

# Development of the RoBE self-efficacy scale for people with Breathing Pattern Disorders

Janet Rowley Dip Phys, MHSc, MNZSP  
Respiratory Physiotherapist, Breathing Works

David Nicholls MA, GradDipPhys  
Senior Lecturer, School of Physiotherapy,  
Auckland University of Technology, Auckland, New Zealand.

## ABSTRACT

This pilot study developed the Rowley Breathing Self-Efficacy scale (RoBE scale) to assess people's self-efficacy regarding their ability to control symptoms of their Breathing Pattern Disorders (BPD). The participants were 16 patients attending physiotherapy clinics for treatment of BPD, and 10 control participants. Participants completed a Nijmegen questionnaire, Hospital Anxiety and Depression (HAD) Scale, and the RoBE scale, and repeated this four days later. Reliability of the RoBE scale was supported in the intraclass correlation value of 0.69 for the BPD population, and Cronbach's alpha values of 0.84 and 0.80 for the two data completions. The Mann-Whitney U analysis supported a statistically significant difference between the scores of the BPD and control populations, which was also seen in the median scores in first and second completions (BPD population 54/90 and 53/90, control population 89/90 and 90/90 respectively). When a cut-off score of 75/90 was applied, based on the distribution of the scores of the control group, this discriminated between the control and the BPD groups in 15/16 cases. The Spearman's analysis did not show statistical significance comparing RoBE scores with the other questionnaires. The raw data showed a clear differentiation, however, therefore the lack of statistical significance may be due to the study being underpowered for such analysis. This study indicates the RoBE scale shows potential for assessing self-efficacy in the population of people with BPD, and further research is required to confirm this. **Rowley J, Nicholls D (2006): Development of the RoBE self-efficacy scale for people with breathing pattern disorders. New Zealand Journal of Physiotherapy 34(3) 131-141.**  
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## INTRODUCTION

The recognition of idiopathic breathing pattern disorders (BPD) as a distinct entity is relatively recent. Consequently, there is a paucity of valid assessment tools for this area. This can impact on treatment and impede research, where established assessment /measurement tools are essential. Self-efficacy has been shown to impact on health behaviours. In the clinic we can enhance the patient's self-efficacy and therefore increase the likelihood of successful health outcomes (Barnason, Zimmerman, Atwood, Nieveen, & Schmaderer, 2002; Sallis, Pinski, Grossman, Patterson, & Nader, 1988; Shin, Jang, & Pender, 2001). Research to date has concentrated on self-efficacy in numerous health populations, but little attention has been paid to the BPD population.

## BREATHING PATTERN DISORDERS

Breathing pattern disorders describe the diverse array of symptoms variously associated with physiological, psychological and mechanical respiratory dysfunction, in the absence of organic lung disease. They are commonly associated with metabolic responses to a wide range of triggers, frequently mediated by the sympathetic nervous system. BPD may affect as much as 10% of the

population at any one time and often have an indeterminable history. Whilst BPD have been considered to be predominant in Caucasian women of working age, BPD occur in children and the elderly, men and women, regardless of race. It seems relatively clear from clinical practice and the available literature, that breathing pattern disorders are a feature of contemporary post-industrial societies.

Hyperventilation is the most common cause and predominant symptom of a disordered breathing pattern. Hyperventilation is thought to occur as the end product of an interaction of (i) physiological, (ii) psychological and (iii) mechanical processes:

- (i) abnormal patterns of hypocapnia due to altered central and peripheral chemo-receptor drive, and altered cortical input (Gardner, 2004; Jack, Rossiter, Pearson, & Ward, 2004).
- (ii) heightened sympathetic excitability resulting from both respiratory alkalosis, and elevated levels of adrenalin due to factors such as chronic stress (Schleifer, Ley, & Spalding, 2002).
- (iii) disrupted mechanics of breathing with altered respiratory muscle function (Chaitow, 2002).

The current assessment for breathing pattern disorders covers a wide array of domains. When considering the physical remedies for breathing problems, the focus is upon the subjective history taking, clinical presentation and observation of respiration. Most therapists utilise the Nijmegen questionnaire, an internationally validated tool used to support a diagnosis of hyperventilation syndrome (van Dixhoorn & Duivenvoorden, 1985). There appears to be no other measurement/assessment tool consistently used amongst physiotherapists, reflecting the absence of reliable and clinically useful tools for this population (Roth, Wilhelm, Meuret & Alpers, 2002). A self-efficacy scale designed for the BPD population would address this gap.

## SELF-EFFICACY

Self-efficacy refers to the confidence people have in their ability to successfully perform certain tasks, based on a self appraisal of their own skills and resources (Maddux, Brawley, & Boykin, 1995). Self-efficacy is not, therefore, a reflection of skill level, but instead is a subjective self-assessment of one's ability to perform the task of interest. Such assessment has significance for the BPD population since the success of their treatment depends largely upon the patient applying and utilising the strategies and breathing skills taught by the physiotherapist. It is somewhat surprising therefore that no such self-efficacy scale exists for this population.

Self-efficacy is a concept that owes its origins to the work of Canadian born psychologist Albert Bandura, whose Social Learning Theory formed the backbone of much of the work in this area (see, for instance, Bandura, 1977). Bandura's theory of self-efficacy is based on the multi-directional interplay of environment, behaviour and personal factors, where each affects, and is affected by, the others.

Four key factors are commonly identified as influencing self-efficacy:

- Mastery experience – thought to be the most significant influence upon self-efficacy, this refers to a person's experience of success in mastering a particular task.
- Vicarious experience – drawn from observations of others achieving positive results in similar tasks to one's own.
- Verbal persuasion – refers to the influence of other's words; particularly those perceived to be creditable and trustworthy.
- Physiological information – gleaned from 'listening to' one's own body, and utilising this information to make an assessment, albeit not necessarily accurate, of one's achievement.

