Measuring a Change in Self-Efficacy Following Pulmonary Rehabilitation: An Evaluation of the PRAISE Tool

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An Evaluation of the PRAISE Tool

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Background: Self-efficacy explores the emotional functioning and coping skills of an individual and is thought to be a strong predictor of health behaviors, which is particularly important for pulmonary rehabilitation (PR). However, to our knowledge, there is no measure of self-efficacy developed to explore behavior change in the context of PR.

Methods: We investigated the reproducibility and sensitivity of Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE): a tool adapted from the General Self-Efficacy Scale (GSES) to measure the dimension of self-efficacy at the time of a course of PR. Twenty-nine clinically stable patients with COPD completed PRAISE on their initial assessment to PR. The tool was then completed 7 days later. An additional 225 patients completed PRAISE prior to, and on completion of a 7-week course of PR. In addition, exercise capacity was measured by the incremental shuttle walk test (ISWT), with the Medical Research Council (MRC) dyspnea scale, Chronic Respiratory Questionnaire-Self Reported (CRQ-SR), and Hospital Anxiety and Depression Scale (HADS) also being collected. This process was repeated postrehabilitation. Data were then analyzed to investigate the possibility that PRAISE could be an indicator of PR response.

Results: In the reproducibility study, the mean change in score was 0.72 (95% CI, −2.27-0.82), examined with intraclass correlation coefficients, $r = 0.99$; indicating PRAISE test-retest reproducibility. The mean change of score in the sensitivity study pre- to post-PR was 3.59 (95% CI, 2.24-4.73; $P = .015$). Change in the ISWT was 83.44 m (95% CI, 54.0-112.8; $P < .0001$). There were several statistically significant differences between variables, particularly with the mastery and emotion elements of the CRQ-SR at baseline, but this was lost post-PR. This observation was also found with HADS. No significant differences were found between MRC dyspnea scale grades with the change in PRAISE score. PRAISE could not predict a successful outcome of PR.

Conclusions: The PRAISE tool is a reliable and sensitive measure of self-efficacy for patients with COPD attending PR. *CHEST 2011; 140(6):1534–1539*

Abbreviations: CRQ-SR = Chronic Respiratory Questionnaire-Self Reported; GSES = General Self-Efficacy Scale; HADS = Hospital Anxiety and Depression Scale; ISWT = incremental shuttle walk test; MICD = minimal important clinical difference; MRC = Medical Research Council; PR = pulmonary rehabilitation; PRAISE = Pulmonary Rehabilitation Adapted Index of Self-Efficacy

Self-efficacy is beginning to emerge as a strong predictor of health behaviors, both in health and illness.[1] It has already been associated with successful short- and long-term behavioral change.[2] Self-efficacy, however, has not been widely reported in pulmonary rehabilitation (PR), despite the concept being acknowledged by advisory bodies, particularly by the American Thoracic Society/European Respiratory Society Statement on Pulmonary Rehabilitation.[3]

Self-efficacy can affect a positive or negative status of the mind. The concept, which was introduced by Bandura,[4] is a core aspect of his social-cognitive theory. Self-efficacy explores the emotional functioning and coping skills of individuals. It reflects the perceived ability to carry out a particular task. This "can-do" cognition echoes their sense of control over their environment; by measuring this concept, a practitioner may be able to detect important determinants of successful behavioral change. The definition can be further

defined into categories of general or specific/domain specific. General self-efficacy is a reflection upon the whole personality and how that individual copes on a day-to-day basis. Specific self-efficacy is related to areas of health or illness.

Causal relationships between the attendance of PR and the improvement in specific self-efficacy have, however, already been suggested.[5] A fundamental principle of PR is increasing the confidence of the patient; this may be a determinant of improved physical functioning. Therefore, enhancing self-efficacy should be an important aim in the treatment of patients with COPD. Overall, PR aims to change behavior and, as such, the measurement of self-efficacy may be fundamental in understanding both the resistance and the ability to change.

