in the other two groups. Their mean scores on the RAP and the NHP were lower, and their mean Barthel score was higher. Furthermore, the non-RAP group showed less comorbidities than the other two study groups. These

**Table 2** Baseline characteristics of the rehabilitation centres, per study group

Characteristics rehabilitation centre	RAP group 2	Partial RAP group 3	Non-RAP group 5	Total 8
<i>Number of centres*</i>				
<i>Inpatient capacity†</i>				
Number of beds	80–105	80–105	0–134	0–134
Number of patients/year	355	355–391	0–549	0–549
Number of treatment hours/yr	31720–37387	24589–37387	0–56937	0–56937
<i>Outpatient capacity†</i>				
Number of patients/year	1130	435–1130	323–1583	323–1583
Number of treatment hours/yr	40481–83744	21228–83744	43110–48450	21228–83744
<i>Teaching capacity†‡</i>				
<i>Quality management</i>	0.25–0.40	0.25–0.71	0.00–0.87	0.00–0.87
0. orientation phase	–	–	1	1
1. preparation phase	–	–	–	–
2. implementation phase	2	2	3	5
3. establishment phase	–	1	1	2

\*The total number of participating rehabilitation centres ( $n = 8$ ) does not correspond to the sum of the centres mentioned in the study groups, because two centres are mentioned twice (with each centre having two teams in the RAP group, and one team in the partial RAP group).

†Range (lowest - highest score).

‡Ratio of number of trainees and number of rehabilitation physicians.

**Table 3** Baseline characteristics of the rehabilitation teams, median scores per study group

Characteristics rehabilitation team	RAP group 4	Partial RAP group 5	Non-RAP group 9	Total 18
<i>Number of teams</i>				
Team size	36	51	30	35.5
Team stability (%)*	59.2	70.5	72.4	70.3
Stability of team leadership†	3	2	4	9
% staff with computer network	0	52	6	5
<i>Group Environment Scale (median)</i>				
Team cohesion	– 0.440	0.105	0.552	0.176
Leader support	– 0.053	0.077	– 0.524	0.082
Expressiveness	0.683	0.032	– 0.161	– 0.054
Independence	0.003	0.098	– 0.334	– 0.076
Task orientation	– 0.118	0.111	– 0.267	0.149
Self-discovery	0.168	0.708	– 0.213	– 0.010
Anger and aggression	0.008	– 0.218	– 0.673	– 0.264
Order and organization	– 0.134	– 0.180	0.572	– 0.051
Leader control	– 1.222	– 0.444	0.454	0.175
Innovation	– 0.390	0.504	– 0.177	– 0.021

\*Team stability defined as the percentage of team members per team participating during the full study period.

†The number of teams with one team leader (same person) during the whole study period.

differences between the three study groups (RAP group, partial RAP group, non-RAP group) on admission emphasize the importance of adjustment for baseline differences in the relationship between the RAP team approach and the five outcome measures. The variables summarized in tables 2–4 were used in the multilevel models as potential confounders.

Seventy-three patients (7.8%) could not be interviewed on discharge, due to illness or death ( $n = 29$ ), refusal of the second interview ( $n = 18$ ), logistic problems ( $n = 15$ ), or other reasons ( $n = 11$ ). Therefore,

there is no available information about their discharge scores on the Barthel Index, the RAP-CPM, or the NHP, but there is information about their LOR and discharge destination.

The scores on the Barthel Index, the RAP-CPM and the NHP, as well as the LOR are presented in table 5. The median LOR for 817 patients who were discharged to home was 99 days (quartiles: 58–154 days). Twelve per cent of the patients were discharged to another destination. Overall results show that the scores on the Barthel Index, the RAP-CPM and the NHP improved,

on average, by 18.4% (SD 20.6%), 12.7% (SD 14.0%), and 6.7% (SD 13.7%), respectively, for all patients measured on discharge.