A key aspect influencing all these factors is mood. Anxiety and depression are particularly influential in the interpretation of experiences/symptoms, and the selection of which past experiences are recalled (Kavanagh & Bower, 1985). If mood is negative, greater value is placed on negative experiences, and this will hinder the development of high self-

efficacy (Jerusalem & Schwarzer, 1992). Where low self-efficacy and anxiety co-exist, this produces a heightened sympathetic response, which exacerbates feelings of anxiety. This can create a vicious circle, resulting in poorer performance (Gerin, Litt, Deich, & Pickering, 1996).

In any health population some people will have a high degree of self efficacy – seeing themselves as motivated, resilient and able to meet the challenges of illness 'head-on', while others, with low self-efficacy, see themselves as unlikely to achieve and focus on failures, so consequently invest less effort, give up more easily, and thus fulfill their low expectations. A number of health outcome measures have been developed utilising self-efficacy scales for various health conditions, such as asthma (Tobin, Wigal, Winder, Holroyd & Creer, 1987), stress incontinence (Chen, 2004), multiple sclerosis (Arlie, Baker, Smith & Young, 2001), and exercise adherence (Shin, Jang & Pender, 2001). With very few exceptions, high self-efficacy correlates strongly with positive health outcomes (Ewert, 1992; Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986; S. Williams, 1995; S. L. Williams, 1995). Assessing a person's self-efficacy prior to treatment can therefore be a useful *predictor* of the patient's ability to self-manage successfully. Indeed self-efficacy has been shown to be a stronger predictor of outcome than actual skill level (Bandura, 1992). The effectiveness of self-efficacy's predictive value may be due to its impact on aspects of behaviour, including commitment, adherence, and utilisation of skills and resources.

Self-efficacy has been identified as a primary determinant for long term adherence to any health treatment programme (Maddux et al., 1995). This has been shown in studies examining weight loss, smoking cessation and abstinence from alcohol (Strecher et al., 1986). Adherence is particularly important for the treatment of BPD, as a successful outcome is highly dependent on the patient practising and utilising the breathing retraining skills they gain during a treatment session, and subsequently incorporating these skills into the daily routine, despite setbacks. By identifying areas in which the patient is not confident of success, strategies can be put in place to raise self-efficacy, thereby improving the likelihood of a positive outcome (Ewart, 1992; Meichenbaum & Turk, 1987). Measuring self-efficacy in the population of people with BPD would seem therefore appropriate to improve the effectiveness of treatment, and quality of outcome for this population.

## METHOD

This study consisted of two phases. Phase one was the development of the RoBE scale, involving development of the questions, questionnaire format and assessment of content validity. In phase two, the revised questionnaire was presented to the participants, and statistical analysis of the range of data collected evaluated the potential reliability and validity of the scale.

## **PHASE 1: DESIGN OF THE RoBE SCALE**

There is currently no existing self-efficacy scale that could be adapted for the BPD population. The self-efficacy scale developed in this study follows the format of other self-efficacy scales, that is, the use of the Likert scale and ranking tasks. Strength of self-efficacy is the most commonly measured attribute, and is linked with perseverance, which is essential to achieve long-term health behaviour changes (Schwarzer, 1992).

### **Question Selection**

The questions that form the basis of the RoBE scale (see figure 1) are based on activities/attitudes that people with BPD find difficult, as identified in the literature, and anecdotally in clinical settings. The first four questions relate to the person's confidence in performing particular tasks. The tasks are broadly stated, as the patient may perform them in a wide range of settings. The fifth and sixth questions relate to locus of control, which closely relates to self-efficacy and impacts directly upon it. The seventh and ninth question relate to attitude to treatment, as this affects the effort the patient invests in adhering to prescribed behaviours (Meichenbaum & Turk, 1987). The eighth and tenth question ask about behaviours which are also expressions of self-efficacy, and impact on treatment outcomes (Pajares, 2002).

The questions that related to mood departed from traditional self-efficacy scales, but were added for two reasons. Firstly, mood influences self-efficacy, and therefore these questions may reveal factors influencing the participant's responses (Ewart, 1992).

Secondly, the mood responses in the RoBE scale and the HAD scale could be compared, to evaluate whether the expected correlation occurred.

### **Question Formation**

Wording was chosen for clarity and to keep the text below the recommended reading age of twelve (Streiner & Norman, 2003). The format of the questions ensured that (almost) all of the questions were not more than twenty words, to maximise clarity (Leary, 2001).

The order of the questions deliberately utilised a "funnel sequence" (Sarantakos, 1995). Subjects progress from simple task-orientated questions, to questions that may require more thought and self-reflection. Streiner and Norman (2003) note that responses to previous questions influence answers given to subsequent questions, therefore funnel sequencing enhanced the accuracy of the responses. The number of questions is in keeping with advice from the panel of experts.

### **Likert Scale**

The questionnaire includes a Likert scale responses to questions, as this has been commonly used in self-efficacy scales shown to be reliable

and valid (Brady, 2003; Shortridge-Baggett, 2002). The Likert scale allocates a numerical value to the responses, enabling a total for the self-efficacy scale. The Likert scale range in the RoBE scale was developed in keeping with recommendations by Streiner and Norman (2003). The range of 1-9 and labelling of endpoints only, was chosen in keeping with recommendations by Galvin (2002) and Streiner and Norman (2003). The potential for responses to gravitate towards the labelled points was considered in data analysis.

### **Format**

The format was chosen for minimal text and maximum clarity. It enables the health practitioner to gain an immediate visual impression of the patients' responses. A limitation with this is that it is easy for a patient to circle the same number in each question, as it follows a vertical line (Streiner & Norman, 2003). This repetition of responses was looked for during data analysis.

### **Face Validity**

The preliminary scale was presented to a panel of experts and clinicians for their feedback (five international experts on self-efficacy, and five physiotherapists who treat patients with BPD). A content validity index could not be calculated, as a majority of their feedback was given as written comment rather than using the marking Likert scale provided, as recommended by Lynn (1999). Face validity was instead assessed, and modifications were made to the scale in keeping with the comments received. This final version was used in phase two, where comments were also invited from the participants themselves, to further enhance the development of the RoBE scale.

