

## Relationship between pulmonary rehabilitation and care dependency in COPD

### ABSTRACT

**Abstract** The aims of this study were to explore care dependency before and after pulmonary rehabilitation (PR) in patients with COPD (n=331) and to compare the response to PR between care dependent and independent patients. At baseline, 85 (25.7%) patients had a Care Dependency Scale (CDS) score  $\leq 68$  points and were considered as care dependent. CDS scores of these patients improved after PR ( $p < 0.001$ ). After PR, CDS score of 38 (44.7%) patients with a baseline CDS score  $\leq 68$  points increased to  $> 68$  points. Patients with a baseline CDS score  $\leq 68$  points or  $> 68$  points showed after PR a comparable improvement in COPD Assessment Test, Hospital Anxiety and Depression Scale and 6-min walk distance (all  $p < 0.05$ ).

**Trial registration number** NTR3416 (The Netherlands).

### BACKGROUND

Care dependency is a significant problem for patients with advanced COPD. Almost half of the outpatients with advanced COPD and more than two-thirds of the hospitalised patients with COPD are care dependent.<sup>1 2</sup> Care dependency is an important determinant of health status and an independent predictor of survival in COPD.<sup>3 4</sup> Pulmonary rehabilitation (PR) reduces dyspnoea, increases exercise capacity and improves health status in patients with COPD.<sup>5</sup> To what extent PR can reduce care dependency in patients with COPD remains unknown. Therefore, the aim of the present study was to explore care dependency before and after PR in patients with COPD. In addition, we aimed to compare the response to PR between care dependent and independent patients regarding health status, symptoms of anxiety and depression and exercise capacity.

## METHODS

This study is a secondary analysis of the COPD, Health status and Comorbidities (Chance) study. The Chance study prospectively explored the impact of cardiovascular comorbidities on COPD Assessment Test (CAT) and its responsiveness to PR in 518 patients with moderate-to-very severe COPD.<sup>6</sup> The study was registered at the Dutch Trial Register (NTR 3416). Patients were eligible if they were between 40 and 85 years, had a diagnosis of COPD and were referred for PR. Patients provided written informed consent.

Patients followed an interdisciplinary PR programme according to the latest American Thoracic Society/European Respiratory Society Statement on PR.<sup>5</sup> They underwent an assessment before and after the PR programme, including measurement of health status (CAT), symptoms of anxiety and depression (Hospital Anxiety and Depression Scale (HADS), consisting of an anxiety subscale (HADS-A) and a depression subscale (HADS-D)) and exercise capacity (6-min walk distance (6MWD)).<sup>7</sup> Care dependency was assessed using the Care Dependency Scale (CDS), consisting of 15 items regarding basic and instrumental activities of daily living.<sup>8</sup> Total CDS score ranges from 15 (worst) to 75 points (best). Patients with a CDS score  $\leq 68$  points were considered as care dependent. Using this cut-off results in a sensitivity of 0.85 and a positive predictive value of 0.90 for detecting care dependency.<sup>9</sup>

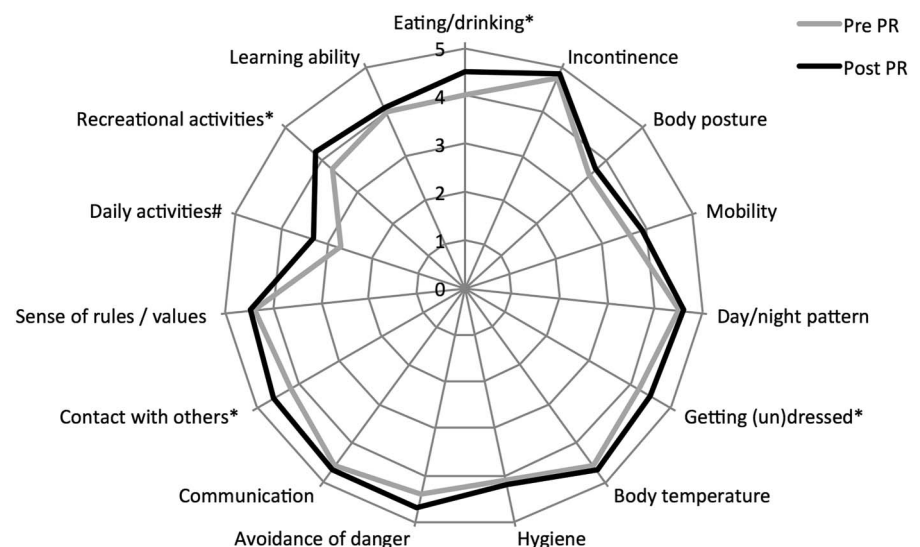
Baseline patient characteristics and changes after PR were compared between patients with a baseline CDS score  $\leq 68$  points and patients with a CDS score  $> 68$  points using  $\chi^2$  tests, independent sample t-tests or Mann-Whitney U tests, as appropriate. Total CDS scores and CDS item scores were compared before and after PR using Wilcoxon signed-rank tests. A binary logistic regression model was developed to explore determinants of a change towards a CDS score  $> 68$  points after PR in patients with a CDS score  $\leq 68$  points before PR. Statistics were done using IBM SPSS statistics V21.0. The level of significance was set at  $p \leq 0.05$ .