#### EFFECTS OF THE RAP TEAM APPROACH

##### *Functional status and perceived health*

The unadjusted and adjusted effects of the RAP team approach and the 95% confidence intervals on functional status and perceived health, for each study group relative to the non-RAP group are presented in table 6. To simplify the interpretation, it should be noted that on all three scales in this table a decrease in score (- sign) indicates a negative effect, and an increase in score (+ sign) indicates a positive effect. The adjusted results show that treatment from a rehabilitation team using the RAP is associated with a significantly lower score on the Barthel Index (- 3.7%, 95% CI: - 7.0 to - 0.3), and a small, non-significant improvement in the scores on the RAP-CPM (0.1%, 95% CI: - 4.4 to 4.6) and the NHP (1.5%, 95% CI: - 1.1 to 4.0). Treatment by a rehabilitation team that made partial use of the RAP had a non-significant negative effect on all three continuous outcome measures, compared to treatment by teams that did not use the RAP.

##### *Discharge destination*

The percentage of patients who were discharged to home in the three study groups was 90.6, 81.5 and 91, respectively (table 5). The unadjusted odds ratios for the RAP and partial RAP groups are 1.03 (95% CI: 0.35 to 3.00) and 0.31 (95% CI: 0.12 to 0.77), respectively. After adjustment for baseline differences, the odds ratios from the logistic multilevel regression analysis for the RAP approach are 1.98 (95% CI: 0.59 to 6.67), and for the partial RAP approach 0.56 (95% CI: 0.19 to 1.68), with the non-RAP approach as reference. An odds ratio of more than one indicates that the intervention group is superior to the reference group. Neither of the adjusted odds ratios is significant. If the analysis is restricted to inpatients only, the results are similar: adjusted odds ratios for discharge to home are 1.82 (95% CI: 0.47 to 7.05) and 0.49 (95% CI: 0.14 to 1.71), respectively.

##### *Length of rehabilitation (LOR)*

The median length of rehabilitation for the patients who were discharged to home was 111 days in the

RAP group (quartiles: 76–157 days), and 93 days in the partial RAP and the non-RAP groups (quartiles: 59–149 days and 51–154 days, respectively) (table 5). After adjusting for differences in case-mix and other team and centre determinants, the regression model resulted in two effect-modifying variables. The type of rehabilitation (inpatient or outpatient) and the teaching capacity of the centre (mean ratio trainees/rehabilitation physicians: 0.47, range: 0.00 to 0.87) were found to modify the effect of the intervention (table 7). At a mean teaching capacity of 0.47, the length of stay of inpatients is more or less the same for those treated by a RAP team and those treated by a non-RAP team (multiplicative effect 0.99, 95% CI: 0.70 to 1.40), whereas inpatients who were treated by a partial RAP team stayed longer in the rehabilitation centre (multiplicative effect 1.15, 95% CI: 0.94 to 1.41). Inpatients who were treated in a centre with a high teaching capacity were discharged sooner than inpatients treated in centres with a low teaching capacity. With respect to outpatients, we only calculated the multiplicative effect for the partial RAP group vs the non-RAP group, because there were no outpatients in the RAP group. Outpatient rehabilitation, at a mean teaching capacity, was 0.49 times shorter for the partial RAP group (95% CI: 0.30 to 0.79).

#### EFFECTS OF OTHER ORGANIZATION AND PROCESS CHARACTERISTICS

The predictors of interest in addressing the second research question were the variables for the rehabilitation centre and the rehabilitation team (table 1). However, the five final regression models showed no consistent influence of those level 3 and level 2 variables. Team size, two GES domains (e.g., independence and anger), computer network facilities, and teaching capacity were each included in only one of the models. Neither the capacity of the rehabilitation centre, nor the level of quality management had an independent effect on the outcomes. Patient characteristics, such as the admission scores on the Barthel Index, the RAP-CPM, and the NHP, and diagnosis and co-morbidity, were the most influential factors with regard to rehabilitation outcome.