## **PHASE 2: RESEARCH DESIGN**

### **Participants**

A population of sixteen participants referred with the preliminary diagnosis of BPD was recruited within a 21 day period, from one private and one public physiotherapy clinic in Auckland, New Zealand. The diagnosis was confirmed by the treating physiotherapist. Convenience sampling was utilised to recruit subjects for the study. No direct contact with the researcher was made prior to their first clinic appointment. A control group of ten participants was recruited from a post-graduate class at Auckland University of Technology, using convenience and snowball sampling. Research was approved by the Auckland Regional Ethics Committee, the Maori Research Review Committee and the Auckland District Health Board. Written informed consent was gained from all participants. Inclusion criteria for the BPD population were; a) age 17-80 years, b) fluent in English: written and spoken, and c) able to give informed consent. Exclusion criteria were; a) current lung disease (with the exception of occasional asthma symptoms), b) heart disease/

disorder, c) current disease process or taking a medication/supplement known to contribute to respiratory symptoms, and d) currently receiving treatment for a breathing disorder. The criteria were the same for the control group, but with the additional exclusion criteria of experiencing symptoms likely to be caused by a BPD. All the consecutive patients referred to the physiotherapy clinics for treatment of a BPD, in the stated time frame, were potential candidates. The 16 participants are described in Table 1.

**Table 1: Description of Respondents and non-Respondents in the Breathing Pattern Disorder and Control Groups.**

	BPD Group		Control Group	
	Public	Private	total	total
Age (years)				
17-24	0	2	2	0
25-39	1	2	3	5
40-59	2	5	7	2
60-80	2	2	4	3
Gender				
female	3	9	12	6
male	2	2	4	4
ethnicity				
NZ Euro	4	10		9
other	1	1		1
<b>total</b>	<b>5</b>	<b>11</b>	<b>16</b>	<b>10</b>

### Assessment Procedures

There is no gold standard assessment tool with which the RoBE scale can be compared, as general self-efficacy scales may not reflect self-efficacy in a specific area (Du Bois, 2002). The Nijmegen questionnaire and the HAD scale were chosen as they assess areas relevant to self-efficacy in the BPD population, and have been used previously in research examining BPD (Jack, Pearson, & Warburton, 2001; Jack, Rossiter, Warburton, & Whipp, 2003; Williams, 2000). This approach has been used in other studies developing a self-efficacy scale (Arlie, Baker, Smith, & Young, 2001; Smarr et al., 1997).

### Nijmegen Questionnaire

The Nijmegen questionnaire is widely used in research addressing BPD (Humphriss, Baguley, Anderson, & Wagstaff, 2004), and is easy to use in the clinical setting. It consists of a list of 16 symptoms, and various degrees of frequency, each of which has a numerical value (rare = 0, through to very often = 4), giving a total score out of 64. A total score of over 23 is suggestive of hyperventilation disorder (van Dixhoorn & Duivenvoorden, 1985). It was hypothesised a high Nijmegen score would correlate with a low score on the RoBE scale.

### The HAD scale

The HAD scale was developed by Zigmond and Snaith (1983), to assess levels of anxiety and depression in patients attending non-psychiatric hospital outpatient clinics. Depression and anxiety have been shown to have a significant effect on both self-efficacy (Arlie et al., 2001; Kavanagh, 1992) and BPD, in many people (Gilbert, 2002). The HAD scale has been shown to be valid and reliable (Aylard, Gooding, McKenna, & Snaith, 1987; Snaith & Taylor, 1985), and is feasible to use in a clinic setting. It has been used in other research for BPD (Bastow, 2001; Jack et al., 2003) and self-efficacy (Arlie et al, 2001).

The HAD scale consists of 14 questions, including two subscales. These subscales assess anxiety and depressive traits separately (seven questions apply to each trait), and respondents tick the appropriate response (four options are given for each question). These responses have a numerical value, giving a maximum total score of 21. A score of ten or more, in either trait subtotal, strongly suggests an anxiety or depression disorder. If there were differences in a participant's RoBE scale responses, it was hypothesised the HAD scale would reflect whether mood had changed, indicating a possible reason for the seeming disparity.

### Demographic questionnaire

A questionnaire was designed to provide information regarding the participants' age, gender, ethnicity, time span of symptoms experienced, previous treatment and its effect, symptoms since such treatment, and current medication or supplement use.

### Data Collection.

Both the BPD participants and the control population completed all the forms necessary for participation in this study.

The participants in the control group were given all the forms, including the informed consent, baseline and follow-up forms. They posted the initial completed set of forms to the private physiotherapy clinic participating in the study. Four days later they completed the three questionnaires again, and posted them as before.

Potential participants of the BPD group were posted only the consent forms and baseline forms, as a large amount of paperwork before the first appointment might have discouraged patients from attending. Mailed questionnaires frequently have poor return rates, and so strategies were used to improve the number of responses, including ensuring anonymity and pre-coding questionnaires, enclosing stamped, self-addressed envelopes, and keeping wording to a minimum, both in the covering information and the selection of questionnaires used. (Sarankatos, 1995, Streiner and Norman, 2003). Staff at the clinics kept a master list of potential participants, so that the age and gender of the non-responders could be noted. The BPD

participants brought their completed forms (informed consent, and questionnaires) to their first appointment. The completed forms were exchanged for the second set of the questionnaires (with letter of thanks), to complete before treatment commenced.

## DATA ANALYSIS

Statistical analyses were selected appropriate for the small sample sizes and absence of a normal distribution of data. Reliability of the RoBE scale was assessed by i) intra-class coefficient (ICC) to determine scale stability over time, and ii) Cronbach's alpha to assess internal consistency. Cronbach's alpha was applied to the RoBE scale total score, and to the scale with each item deleted. The responses from the BPD population and the control population were analysed separately.