Self-efficacy also impacts people's ability to self-manage,[6] particularly in areas that are domain specific, such as patients' disease. It has been suggested that self-efficacy is fundamental to an individual's ability to participate in active self-management, an important component of PR.[7] Some of the fundamental concepts behind PR encourage coping mechanisms that enable the patient to adapt to necessary lifestyle changes. In doing so, PR becomes an intervention of indirect positive psychology, meaning that often no additional specific training in behavioral change is given.

There are a few studies in individuals with COPD that have investigated self-efficacy in relation to rehabilitation. These have reported self-efficacy for walking[8] and have looked at correlations with an improved health status.[9] Some studies measuring self-efficacy more generally within the rehabilitation forum have used well-validated tools, such as the one described by Wigal et al.[10] This tool is specific to the population with COPD and the challenges related to the disease but it does not explore behavior change promoted through PR. There is, however, a need to develop a specific tool, with the ability to focus upon the impact of all aspects of PR. To date, there are no validated scales in existence. We had two study aims: to investigate both the repro-

ducibility (and internal reliability) and the sensitivity of the adapted tool Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE).

MATERIALS AND METHODS

Pulmonary Rehabilitation Adapted Index of Self-Efficacy

We adapted the General Self-Efficacy Scale (GSES) specifically for the population of patients in PR. The original tool is a validated 10-item scale.[11] Currently, the original scale has been translated into 26 languages. It measures generalized perceived self-efficacy at any given time and has been reported extensively in the literature. Typical items are "Thanks to my resourcefulness, I know how to handle unforeseen situations" and "When I am confronted with a problem, I can usually find several solutions." As a general measure, however, it does not tap into domain-specific behavior around lifestyle changes. The authors of the GSES suggest, therefore, that additional statements can be added to measure changes in domain-specific self-efficacy (for example, coping with COPD). Adaptations of this measure have been reported in other populations with chronic disease such as those related to arthritis, sexual health, and smoking cessation, but not for COPD.[12] Five additional items addressing the specific challenges faced by those patients attending PR were added to the scale; these ranged from how they felt able to cope with the exercises, to how informed they felt about their disease. The adapted scale is shown in e-Appendix 1. The advice given by the authors for adapting the scale was to try and ensure that each statement was balanced with a positive and negative spin (for example, "I feel confident that I will be able to perform the exercises asked of me during the course of rehabilitation, even if I find them difficult"). The items were generated by expert clinicians in focus groups, and confirmed with patients and health psychologists external to the organization. Each statement on the scale is scored from 1 to 4, 4 being the highest level of perceived self-efficacy. The adaptations made the scoring range from 15 to 60, with higher scores indicating high levels of self-efficacy. The scale takes approximately 4 min to complete.

Reproducibility Study

Patients (baseline characteristics shown in Table 1) were recruited on a convenience basis and completed the PRAISE tool at the initial assessment to PR. This process was then completed 7 days later, prior to commencement of the rehabilitation program. This time frame was chosen to reduce the likelihood that patients could remember their previous responses but were unlikely to have changed clinically.[13] Neither the patient nor the principal investigator had knowledge of the baseline scores.

Sensitivity Study

A separate cohort of patients (shown in Table 1) was recruited for a prospective, observational, uncontrolled study. The patients completed PRAISE prior to starting the 7-week course of pulmonary rehabilitation. In addition, each patient's exercise capacity was assessed using the incremental shuttle walk test (ISWT).[14] The Medical Research Council (MRC) dyspnea scale for grading degree of patient's breathlessness, Chronic Respiratory Questionnaire-Self Reported (CRQ-SR),[13] and Hospital Anxiety and Depression Scale (HADS) were also collected. This process was then repeated postrehabilitation, 7 weeks later.