#### **Discussion**

The main objective of this study was to determine whether co-ordinated rehabilitation team care, using the Rehabilitation Activities Profile, resulted in a better functional status and well-being of patients on discharge from the rehabilitation centre, a shorter length of reha-

**Table 4** Patient characteristics and functional status on admission (baseline), per study group

<i>Patient characteristics<sup>1</sup></i>	<i>RAP group</i> 214	<i>Partial RAP group</i> 282	<i>Non-RAP group</i> 437	<i>Total</i> 933
<i>Number of patients</i>				
<i>Gender</i>				
Men	133 (62.1)	179 (63.5)	254 (58.1)	566 (60.7)
Women	81 (37.9)	103 (36.5)	183 (41.9)	367 (39.3)
<i>Mean age (SD)</i>	57.3 (13.0)	56.0 (14.5)	55.3 (13.7)	56.0 (13.8)
<i>Living arrangements</i>				
Living alone	57 (26.6)	83 (29.4)	81 (18.5)	221 (23.7)
Living with others	157 (73.4)	199 (70.6)	356 (81.5)	712 (76.3)
<i>Level of education</i>				
Basic	42 (19.7)	74 (26.4)	89 (20.6)	205 (22.1)
Low	93 (43.7)	113 (40.4)	188 (43.4)	394 (42.5)
Intermediate	38 (17.8)	66 (23.6)	83 (19.2)	187 (20.2)
High	40 (18.8)	27 (9.6)	73 (16.9)	140 (15.1)
Unknown	1	2	4	7
<i>Vocational status</i>				
Job/education	54 (25.2)	72 (25.5)	128 (29.4)	254 (27.3)
Housewife	21 (9.8)	22 (7.8)	37 (8.5)	80 (8.6)
Unemployed	17 (7.9)	11 (3.9)	8 (1.8)	36 (3.9)
Disability pension	37 (17.3)	60 (21.3)	97 (22.2)	194 (20.8)
Retired	80 (37.4)	101 (35.8)	149 (34.2)	330 (35.4)
Other	5 (2.3)	16 (5.7)	17 (3.9)	38 (4.1)
Unknown	-	-	1	1
<i>Income</i>				
Low	63 (33.5)	94 (38.7)	112 (31.3)	269 (34.1)
Medium	93 (49.5)	118 (48.6)	185 (51.7)	396 (50.2)
High	32 (17.0)	31 (12.8)	61 (17.0)	124 (15.7)
Unknown	26	39	79	144
<i>Diagnosis</i>				
Stroke	151 (70.6)	109 (38.7)	206 (47.1)	466 (49.9)
Amputation	31 (14.5)	68 (24.1)	61 (14.0)	160 (17.1)
SCI	15 (7.0)	60 (21.3)	57 (13.0)	132 (14.1)
MS	11 (5.1)	29 (10.3)	97 (22.2)	137 (14.7)
Other	6 (2.8)	16 (5.7)	16 (3.6)	38 (4.1)
<i>Admitted from</i>				
Acute hospital	187 (87.4)	237 (84.0)	259 (59.3)	683 (73.2)
Home	20 (9.3)	34 (12.1)	142 (32.5)	196 (21.0)
Other	7 (3.3)	11 (3.9)	36 (8.2)	54 (5.8)
<i>Pre-admission period</i>				
< 1 month	73 (34.3)	133 (47.3)	154 (35.3)	360 (38.7)
1–2 months	80 (37.6)	58 (20.6)	82 (18.8)	220 (23.7)
2–3 months	25 (11.7)	22 (7.8)	31 (7.1)	78 (8.4)
3–6 months	9 (4.2)	9 (3.2)	31 (7.1)	49 (5.3)
6–12 months	5 (2.3)	2 (0.7)	15 (3.4)	22 (2.4)
> 12 months	21 (9.9)	57 (20.3)	123 (28.2)	201 (21.6)
<i>Type of rehabilitation</i>				
Outpatient	-	9 (3.2)	152 (34.8)	161 (17.3)
Inpatient	214 (100.0)	273 (96.8)	285 (65.2)	772 (82.7)
<i>Disability (yes)</i>				
Communication	57 (26.6)	39 (13.8)	68 (15.6)	164 (17.6)
Cognition	63 (29.4)	84 (29.8)	101 (23.1)	248 (26.6)
Behaviour	13 (6.1)	21 (7.4)	22 (5.0)	56 (6.0)

(continued overleaf)