Three statistical tests assessed for validity. Spearman's rank order coefficient assessed whether participants' response scores, when ranked according numerical value, ranked in the same order, across the questionnaires.

The Fisher Exact test was used to ascertain if a correlation occurred between the responses to the questionnaires, when the pre-established cut-off scores for the questionnaires were considered. In the Nijmegen questionnaire the defining score was  $\geq 24/64$ , as this has been established as indicating hyperventilation syndrome (van Dixhoorn & Duivenvoorden, 1985). Similarly the defining score for the HAD Scale was the pre-set mark of  $\geq 10/21$ , as established by the authors (Zigmond & Snaith, 1983). A defining score for the RoBE scale was determined by using two standard deviations from the mean score of the normal population ( $85.95 - 10.36 = 75.64$ ). This would theoretically ensure that 98% of the normal population would score above the cut-off mark, which was established as 75/90. It is therefore likely that a RoBE score of  $\leq 75$  on this scale suggests a person is either an outlier, or is outside the parameters of the normal population. The results of only the baseline/first responses were considered, as the BPD group and the control group both completed the forms at home, unlike the second completions, where the BPD group completed the forms at the clinic.

The Mann-Whitney U test was used to analyse variances in the responses of the BPD population versus the control population. This test was applied to assess the difference between the scores on a continuous measure in the BPD population and the control group. All the questionnaires provide a continuous scale.

The data was also examined for patterns of responses, suggesting potential bias which is inherent in any self-report questionnaire.

## RESULTS

### Demographics Sheet Data

Demographics of the two groups are shown in Table 1. Twenty three patients were invited to

participate in the study, six declined or did not respond, and one was excluded after returning inadequate information. The mean length of time BPD participants had been experiencing symptoms was evaluated from numerical responses and translating written responses into a likely time period. The mean time symptoms were experienced was 6 years ten months. The range was from two weeks, to 'maybe as long as I can remember'.

The possible impact of participant's medications were assessed using the New Ethicals Catalogue (ADIS, 2003) and observing the participant's relevant responses in the Nijmegen questionnaire and HAD scale. No effect of medication on symptoms was apparent.

### RoBE scale, Nijmegen questionnaire and HAD scale

The data from the three questionnaires are shown as scatter plots in Figures 1, 2 and 3. The responses from the first and second completions of the questionnaires are shown. The scatter plots show differentiation between the BPD group and the control group in all the questionnaires. The clearest definition appears to be in the RoBE scale.

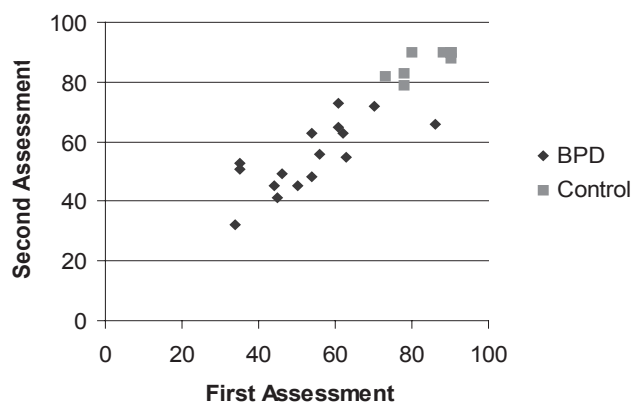


Figure 1. Self-Efficacy Scale responses.

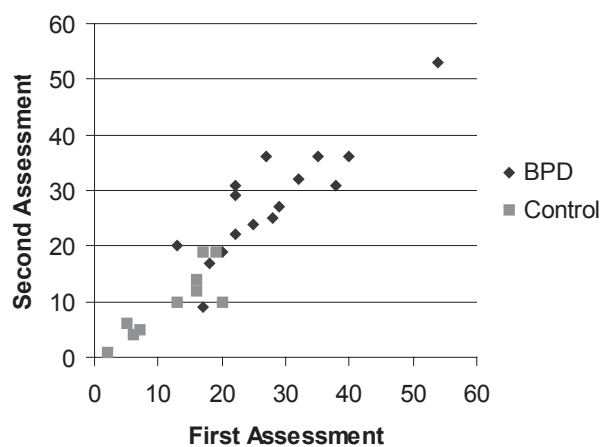


Figure 2. Nijmegen Questionnaire responses

### Median values for the RoBE scale

The median score for each item on the RoBE scale is shown in Table 2. This table shows the median

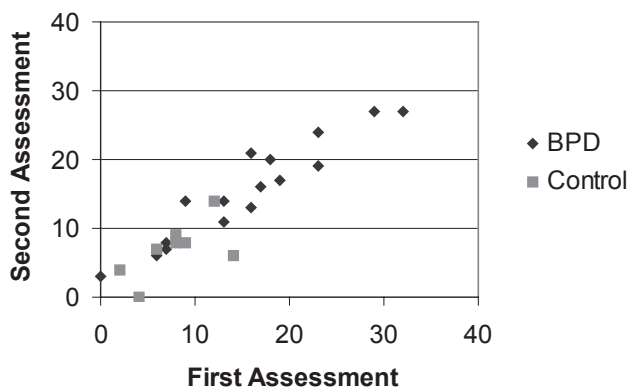


Figure 3. HAD scale responses (total score).

scores for both the first and second completion, and the range of responses. Results reflect a greater variation in the BPD group. Question five shows the greatest range over the two groups.

### Potential bias in responses

The RoBE scale was assessed for two aspects of potential response bias, that is, a) avoidance of using end range numbers, and b) repeated same responses. Four or more of the same response repeated was considered a positive result. The control population was not included in the assessment as repeated responses, especially '9', may reflect actual status.

In the BPD population (32 responses), 19 responses included the end range numbers (59%). This suggests participants frequently considered the entire range of numbers. When responses were assessed for repeated same responses, six responses (19%) showed a positive result. The responses were from a total of four participants. This suggests the bias was not consistent and did not appear likely to threaten scale validity.