Internal Variable Correlations: To investigate whether PRAISE could be used as an indicator of PR response, several correlations

Table 1—Baseline Characteristics of Patients

Characteristics	Reliability Study (SD)	Sensitivity Study (SD)
No.	29	225
Male, n	18	123
Age, y	70 (9.36)	69 (8.8)
FEV_1, L	1.08 (0.44)	1.06 (0.48)
ISWT, m	196.30 (112.48)	204.62 (100.52)

ISWT = incremental shuttle walk test.

were examined. Correlations included gender, social circumstances, MRC, and the mastery component of the CRQ-SR.

PR Program

The PR program took place at Glenfield Hospital (University Hospitals of Leicester NHS Trust, Leicester, England) and was provided as previously reported.[15] The details of the program are provided in e-Appendix 1.

Analysis

Reproducibility Study: Statistical analysis was completed using SPSS software, version 10 (SPSS Inc; Chicago, Illinois). Baseline values are described as mean (SD) differences with 95% CI and intraclass correlation coefficients presented. A test-retest and a Cronbach α were calculated on all items to assess internal consistency.

Sensitivity Study: The mean changes and 95% CI are presented, P values were calculated by using the Wilcoxon signed-rank test. Relationships between internal group variables were also analyzed using nonparametric Spearman correlation coefficients. The magnitude of change between men and women was examined using an independent t test. One-way analysis of variance was performed for measuring change in PRAISE scores across the MRC dypsnea scale grades.

Ethical Considerations

Ethical approval was obtained from the hospital ethical review committee as part of a larger trial.[16] Informed written consent was provided by all participants.

Results

Reliability Study

The mean change in score was 0.72 (95% CI, −2.27-0.89; P = .34). The intraclass correlation coefficient was $r = 0.99$ ($P \leq .001$). A Cronbach α was calculated on all items of the scale (0.95). A Bland and Altman plot is also provided in e-Figure 1.

Sensitivity Study

The mean change of 3.59 in PRAISE score was statistically significant (P = .015). The mean change in the ISWT was 83.44 m (P < .0005). The 38 patients who dropped out from the study did score lower overall before PR in ISWT, CRQ-SR, HADS, and PRAISE, but this was not statistically significant when compared

with the group that completed PR. There were no significant differences found between either the baseline or the change in PRAISE score between male and female patients (Table 2). There was, however, a trend toward a greater change in score pre- to post-PR in the male patients.

PRAISE Relationships With Exercise Performance, Disability, and Health Status

MRC Dyspnea Scale: There were statistically significant differences for both baseline and post-PRAISE scores between the MRC dypsnea scale grades (Table 3). Post hoc analysis demonstrates statistically significant differences between MRC dypsnea scale grades 2 and 5, at baseline (P = .03) and post-PR (P = .022). However, change in PRAISE was not significant between the MRC dypsnea scale grades (Table 3).

Social Support: Patients who lived with a spouse (mean change of 4.21, P = .001), with family (mean change of 7.25, P = .01), or received some level of social support (mean change of 1.67, P = .038) all had a statistically significant change in their PRAISE score. Compared with those patients who lived alone (mean change of 0.65, P = .59) whose change in score did not change significantly.

Exercise: The relationship between exercise performance (as measured by the ISWT) and PRAISE was examined. There were no significant correlations between the baseline PRAISE scores and pre-ISWT; a lower PRAISE score did not correlate with a lower ISWT pre-PR ($r = 0.22$). The change in ISWT and PRAISE pre- to post-PR were also compared, no significant results were found ($r = 0.35$; shown in more detail in e-Fig 2). There was a trend, however, for those who had a greater baseline ISWT to have a greater baseline PRAISE score (this is shown further in e-Fig 3.) All MRC dypsnea scale groups achieved a mean change exceeding the minimal important clinical difference of 48 m in their ISWT.

Health Status: Prescores for each domain of the CRQ-SR with pre-PRAISE were examined, as was the magnitude of change pre- to post-PR between each

Table 2—PRAISE and Gender Subanalysis Pre- to Post-PR

	Mean PRAISE		
	Pre (SD)	Post (SD)	Change (95% CI)
Male	40.65 (8.83)	44.76 (9.22)	4.11 (2.36-5.85)
Female	42.46 (7.72)	45.96 (7.69)	3.50 (1.86-5.14)

NS between male/female change (P = .617). NS = nonsignificant; PR = pulmonary rehabilitation; PRAISE = Pulmonary Rehabilitation Adapted Index of Self-Efficacy.