**Table 4** (continued)

<i>Patient characteristics<sup>1</sup></i> <i>Number of patients</i>	<i>RAP group</i> <i>214</i>	<i>Partial RAP group</i> <i>282</i>	<i>Non-RAP group</i> <i>437</i>	<i>Total</i> <i>933</i>
<i>Co-morbidity (yes)</i>				
Neurological	85 (39.7)	90 (31.9)	168 (38.4)	343 (36.8)
Orthopedic/rheumatic	157 (73.4)	200 (70.9)	282 (64.5)	639 (68.5)
Cardiovascular	141 (65.9)	177 (62.8)	226 (51.7)	544 (58.3)
Respiratory	48 (22.4)	76 (27.0)	71 (16.2)	195 (20.9)
Vision	50 (23.4)	90 (31.9)	145 (33.2)	285 (30.5)
Hearing	18 (8.4)	38 (13.5)	50 (11.4)	106 (11.4)
Neuropsychological	140 (65.4)	150 (53.2)	265 (60.6)	555 (59.5)
Skin	38 (17.8)	81 (28.7)	40 (9.2)	159 (17.0)
Gastrointestinal	41 (19.2)	59 (20.9)	74 (16.9)	174 (18.6)
Systemic	125 (58.4)	182 (64.5)	181 (41.4)	488 (52.3)
Urogenital	39 (18.2)	65 (23.0)	59 (13.5)	163 (17.5)
Other	84 (39.3)	112 (39.7)	175 (40.0)	371 (39.8)
<i>Barthel Index<sup>2</sup></i>	56.96 (25.33)	55.07 (25.09)	70.55 (25.52)	62.76 (26.36)
<i>Rehabilitation Activities Profile<sup>2</sup></i>				
Communication	14.64 (18.65)	8.45 (13.94)	9.19 (15.15)	10.21 (15.85)
Personal care	48.41 (19.97)	49.09 (19.96)	39.25 (21.87)	44.33 (21.40)
Mobility	67.11 (18.49)	69.94 (18.12)	56.54 (22.06)	63.02 (21.04)
Occupation	93.40 (12.99)	94.01 (12.81)	79.08 (22.31)	86.88 (19.35)
Relationships	13.16 (18.07)	13.36 (20.24)	15.78 (20.93)	14.45 (20.12)
RAP-CPM <sup>2</sup>	51.60 (15.83)	52.22 (15.17)	42.37 (17.65)	47.47 (17.19)
<i>Nottingham Health Profile<sup>2</sup></i>				
Sleep	31.51 (18.68)	31.29 (18.32)	27.74 (17.39)	29.67 (18.05)
Energy	31.68 (32.08)	30.21 (30.85)	23.98 (30.04)	27.63 (30.92)
Social isolation	32.55 (37.03)	33.57 (37.94)	35.47 (35.92)	34.23 (36.78)
Social isolation	18.22 (22.66)	13.88 (20.13)	15.01 (20.36)	15.41 (20.88)
Physical mobility	58.82 (28.34)	63.83 (24.72)	53.18 (28.67)	57.69 (27.81)
Pain	21.50 (27.13)	22.29 (28.64)	19.57 (25.64)	20.83 (26.91)
Emotional reactions	23.05 (24.87)	21.67 (25.02)	19.48 (23.22)	20.96 (24.17)
<i>Multidimensional Health Locus of Control<sup>2</sup></i>				
Internal	23.44 (5.36)	23.09 (5.06)	22.05 (4.95)	22.69 (5.11)
Powerful others	22.50 (6.48)	21.56 (6.06)	21.12 (5.87)	21.58 (6.09)
Chance or luck	22.58 (5.41)	21.63 (5.26)	22.09 (4.98)	22.06 (5.17)
<i>Social Support List<sup>2</sup></i>	85.38 (16.58)	83.84 (16.76)	83.96 (17.71)	84.25 (17.15)

RAP = Rehabilitation Activities Profile; CPM = sum score of the RAP domains communication, personal care, and mobility.

<sup>1</sup> The patient characteristics are mainly presented as number of patients, with percentages between parentheses.