### Reliability

The ICC values for the RoBE scale are adequate at 0.69 for the BPD population, and reasonable at 0.73

for the normal population. The broad confidence intervals, however, (0.28 to 0.88 and 0.22 to 0.93 respectively) suggest there is considerable variation around the ICC values in both populations. The higher ICC value for the control population suggests this group is more static.

### Internal Consistency

The Cronbach's alpha values for the RoBE scale (shown in Tables 3 & 4) indicate that the RoBE scale shows good internal consistency in both groups. The responses from the normal population showed a higher internal consistency. This would be expected, given the homogenous lack of symptoms, and suggests the scale is stable over time.

Table 3: Cronbach's Alpha Values in First and Second Response for RoBE Scale in Both Populations.

Population	Data collection	Cronbach's alpha value
BPD	1st	0.84
	2nd	0.80
Control	1st	0.93
	2nd	0.95

With each question individually deleted the alpha values for the total scale showed little variation between completions (see Table 4).

The question most affecting internal consistency in the BPD population responses appeared to be question five (this question referred to identifying triggers), as the removal of this item increased the Cronbach's alpha level above that of the total scale in both first and second completions (0.85 compared to total scale alpha 0.84, and 0.82 compared to total scale alpha 0.80, respectively). It is possible therefore that question five in particular is testing a slightly different dimension than the other questions within the scale.

Table 2: RoBE Scale Individual Items Range (combined first and second response) and Median Score

Item	BPD Population			Control population		
	Range	1st response	2nd response	Range	1st response	2nd response
1	7	5	5	2	7.5	9
2	7	6	4	1	9	9
3	5	5	5	1	9	9
4	5	4	5	2	9	9
5	8	5	5	4	9	9
6	8	4	5	2	9	9
7	8	5	6	2	9	9
8	8	4	5	2	9	9
9	5	7	7	2	9	9
10	5	7	8	2	9	9
total	54	54	53	12.5	89	90

**Table 4: Cronbach's Alpha Values for Each Item Deleted, in 1st and 2nd Response in Breathing Pattern Disorder Population.**

Item deleted	1st response	2nd response
	Cronbach's Alpha when item deleted	Cronbach's Alpha when item deleted
1	0.82	0.78
2	0.83	0.84
3	0.83	0.78
4	0.84	0.77
5	0.85	0.82
6	0.81	0.80
7	0.81	0.76
8	0.83	0.77
9	0.82	0.77
10	0.83	0.78

**Assessment of concurrent/parallel validity Spearman's rank order coefficient**

The Spearman's test provides a *rho* value (*r*) which is between 0 and 1. The *r* values for the BPD participants' responses of the baseline completion of the questionnaires, as they compare against another questionnaire, are shown in Table 5.

**Table 5: Spearman's Rank Coefficient for RoBE Scale, Nijmegen Questionnaire and Hospital Anxiety and Depression (HAD) Scale**

	1	2	3	4	5	6	7
1. RoBE score							
2. Nijmegen score	-.01						
3. HAD anxiety	-.42	.62*					
4. HAD depression	-.17	.50*	.77**				
5. HAD total	-.36	.62*	.96**	.88**			
6. RoBE mood today	.45	-.33	-.55*	-.40	-.56*		
7. RoBE mood generally	.25	-.51	-.61*	-.34	-.56*	.85**	

HAD = Hospital Anxiety and Depression scale  
\*  $p < .05$ , \*\*  $P < .01$ .

The RoBE score did not have a statistically significant correlation with any of the other assessment tools when Spearman's analysis was applied. The two mood questions on the RoBE scale, that is, mood today and mood generally had a significant correlation with the HAD anxiety subscale (-0.55 ( $p = 0.032$ ) and -0.62 ( $p = 0.017$ ) respectively). The negative correlation between the RoBE scale and both Nijmegen and HAD scores, reflects the inverse scoring; that is, a high RoBE score reflects minimal/no BPD symptoms, and low anxiety/depression.

**Fisher Exact test**

The Fisher exact test was applied to assess the scores of the BPD population on their baseline

data. The results could not be used, however, as the distribution of the data did not satisfy the assumptions of the test. The scores were distributed as follows i) in the RoBE scale one of the 16 participants with BPD scored above 75/90 – that is, within the expected normal range ( this did not occur when they repeated the scale 4 days later), ii) in the Nijmegen questionnaire, 9/16 of the BPD population, and none of the control group showed a score over 23/64 ( suggestive of hyperventilation), iii) in the HAD scale 0/10 in the control group had a positive score for depression or anxiety, whereas in the BPD population the positive scores were 4/16 and 9/16 respectively.

**Mann-Whitney U Test**

There was a statistically significant differentiation between the different populations and their scores in all of the questionnaires, with the exception of the HAD Depression subscale (see table 6). The RoBE scale showed the strongest differentiation ( $p = 0.00$ ), and this reflects the marked difference in the median scores in the two completions, of 54(53)/90 in the BPD population and 89(90)/90 in the control group. The Nijmegen questionnaire also showed significant differentiation ( $p = 0.00$ ), and this would be expected as it is designed specifically for the BPD population. The HAD anxiety subscale result ( $p = 0.003$ ) was similarly statistically significant.

**Table 6: Mann-Whitney U Test, Comparing Breathing Pattern Disorder Population and Control Group Scores on all Questionnaires**

Questionnaire	Mann Whitney U value
RoBE scale	4.00**
Nijmegen questionnaire	10.50**
HAD anxiety score	15.50*
HAD depression score	43.00
HAD total score	28.00*

\*  $p < .05$ , \*\*  $p < .01$ .

**DISCUSSION**

In this study we have reported the development of a self-efficacy scale for routine use in the treatment of BPD. This scale is intended to address the lack of psychometric assessment tools for BPD (Roth, Wilhelm, Meuret, & Alpers, 2002).