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Original Research

MRC Dypsnea Scale	Mean SE			Mean ISWT, m		
	Pre (SD)	Post (SD)	Change (95% CI)	Pre (SD)	Post (SD)	Change (SD)
2, No. = 30	44.56 (7.04)	48.87 (8.45)	4.30 (1.69-6.91)	361 (144)	430 (146)	68 (75)
3, No. = 60	42.56 (8.00)	45.25 (7.63)	3.10 (1.53-4.67)	233 (128)	283 (114)	51 (67)
4, No. = 50	40.90 (8.96)	44.70 (9.10)	3.80 (1.13-6.47)	156 (92)	243 (112)	86 (62)
5, No. = 17	37.47 (10.11)	41.41 (9.35)	3.94 (−1.39-9.27)	112 (60)	192 (68)	80 (60)
P Value	.041	.03	.912	< .001	< .001	.204

Post hoc analysis showed statistically significant differences between PRAISE scores in MRC dypsnea scale groups 2 and 5 at baseline ($P = .03$ analysis of variance) and post-PR ($P = .022$ analysis of variance). MRC = Medical Research Council. See Table 1 and 2 legends for expansion of the other abbreviations.

domain and PRAISE. All of these differences are shown in Table 4. There were statistically significant relationships shown with all the pre-CRQ domains and pre-PRAISE. However, the significant correlations for post-PR were only evident among the changes in emotion, mastery, and anxiety (measured by the HADS) when correlated with the change in PRAISE score.

Discussion

This article describes the development and testing of a self-efficacy scale specifically for use in PR. There is no other tool currently available. The GSES adapted for PR, PRAISE, demonstrates test-retest reliability and internal consistency. PRAISE is also sensitive to change, enabling us to document an improvement in the patient's level of self-efficacy after a course of PR. This correlates with previous research findings suggesting that PR may have a direct effect upon specific self-efficacy.[5,9] However, the tools used to make this assessment were not specific to PR as PRAISE is designed to be.

The overall magnitude of change for the sensitivity study should be seen in the context of the reproducibility study; however, this study did not explore changes in PRAISE scores in a control group over a comparable time period. In addition, it is accepted that there is no minimal important clinical difference; however, this should be addressed in future studies. Nevertheless, we were able to measure a change over a short time period

Table 4—*Differences Shown Between PRAISE and CRQ-SR*

Baseline PRAISE, r, P		Change PRAISE, r, P
0.166 < .05	CRQ dyspnea	0.152 NS
0.300 < .001	CRQ fatigue	0.137 NS
0.449 < .05	CRQ emotion	0.210 < .01
0.394 < .001	CRQ mastery	0.161 < .05
−0.364 < .001	HADS anxiety	−0.307 < .001
−0.370 < .001	HADS depression	−0.162 NS

CRQ-SR = Chronic Respiratory Questionnaire-Self Reported; HADS = Hospital Anxiety and Depression Scale. See Table 2 legend for expansion of the other abbreviation.

despite the complexity of self-efficacy as a construct. PRAISE can therefore be proposed as a practical instrument that explores a different dimension in those patients attending rehabilitation.

It is possible that self-efficacy is the key to translating the completion and success of PR into tangible functional improvements in activities of daily living. The lack of relationships between other measured variables highlighted that self-efficacy is a specific emotion, with a very separate identity: for example, patients' own perceptions of their ability to participate in PR may not necessarily correlate with their level of exercise performance. This therefore further strengthens the need to measure self-efficacy with an independent tool.

There was no significant difference in the PRAISE score of those completing PR compared with those who dropped out. This was perhaps not anticipated, indicating that PR is a complex intervention; the ability to predict success or dropout remains elusive.