<sup>2</sup> Mean scores and standard deviation. The score range of the RAP, the Barthel Index and the NHP is 0–100%. However, a score of 100% on the Barthel Index represents a good functional status, whereas a score of 100% on the RAP and the NHP represents a bad outcome. The score range on the Multidimensional Health Locus of Control Scale dimensions is 6–36, and on the Social Support List 34–136.

bilitation and a higher percentage of patients being discharged to home. Our findings indicate that use of the RAP only resulted in very small changes in these rehabilitation outcomes. What explanations do we have for this apparent lack of effect? Several processes could have disturbed the methodological quality of this study comparing the performance of different rehabilitation teams.<sup>36</sup>

#### CASE-MIX

Observational studies are considered to be less valid than randomized trials.<sup>37</sup> However, there is evidence that

the results of well-designed observational studies are not systematically biased when compared to randomized studies.<sup>38</sup> The confounding effect of case-mix variation is probably one of the most compromising types of bias in non-randomized studies.<sup>39</sup> To achieve a meaningful interpretation, we tried to correct for case-mix differences by using multivariate analysis techniques. We measured and controlled for most of the prognostic patient, team and centre characteristics relating to rehabilitation outcomes.<sup>40</sup> In our opinion, it is therefore unlikely that inadequate adjustment for variation in case-mix or other team and centre variables has obscured the effect of the RAP.

**Table 5** Scores on the outcome measures, per study group

<i>Outcome characteristics</i>	<i>RAP group</i>	<i>Partial RAP group</i>	<i>Non-RAP group</i>	<i>Total</i>
Participants on admission	214	282	437	933
Withdrawals	10 (4.7%)	25 (8.9%)	38 (8.7%)	73 (7.8%)
Participants on discharge	204	257	399	860
<i>Barthel Index</i> <sup>1</sup>				
Admission	56.96 (25.33)	55.07 (25.09)	70.55 (25.52)	62.76 (26.36)
Discharge	82.55 (20.87)	77.41 (22.89)	83.45 (20.76)	81.43 (21.58)
Change	25.29 (20.48)	22.61 (22.34)	12.07 (17.42)	18.36 (20.58)
<i>RAP-CPM</i> <sup>1</sup>				
Admission	51.60 (15.83)	52.22 (15.17)	42.37 (17.65)	47.47 (17.19)
Discharge	34.45 (16.49)	38.52 (15.83)	31.78 (17.42)	34.43 (16.97)
Change	- 16.78 (13.09)	- 13.82 (13.27)	- 9.78 (14.27)	- 12.65 (13.98)
<i>Nottingham Health Profile</i> <sup>1</sup>				
Admission	31.51 (18.68)	31.29 (18.32)	27.74 (17.39)	29.67 (18.05)
Discharge	20.90 (16.07)	24.41 (20.26)	22.34 (17.97)	22.61 (18.29)
Change	- 10.48 (14.04)	- 6.89 (14.28)	- 4.60 (12.71)	- 6.70 (13.70)
<i>Discharge destination/length of rehabilitation</i>				
Home	193 (90.6%)	229 (81.5%)	395 (91.0%)	817 (88.0%)
Length of rehab, median days	111	93	93	99
Quartiles	76–157	59–149	51–154	58–154
Elsewhere	20 (9.4%)	52 (18.5%)	39 (9.0%)	111 (12.0%)
Length of rehab, median days	155	132	134	134
Quartiles	72.5–262.5	43–177.5	63–241	59–209
Unknown (end-of-study censoring)	1	1	3	5

RAP = Rehabilitation Activities Profile; CPM = sum score of the RAP domains communication, personal care, and mobility.

<sup>1</sup>Mean scores and standard deviation. The score range of the RAP-CPM, the Barthel Index and the NHP is 0–100%. However, a score of 100% on the Barthel Index represents a good functional status, whereas a score of 100% score on the RAP-CPM and the NHP represents a bad outcome. Decreases in Barthel Index scores (– sign) represent a negative effect, whereas decreases in RAP-CPM and NHP scores indicate a positive effect.