The results indicate that the RoBE scale has good reliability with ICC values 0.69 for the BPD population and 0.73 for the control group. Taking into account the small population size, the statistical values regarding reliability are comparable with other studies developing a SE scale (Arlie et al., 2001; Brady, 2003; Shin et al., 2001). The Cronbach's alpha values for the RoBE scale suggest the scale has an acceptable level of internal consistency at first and second data completion. Internal consistency value may have been higher if the questionnaires had been completed in the same setting instead of home and clinic. It is also possible that the RoBE scale is

reflecting actual change in condition over the four day period, as BPD symptoms are often variable dependent on the triggers present.

The tests of concurrent/parallel validity showed significance in some areas but not others. Results of the Mann Whitney U test supported the RoBE scale significantly differentiated between the BPD and the control group ( $p < 0.01$ ), and this reflects the marked difference in the median scores of the two populations. Figures 1-3 show the two populations have more distinct scores in the RoBE scale than either the Nijmegen or HAD scales.

The lack of applicability of the Fisher Exact test likely reflects inadequate numbers, and a larger sample size may support the statistical significance regarding whether the participants' scores which fell above the pre-established cut-off mark in one questionnaire also did so in the other questionnaires. The raw data supports such significance may be likely.

The Spearman's result, analysing the ranking of each participant's scores across the three questionnaires, did not reach significance, suggesting the RoBE score was not strongly related to severity of symptoms (Nijmegen score) or level of anxiety (HAD anxiety score). Anxiety is one of many factors that, in interaction with environmental and personal factors, affects self-efficacy. The Spearman's scores support that anxiety and symptom severity do not operate as isolated factors influencing SE. When the scores were considered in relation to the cut-off marks for each questionnaire, the raw data suggests further research may support some correlation between the three questionnaires.

There did not appear to be bias in the participants' responses on the RoBE scale. The wide range of scores (range = 54), and distribution suggests the bias of the 'social desirability response', that is, giving the answer they think the researcher wants, was not evident. It is possible there was some under-reporting of difficulties, however this can occur with any self-report assessment. The bias of 'acquiescence and nay-saying', that is, repeated responses at one end of the scale, was rare.

The data from the participants with repeated scores, that is, four or more of consecutive same response to questions, was examined for commonalities. One participant showed similar repetition in responses on the Nijmegen questionnaire and RoBE scale, suggesting the responses may be an accurate reflection of their symptoms. This corresponding repetition was not seen in the other participants. Where the repetition of responses did exist, it was noted to concur with higher HAD depression scores, and changed with changes in the depression score. One participant showed a marked decrease in their HAD

depression scale score, from 11/21, suggesting probable depression disorder, to 7/21, suggesting no depressive disorder. Their second RoBE scale showed greater variability and range. When the HAD depression scores were considered in all BPD participants, eleven reported altered levels of depression, and seven of these had a change of two or more points. Of these, all except one showed changes in RoBE responses. When in the less depressed state, three had a greater range in their responses, three showed fewer repetitions in their responses, and two showed a shift towards improved scores (range did not change). Although there was no statistical correlation between HAD depression score and RoBE score, this closer analysis suggests depression may influence responses on the RoBE scale. It is possible depression influenced responses on the RoBE scale, as the range of numbers used in responses was higher when depression lessened ( $n=3$ ). The lethargy associated with depression may explain the repetition of same responses on the scale. This suggests mood may be influencing responses rather than questionnaire response bias.

Changes in the HAD anxiety score were small: all except one participant showed little/no change (range 0-1). There appeared to be no correlation with changes in the RoBE responses.

The strongest correlations regarding mood that are of clinical interest, are the correlations between the RoBE mood questions and HAD anxiety, as shown in Spearman's rank coefficient. These results suggest the RoBE mood questions reflect the patient's level of anxiety. They also reflect the impact mood may have on the patient's rating of their symptoms severity, or conversely, the effect of their symptoms on their mood. Literature supports the bi-directional relationship between mood, in particular anxiety and depression, and self-efficacy (Ewart, 1992; Kavanagh, 1992). Anxiety is a key factor in BPD, and this was supported by the higher HAD anxiety scores in this group. There is little written on depression and BPD, and this is an area deserving further investigation.

Self-efficacy tools have a unique role in assisting physiotherapists' assessment of patients' attitudes and self-beliefs regarding their symptoms, and predicting the patients' likely health

behaviours, such as motivation, commitment and perseverance with the treatments we provide. High self-efficacy is linked to better self-management, and the benefits of this are far reaching for the client, the clinician and the community.

For the clinician, the scale provides insight into the patients' experience of the BPD – and areas of concern that can be addressed. A self-efficacy scale is a quick method of recording the patient's perception of their control over symptoms, and

*“A self-efficacy scale is a quick method of recording the patient's perception of their control over symptoms”*



repeating the scale post-treatment could clearly show change. This scale could be included within the routine treatment for BPD. Done before the first treatment, at the last appointment and sent as a follow-up 12-18 months later, this scale may reveal changes, and any ongoing areas of concern for the patient. This will help determine when treatment can be stopped, or needs to be re-established. A self-efficacy scale provides numerical values, reflecting treatment efficacy and health outcome in a way that can be easily understood by people working outside the field, and this is important as competition for health expenditure increases. The RoBE scale measures an outcome that reflects the reality of the illness experience of the patient.

For the patient, the RoBE scale encourages meta-cognitive thinking that challenges assumptions and beliefs which are irrational or unfounded – cognitions which may hinder the patient from progressing (Maddux et al., 1995). As healthcare embraces a more qualitative approach, the consideration of what constitutes successful treatment outcomes must broaden (Frith, 1999).

The limitations of the current study include the small sample sizes, and the lack of independent screening of both groups confirming the presence or absence of a BPD. The different settings in which the BPD population completed their questionnaires were not ideal, and may have decreased the reliability scores. It was not feasible to replicate the settings of either population for all participants. The questions in the RoBE scale were developed from literature and clinical findings. It would be useful to discuss the questions with people who have/had BPD to gain their input. They may suggest areas not covered in the existing questions, and this merits further research.