## RESULTS

In total, 419 patients (80.9%) completed PR and 331 (63.9%) had complete CDS data before and after PR and were included in this analysis. Age, CAT scores and FEV<sub>1</sub> were comparable for included and excluded patients ( $p > 0.05$ ). At baseline, 85 patients (25.7%) had a CDS score  $\leq 68$  points and were considered care dependent. The majority of the care dependent patients were to a limited extent care dependent

(please see online supplementary e-figure). Patients with a baseline CDS score  $\leq 68$  points were older (the mean age 66.0 (8.9) vs 63.8 (8.6) years, respectively,  $p = 0.04$ ), had a lower FEV<sub>1</sub> (44.3 (20.0) vs 51.0 (19.1) % predicted, respectively,  $p = 0.01$ ), more frequently used long-term oxygen therapy (43.5% vs 19.1%, respectively,  $p < 0.001$ ), had a worse CAT score (24.4 (5.9) vs 20.1 (6.5) points, respectively,  $p < 0.001$ ), a lower 6MWD (362.3 (110.4) vs 467.9 (108.8) m, respectively,  $p < 0.001$ ), a higher HADS-A score (9.3 (4.3) vs 6.7 (4.0) points, respectively,  $p < 0.001$ ) and a higher HADS-D score (9.6 (4.1) vs 6.6 (3.9) points, respectively,  $p < 0.001$ ) than patients with a baseline CDS score  $> 68$  points. The proportion of patients with CDS score  $\leq 68$  points was comparable for patients completing the programme and for those dropping out ( $n = 106$  (27.2%) vs  $n = 31$  (34.1%),  $p = 0.24$ ). Median (IQR) CDS scores of

patients with CDS score  $\leq 68$  points improved after PR from 64.0 (59.0–66.0) to 68.0 (61.5–71.0) points ( $p < 0.001$ ). CDS scores of patients with CDS score  $> 68$  points did not change after PR (pre-PR 74.0 (71.0–75.0) to 74.0 (72.0–75.0) points,  $p = 0.83$ ). After PR, 38 of the 85 patients with a baseline CDS score  $\leq 68$  points (44.7%) became care independent (CDS score  $> 68$  points). Significant improvements were seen in the items: eating/drinking, getting (un)dressed, contact with others, daily activities and recreational activities (figure 1). Patients with baseline CDS score  $\leq 68$  points or  $> 68$  points showed after PR a comparable improvement in CAT score, HADS-A score, HADS-D score and 6MWD (table 1). Care dependent patients with a higher baseline CDS score were more likely to have a CDS score  $> 68$  points after PR (adjusted p value 0.048) (please see online supplementary data and e-table).



**Figure 1** Care Dependency Scale (CDS) item scores of care dependent patients (CDS total score  $\leq 68$  points) before pulmonary rehabilitation (PR) (pre-PR) and after PR (post-PR) presented as mean. \* $p \leq 0.05$ , # $p \leq 0.001$  based on Wilcoxon signed-rank test.

**Table 1** Response to pulmonary rehabilitation (PR) after stratification for baseline Care Dependency Scale (CDS) score

Change after PR in	Baseline CDS score $> 68$ points (n=246)	Baseline CDS score $\leq 68$ points (n=85)	p Value
CAT score, points	−3.1 (6.8)*	−3.5 (6.9)†	0.43
HADS anxiety score, points	−1.5 (3.5)*	−1.7 (3.6)†	0.73
HADS depression score, points	−1.9 (3.4)*	−2.6 (4.0)†	0.16
6MWD, m	17.6 (63.8)‡	26.4 (71.1)§	0.24¶
CDS total score, points	−0.4 (3.7)	4.0 (8.1)	<0.001¶

Data are shown as mean (SD) or number (%).

\*n=217.

†n=77.

‡n=238.

§n=79.

¶Non-parametric statistical tests have been used because of skewed data.

6MWD, 6-min walk distance; CAT, COPD Assessment Test; HADS, Hospital Anxiety and Depression Scale.

## DISCUSSION

Several questions remain unanswered. First, only 63.9% of the population of the Chance study were included in this analysis. It's unknown whether findings can be generalised towards all patients with COPD entering PR. Second, 55.3% of patients with CDS score  $\leq 68$  points before PR had also a CDS score  $\leq 68$  points after PR. Moreover, CDS score in these patients did not improve (CDS score pre-PR 62.0 (56.0–64.0) vs post-PR 62.0 (56.0–65.0) points,  $p=0.60$ ). It is unknown why PR failed to reduce care dependency in these patients. Thus, the optimal approach in PR for persistent care dependent patients needs to be established. Third, the CDS was originally developed and validated for other populations.<sup>8</sup> The psychometric characteristics in this population remain unexplored. Other instruments were previously used to assess care dependency in COPD.<sup>10</sup> Strength of the CDS is that it includes basic as well as instrumental activities of daily living. Nevertheless, a ceiling effect was present in this population ( $n=99$  (29.9%), baseline CDS total score 75 points). Future studies should explore the psychometric characteristics, including the minimal clinically important difference, of different instruments to assess care dependency in patients with COPD. Finally, it remains unknown whether the effect on care dependency is sustained after PR.

To conclude, a quarter of the patients referred for PR has a CDS score  $\leq 68$  points and are considered as care dependent. PR is not primarily designed to reduce care dependency. Moreover, care dependency is not one of the previously defined assessment components or PR outcomes.<sup>5</sup> However, the current analysis shows that PR can reduce the proportion of patients with a CDS score  $\leq 68$  points as well as the level of care dependency in patients with a CDS score  $\leq 68$  points before PR. Further, PR can also improve health status, symptoms of anxiety and depression and exercise capacity in care

dependent patients to the same degree as in care independent patients. Assessment of care dependency as part of PR should be considered. Future studies should explore which instrument is the most appropriate to assess care dependency in PR and the optimal approach to address care dependency in PR.

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**Patient consent** Obtained.

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