**Table 6** Unadjusted and adjusted effects (%) of the RAP team approach with 95% confidence intervals, compared to the non-RAP group, on the continuous outcome measures on discharge

	<i>RAP group</i>	<i>95% CI</i>	<i>Partial RAP group</i>	<i>95% CI</i>
<i>Barthel Index</i>				
Unadjusted effect	- 1.242	- 13.297 to 10.813	- 6.861	- 18.213 to 4.491
Adjusted effect	- 3.666	- 7.037 to - 0.295	- 2.541	- 5.705 to 0.623
<i>RAP-CPM</i>				
Unadjusted effect	- 2.798	- 12.051 to 6.455	- 5.805	- 14.798 to 3.188
Adjusted effect	0.097	- 4.395 to 4.589	- 3.139	- 8.036 to 1.758
<i>Nottingham Health Profile</i>				
Unadjusted effect	4.221	- 3.208 to 11.650	- 3.471	- 10.748 to 3.806
Adjusted effect	1.454	- 1.069 to 3.977	- 1.891	- 4.860 to 1.078

A negative (–) sign indicates a negative effect, whereas a positive sign indicates a positive effect.

For more detailed information on the regression models of each outcome measure, please visit our website: <http://www.emgo.nl/publications/>.

**Table 7** Adjusted multiplicative effects of the RAP team approach on length of rehabilitation for rehabilitation centres with a mean teaching capacity of 0.4694

	<i>Multiplicative effect</i>	<i>95% CI</i>	<i>Chi-square (1 df)</i>	<i>P-value</i>
<i>Inpatients</i>				
RAP vs non-RAP	0.989	0.697 to 1.404	0.005	0.944
Partial RAP vs non-RAP	1.153	0.943 to 1.409	2.333	0.127
RAP vs partial RAP	0.858	0.602 to 1.224	0.865	0.352
<i>Outpatients</i>				
Partial RAP vs non-RAP	0.489	0.303 to 0.789	10.405	0.001

CI = confidence interval, df = degrees of freedom, RAP = Rehabilitation Activities Profile.

For more detailed information on the multilevel regression models of each outcome measure, please visit our website: <http://www.emgo.nl/publications/>.

#### OUTCOME INDICATORS

The basic assumption underlying the implementation of quality assurance activities is that effective and efficient care processes will lead to improved clinical outcomes. Although process indicators seem to be more sensitive to differences in the quality of care, outcome measures are of greater intrinsic interest.<sup>41, 42</sup> With the Barthel Index, the RAP-CPM and the NHP, we have explicitly chosen to measure patient-centred outcomes. In the context of post-acute rehabilitation, these measures have all been found to be responsive in detecting clinically relevant within-patient changes. The magnitude of change, quantified as a Standardized Response Mean in our total study population, i.e. including those patients who did not improve, was 0.89 for the Barthel Index, 0.90 for the RAP-CPM, and 0.49 for the NHP. However, adding a more responsive outcome measure, such as Goal Attainment Scaling, would still have produced the same results.<sup>43, 44</sup> The responsiveness of the measures is not at issue, but rather the differences in change between the three study groups. As the definition of quality in health care also includes the concept of efficiency, the length of the rehabilitation period and the discharge destination were also taken into account.<sup>6</sup> Clear treatment goals and end-points can probably improve the cost-effectiveness of rehabilitation medicine. We hypothesized that teams using the RAP are more efficient. Although patients might be discharged from the rehabilitation centre if they reach a certain functional level, we expected that this functional level would have been reached sooner in patients treated by the teams using the RAP. However, no significant effects were found, either on functional status and perceived health, or on length of rehabilitation.

With respect to the effects of the RAP team approach, we hypothesized that this approach would be more effective in complex situations. Fine-tuning and co-ordination of all treatment activities seems to be more crucial for subgroups of patients with a major stroke and evident cognitive problems than for patients with a non-complicated spinal cord injury. However, the final regression models did not include interactions between the RAP and diagnosis, co-morbidities, or for instance the functional scores on admission to the centre. Moreover, there was no indication whatever that, in the RAP groups, a higher percentage of patients with a poor functional status on admission were discharged to home.

Unlike others, we have not measured the perceptions of the team members.<sup>10, 45–48</sup> Quality of care is dependent on balancing and satisfying the needs of all relevant stakeholders, including the care-providers. From our

point of view, however, staff satisfaction could only be considered as an intermediate factor between the rehabilitation process and the rehabilitation outcome. The patient is the final judge of the product and the quality of the service.