A difficulty of developing a new tool in the area of BPD is the diverse aetiology and expression of BPD, which encompasses physical symptoms, cognitive processing, physiological changes and musculo-skeletal issues, driven by an equally eclectic range of triggers. This diversity may explain why the RoBE scale did not show a stronger correlation with the Nijmegen questionnaire, as it is measuring a different dimension in a multi-dimensional disorder. It also reinforces, however, the need to address this by developing new and relevant assessment tools.

Whilst searches on health databases such as Pubmed and Psycinfo produce hundreds of articles acknowledging the role of self-efficacy in health outcomes, there is a significant lack of scales for the assessment of self-efficacy being developed by physiotherapists. This is particularly significant when scales are being developed to examine the outcome of physiotherapy interventions, for example for exercise regimes (Shin, Jang & Pender, 2001) and pelvic floor re-education (Chen, 2004). In order to validly assess treatment outcomes, we need to be actively developing and validating our assessment tools. Physiotherapists work directly with patients in the delivery of treatment regimes,

and this, combined with their medical knowledge, places them in the ideal position to develop such assessment scales.

The RoBE scale shows potential in this pilot study. Preliminary results suggest the scale may prove to be reliable and valid, and further research with larger sample groups is warranted to provide the strong statistical analysis necessary. A multi-centre study may be more appropriate to capture a more diverse population. The sensitivity of this scale to change, and the minimal clinical input necessary to show change have not been established, and this is essential for the RoBE scale to be useful in the clinic and in research.

The development and testing of scales such as the RoBE is essential, for the progression of our profession into a broader vision of health and recovery, and to provide optimal treatment for our patients, enhancing both their level of competency and their belief in their ability to be an active, essential part of their own well-being.

#### Key Points

- Self-efficacy is a person's confidence in their ability to perform a particular task.
- It is a stronger predictor of performance than actual skill level
- By ensuring patients have high self-efficacy they will follow our treatment prescriptions, we can maximise the likelihood of good self-management.
- A large number of self-efficacy scales are being developed for health populations, to assess areas we consider part of our treatment outcomes.
- Very few such scales are being developed by physiotherapists.
- The RoBE scale has been developed to assess self-efficacy in people with breathing pattern disorders, regarding controlling/eliminating their symptoms.
- This pilot study suggests the RoBE scale has potential for achieving this, and merits further research to confirm this.

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#### REFERENCES

- ADIS. (2003). *MIMS New Ethicals* (Vol. May). Auckland: MediMedia (NZ) Ltd.
- Arlie J, Baker GA, Smith SJ and Young CA (2001): Measuring the impact of multiple sclerosis on psychosocial functioning: the development of a new self-efficacy scale. *Clinical Rehabilitation*, 15, 259-265.
- Aylard P, Gooding J, McKenna P and Snaith RP (1987): A validation of three anxiety and depression self-assessment scales. *Journal of Psychosomatic Research*, 31(2), 261-268.
- Bandura A (1977): Self-efficacy: Towards a unifying theory of behavioural change. *Psychological Review*, 84, 191-215.
- Bandura A (1992): Exercise of personal agency through the self-efficacy mechanism. In R. Schwarzer (Ed.), *Self-efficacy: Thought Control of Action* (pp. 3-37). Washington: Hemisphere Pub Corp.