Self-efficacy has shown itself to be an important correlate with the psychologic status of patients with COPD.[8,17] We investigated the relationships between self-efficacy and other independent variables, such as exercise performance, disability, and health status. The differences found with the CRQ-SR were of particular interest. There were statistically significant relationships shown with all the pre-CRQ domains and pre-PRAISE scores. Self-efficacy has been identified as a completely different emotional construct, so although the CRQ-SR explores the domain of mastery, the need to measure and monitor self-efficacy effectively is becoming increasingly more evident in rehabilitation studies. Higher levels of self-efficacy have been correlated with an internal locus of control and feeling more empowered; these patients may not be as vulnerable as those with an external locus of control. It seems feasible to suggest that those patients with an external locus of control and a lower level of self-efficacy may find PR harder to cope with and may require greater levels of supervision and encouragement. PRAISE could help to identify these patients, alongside the CRQ-SR, prior to starting the program. For this study, we used the tool simply as an

outcome measure and not as a prompt or guide for a more intense support package.

There was no relationship shown between either a higher or lower pre-PRAISE score and the completion of PR. A previous study, using the more general COPD self-efficacy scale, also found no differences between baseline self-efficacy scores for those patients who completed and dropped out of PR.[18] However, correlations were found post-PR with the CRQ-SR in mastery, emotion, and anxiety (HADS); in these three domains, significant relationships were shown.

We noted with interest that those with support at home had a higher level of self-efficacy upon completion of PR. It has been reported previously that those with a greater social network should function more effectively and that this in turn will affect their psychologic wellbeing.[19] This was not the case for those who lived alone. However, the group with no social support had the highest overall pre-PRAISE score. It is, therefore, feasible to suggest that a higher change in score would be more difficult to obtain. It could also be implied that those patients who live alone have a higher level of independence (be it enforced) and, therefore, have a greater belief in goal attainment.

We found no significant differences between sexes. Statistically significant differences between MRC dyspnea scale grades 2 and 5 were found with baseline and post-PR PRAISE scores. It is also interesting that the change in PRAISE was not significantly different between any of the MRC dyspnea scale grades. This could imply that an individual's self-reported disability does not influence the magnitude of change in PRAISE following PR. There were no statistically significant correlations found between the change in ISWT and change in PRAISE. The data did suggest a trend toward those with a greater baseline ISWT having a higher score of self-efficacy.

Adhering to a PR program may be difficult for some patients when the benefits of exercise are often not immediate; they may also have several misconceptions and elements of fear related to this. Therefore, it seems prudent to assess how they perceive physical exercise prior to PR, self-efficacy being an important inclusion. Bandura noted that "people avoid activities that they believe to exceed their coping capabilities."[4] As a consequence, self-efficacy influences not only whether individuals will attempt an action, but will also determine whether they persevere in overcoming the obstacles around this. It seems feasible to suggest that by measuring self-efficacy prior to PR a practitioner can, therefore, identify those patients who may have nonphysical fears related to starting exercise and may not otherwise finish the program.

There are some patients attending PR who, despite their disease severity, attain a greater improvement in exercise performance and reward than others at the end of the program. So far, this phenomenon has yet be explained. Is it possible that self-efficacy may be the "missing link" between exercise performance and an improved health and functional status? Although these studies were not randomized controlled trials, the data do support other studies of this nature.[9] PRAISE appears to measure a discrete domain that may be modifiable as a result of PR, but this should be explored in more detail. It would be interesting to observe whether patients with higher self-efficacy post-PR go on to maintain their functional capacity. It may also be interesting to explore the value of targeted interventions for those patients with a low PRAISE baseline score.

Conclusions

This study indicates that PRAISE is both reproducible and sensitive in this population, although it is unable to determine those patients who may drop out of PR. PRAISE is sensitive to change in PR patients, easy to use, and well tolerated. PRAISE can, therefore, be proposed as a practical instrument that explores a different psychologic dimension for those patients attending PR.

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