#### FOLLOW-UP PERIOD

It has been suggested that well-organized discharge planning might result in more adequate provision of care following discharge. However, our study focused only on the rehabilitation period itself, and patients were not followed after discharge from the rehabilitation centre. Whether the functional benefits achieved during rehabilitation were maintained after discharge and subsequent return to work or education, or whether productive use of leisure time could actually be achieved, was not studied. This would probably require an extended follow-up period of several years. For instance, in a Dutch study it was found that patients with an amputation of the lower limb needed a mean period of 2 years to return to work.<sup>49</sup>

#### LEVEL OF IMPLEMENTATION

In our study, ranking of the level of implementation of the RAP was based on written reports of team conferences. In the reports, we especially focused on information about the needs of the patient in the five activities and participation domains of the RAP. The results were used to categorize the rehabilitation teams into three study groups. Not only the three *a priori* defined control teams, but six other teams were also classified as controls. Contamination bias, i.e., the unwanted transfer of intervention effects into the control group did not seem to be as such a problem in this study, but much more of a problem was the lack of systematic implementation of the RAP in the two other study groups.<sup>50</sup> From the analyses of the team reports, we furthermore concluded that none of the non-RAP or partial RAP teams used other structured, or patient-centred methods in their team approach. Our RAP ranking, based only on information from written team reports, probably gives a far too optimistic picture with regard to the complete implementation of the RAP as a quality sub-system.

Team conferences are considered to be of crucial importance for the quality of the rehabilitation treatment provided. The RAP primarily aims at improving the structure of these conferences. However, do conference reports tell us how team members communicate with each other, and, more importantly, whether the

team is functioning effectively? Are team members willing to deviate from their individual discipline-specific goals, expectations and treatment philosophies, in order to offer the patient co-ordinated, integrated rehabilitation treatment?<sup>48</sup> The lack of effects found in this study is probably also due to the fact that the RAP is mainly intended to change multidisciplinary teams into interdisciplinary teams.<sup>10, 45</sup> Teams appear to operate predominantly in one of the following three models: (1) multidisciplinary team, i.e., a group of people who perform tasks independent of one another, with individual expertise, and provide services directly to the patient with little co-ordination or consultation with each other; (2) interdisciplinary team, i.e., a group of people who perform tasks independent of one another, but who co-ordinate their efforts to maximize the benefits for the patient and minimize the duplication of procedures and services; (3) transdisciplinary team, i.e., a group of people who perform tasks collaboratively by sharing not only information, but also roles. Mutually agreed priority goals are formulated, and information, knowledge, and skills are transferred across discipline boundaries.<sup>46, 51</sup> The implementation of the Children's RAP also showed that four hierarchical sub-steps were needed to change a multidisciplinary team into an interdisciplinary team.<sup>45</sup>

Our observational study as well as the recently published study of Wressle *et al.*<sup>48</sup> make clear that more needs to be done to improve team functioning, and to make teams operate as real interdisciplinary, or even transdisciplinary teams. The RAP alone cannot ensure that the many professionals who provide rehabilitation care for a patient communicate and collaborate effectively with each other.<sup>52</sup> Strasser showed that team functioning is significantly more positive in organizational cultures that are characterized as personal or dynamic.<sup>53</sup> The influence of organizational culture, interdisciplinary team characteristics, and process factors on patient outcomes remains a challenging topic for future studies on quality improvement in rehabilitation medicine.<sup>1</sup> Research should focus on identifying organizational, cultural, technological, and environmental factors that affect not only the care processes,<sup>54</sup> but also the health, safety and satisfaction of the patient.<sup>55</sup> We are convinced that a quality sub-system, such as the RAP, could support the rehabilitation team, and improve the rehabilitation process as well as the rehabilitation outcome.

## Conclusion

This study showed that use of the RAP, at the current level of implementation, does not significantly improve

the rehabilitation outcome. We used five outcome measures: scores on the Barthel Index, the RAP-CPM, the Nottingham Health Profile (part I), length of inpatient or outpatient rehabilitation, and discharge destination. The results lend no support as yet to the hypothesis that patients treated by rehabilitation teams using the RAP at its current level of implementation have a better rehabilitation outcome. It was also found that few of the included team and centre characteristics were independently associated with rehabilitation outcome.

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