- Barnason S, Zimmerman L, Atwood J, Nieveen J and Schmaderer M (2002): Development of a self-efficacy instrument for coronary artery bypass graft patients. *Journal of Nursing Measurement*, 10(2), 123-133.
- Bastow V (2001): *Hyperventilation syndrome and physiotherapy intervention: a retrospective study*. Paper presented at the 8th Annual Meeting of the International Society for the Advancement of Respiratory Psychophysiology (ISARP), Oxford, England.
- Brady T (2003): Measures of self-efficacy, helplessness, mastery, and control: The Arthritis Helplessness Index (AHI)/Rheumatoid Attitudes Index (RAI), Arthritis Self-efficacy Scale (ASES), Children's Arthritis Self-efficacy Scale (CASE), General Self-efficacy Scale (GSES), Mastery Scale, Multi-Dimensional Health Locus of Control Scale (MHLC), Parent's Arthritis Self-Efficacy Scale (PASE), Rheumatoid Arthritis Self-Efficacy Scale (RASE), and Self-Efficacy Scale (SES). *Arthritis Care and Research*, 49(S5), S147-S164.
- Chaitow L (2002): Biomechanical influences on breathing. In L. Chaitow, D. Bradley & C. Gilbert (Eds.), *Multidisciplinary approaches to breathing pattern disorders* (pp. 83-110). Edinburgh: Churchill Livingstone.
- Du Bois KA (2002): *Development of a self-efficacy instrument for patients with chronic low back pain and its use as a predictor of physical therapy outcome*. University of Connecticut, Connecticut.
- Ewart C (1992): Role of self-efficacy in recovery from heart attack. In R. Schwarzer (Ed.), *Self-efficacy: Thought Control of Action*. Washington: Hemisphere Pub. Corp.
- Ewert C (1992): Role of self-efficacy in recovery from heart attack. In R. Schwarzer (Ed.), *Self-efficacy: Thought Control of Action*. Washington: Hemisphere.
- Frith L (1999): Priority setting and evidence based purchasing. *Health Care Analysis*, 7(2), 139-151.
- Gardner WN (2004): Hyperventilation. *American Journal of Respiratory and Critical Care Medicine*, 170, 105-107.
- Gerin W, Litt M, Deich J and Pickering T (1996): Self-efficacy as a component of active coping: effects on cardiovascular reactivity. *Journal of Psychometric Research*, 40(5), 485-493.
- Gilbert C (2002): Interaction of psychological and emotional effects with breathing dysfunction. In L. Chaitow, D. Bradley & C. Gilbert (Eds.), *Multidisciplinary approaches to breathing pattern disorders* (pp. 11-130). Edinburgh: Churchill Livingstone.
- Humphriss RL, Baguley DM, Anderson G and Wagstaff S. (2004). Hyperventilation in the vestibular clinic: use of the Nijmegen questionnaire. *Clinical Otolaryngology*, 29(3), 232.
- Jack S, Pearson MG and Warburton CJ (2001): *A placebo controlled randomised study for treatment of patients with idiopathic hyperventilation*. Paper presented at the 8th Annual Meeting of the International Society for the Advancement of Respiratory Psychophysiology, Oxford, England.
- Jack S, Rossiter HB, Pearson MG and Ward SA (2004): Ventilatory responses to inhaled carbon dioxide, hypoxia, and exercise in idiopathic hyperventilation. *American Journal of Respiratory and Critical Care Medicine*, 170(2), 118-125.
- Jack S, Rossiter HB, Warburton CJ and Whipp BJ (2003): Behavioural influences and physiological indices of ventilatory control in subjects with idiopathic hyperventilation. *Behaviour Modification*, 27(5), 637-652.
- Jerusalem M and Schwarzer R (1992): Self-efficacy as a resource factor in stress appraisal processes. In R. Schwarzer (Ed.), *Self-efficacy: thought control of action* (pp. 195-216). Philadelphia: Hemisphere Pub.
- Kavanagh DJ (1992): Self-efficacy and depression. In R. Schwarzer (Ed.), *Self-efficacy: thought control of action* (pp. 177-194). Philadelphia: Hemisphere Pub.
- Kavanagh DJ and Bower GH (1985): Mood and self-efficacy: Impact of joy and sadness on perceived capabilities. *Cognitive Therapy and Research*, 9(5), 507-525.
- Leary M. (2001). *Introduction to behavioural research methods*. Needham Heights, USA: Allyn & Bacon.
- Maddux JE, Brawley L and Boykin A (1995): Self-efficacy and health behaviour. In JE Maddux (Ed.), *Self-efficacy, adaptation, and adjustment: Theory, research and application* (pp. 173-201). New York: Plenum Press.
- Meichenbaum D and Turk D (1987): *Facilitating treatment adherence: a practitioner's guidebook*. New York: Plenum Press.
- Pajares F (2002): *Overview of social cognitive theory and of self-efficacy*. Retrieved 18/03/2004, from <http://www.emory.edu/EDUCATION/mfp/eff.html>
- Roth WT, Wilhelm FH, Meuret AE and Alpers GW (2002): *Respiratory tests for diagnosis and evaluation of outcomes in anxiety disorders*. Paper presented at the 9th Annual Meeting for the International Society for the Advancement of Respiratory Psychophysiology, Washington, USA.
- Sallis JF, Pinski RB, Grossman RM, Patterson TL and Nader PR (1988): The development of self-efficacy scales for health-related diet and exercise behaviours. *Health Education Research*, 3(3), 283-292.
- Sarantakos S (1995): *Social Research*. Melbourne: MacMillan Education Australia Pty Ltd.
- Schleifer L, Ley R and Spalding TW (2002): A hyperventilation theory of job stress and musculoskeletal disorders. *American Journal of Industrial Medicine*, 41, 420-432.
- Schwarzer R (1992): Self-efficacy in the adoption and maintenance of health behaviours. In R. Schwarzer (Ed.), *Self-efficacy: Thought Control of Action*. Washington: Hemisphere Pub Corp.
- Shin Y, Jang H and Pender NJ (2001): Psychometric evaluation of the exercise self-efficacy scale among Korean adults with chronic diseases. *Research in Nursing & Health*, 24, 68-76.
- Shortridge-Baggett L (2002): Self-efficacy: Measurement and intervention in nursing. In E. Lenz & L. Shortridge-Baggett (Eds.), *Self-efficacy in nursing: research and measurement perspectives*. New York: Springer Publishing.
- Smarr KL, Parker JE, Wright GE, Stucky-Ropp RC, Buckelew SP, Hoffman RW et al. (1997). The importance of enhancing self-efficacy in Rheumatoid Arthritis. *Arthritis Care and Research*, 10(1), 18-26.
- Snaith RP and Taylor C (1985): Rating scales for depression and anxiety: a current perspective. *British Journal of Clinical Pharmacology*, 19, 17S-20S.
- Strecher V, McEvoy DeVellis B, Becker M and Rosenstock I (1986): The role of self-efficacy in achieving health behaviour change. *Health Education Quarterly*, 13, 73-91.
- Streiner DL and Norman GR (2003): *Health Measurement scales* (3rd edition ed.). Oxford: Oxford Medical Publications.
- van Dixhoorn J and Duivenvoorden H (1985): Efficacy of the Nijmegen questionnaire in recognition of the hyperventilation syndrome. *Journal of Psychosomatic Research*, 29(2), 199-206.
- Williams J (2000): Audit of physiotherapy breathing re-education for people with hyperventilation syndrome (HVS). *Association of Chartered Physiotherapists in Respiratory Care*, 1-43.
- Williams S (1995): Self-efficacy, anxiety and phobic disorders. In J. E. Maddux (Ed.), *Self-efficacy, Adaptation and Adjustment: Theory, Research and Adaptation* (pp. 176). New York: Plenum Press.
- Williams SL (1995): Self-efficacy, anxiety and phobic disorders. In J. E. Maddux (Ed.), *Self-Efficacy: Adaptation and Adjustment: Theory, Research and Adaptation*. New York: Plenum Press.
- Zigmond AS and Snaith RP (1983): The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, 67, 361-370.

## ADDRESS FOR CORRESPONDENCE

Janet Rowley, Breathing Works, 437 Remuera Road, Auckland 5, New Zealand, Tel: 64 9 5221 122, Fax 64 9 524 9192, e-mail [bw@breathingworks.com](mailto:bw@breathingworks.com)

