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REVIEW

Panic attacks and panic disorder in chronic obstructive pulmonary disease: A cognitive behavioral perspective

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Cognitive behavior therapy – CBT**Summary**

The prevalence of panic disorder in patients with chronic obstructive pulmonary disease (COPD) is up to 10 times greater than the overall population prevalence of 1.5–3.5%, and panic attacks are commonly experienced. When present, clinically significant anxiety decreases quality of life for COPD patients, and also increases health care costs. Therefore, understanding why COPD patients have such high rates of panic attacks and panic disorder is important for optimal management of COPD. The cognitive model of panic anxiety is the most widely accepted theory of panic attacks and panic disorder in physically healthy adults. According to this model, panic attacks occur when catastrophic misinterpretations of ambiguous physical sensations (such as shortness of breath or increased heart rate) increase arousal, creating a positive feedback loop that results in panic. As the major symptom of a terminal illness that threatens our most basic physical requirement, dyspnea in COPD is open to catastrophic misinterpretation. There is some experimental and clinical evidence for the applicability of the cognitive model of panic anxiety in COPD, and of the utility of cognitive behavior therapy (CBT), based on this model, for treating anxiety symptoms and panic attacks in COPD patients. However, there is much need for further studies. Evidence is increasing that mental health professionals, in collaboration with multi-disciplinary pulmonary teams, potentially have key roles to play in preventing and treating panic attacks and panic disorder in COPD patients. This review addresses diagnosis, epidemiology, theoretical conceptualizations, treatment, and recommendations for future research.

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Contents

Introduction	1247
Diagnosis and epidemiology of panic-spectrum psychopathology in COPD	1247
The cognitive model of panic-spectrum psychopathology and its applicability in COPD	1248
Cognitive behavior therapy for panic-spectrum psychopathology in COPD	1249
Cognitive behavior therapy for panic-spectrum psychopathology in COPD: special issues	1250
Future research: where next?	1251
Conclusions	1251
Conflict of interest	1251
References	1251

Introduction

Chronic obstructive pulmonary disease (COPD) is a major global cause of disability and death, with anxiety symptoms among the most frequently reported predictors of impaired quality of life and functional status.^{1–10} Of the nine anxiety disorders listed in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), the incidence of one, panic disorder, is remarkably high in COPD.^{11–13} When panic attacks and panic disorder (panic-spectrum psychopathology) are comorbid with COPD, they are associated with increased symptom reporting, worse quality of life, more use of medical treatments, and increased rates of hospitalisation.^{14–17} The aim of this paper is to, from a cognitive behavioral perspective, review developments in experimental and clinical research on panic-spectrum psychopathology in COPD. The review will address diagnosis, epidemiology, theoretical conceptualizations, treatment, and recommendations for future research.

Diagnosis and epidemiology of panic-spectrum psychopathology in COPD

Using criteria from the DSM-IV (American Psychiatric Association, 1994, p. 432), a panic attack is “A discrete period of intense fear or discomfort”, accompanied by at least four of a possible 13 symptoms of physical arousal (including sensations of shortness of breath or smothering) and fear (of imminent loss of control, madness or death).¹¹ When recurrent panic attacks are experienced by a patient with COPD, but the attacks occur only in association with severe breathing difficulties during infective exacerbations of the illness, then the appropriate diagnosis is not panic disorder but anxiety disorder due to a general medical condition.¹⁸ Panic disorder can be diagnosed (using DSM-IV criteria) in the context of COPD only when an individual experiences recurrent, *unclued* panic attacks; that is, he or she must experience at least some attacks that are not triggered by an identifiable internal stressor such as an infective exacerbation of the illness, or an external stressor such as physical exertion. Regular attacks for which triggers, such as physical exertion, can be identified may *also* be experienced, but would not in themselves be sufficient to meet criteria for the diagnosis of panic disorder.^{18,19} For this diagnosis, a series of unexpected panic attacks must further be followed by at least a month of persistent

concern about having further attacks, worry about the implications or consequences of such attacks, and/or significant behavioral change related to the attacks such as the development of agoraphobic avoidance.¹¹ Avoidance of situations in which it is feared attacks may occur develops in approximately one third of COPD patients with panic disorder.¹⁸ In summary, panic disorder is distinguishable in COPD patients by anticipatory anxiety about future panic attacks, and the unexpected and unpredictable nature of at least some of these attacks, that do not occur solely in response to situations inevitably causing shortness of breath in COPD (such as physical exertion, or infective exacerbations).

There is evidence that panic attacks are a frequent experience for patients with COPD. In a large community sample, postmenopausal women with a history of COPD were significantly more likely to report having had panic attacks (odds ratio 4.13; confidence interval 2.65–6.43) than were women without COPD.²⁰ Another study of a convenience sample of 48 outpatients with COPD found that 37% had experienced a panic attack in the previous three weeks.²¹ In a more recent study, also using a convenience sample, 63% (n = 37) of subjects had experienced at least one panic attack in the previous year, and 51% (n = 19) of these an attack in the previous month.²²

Estimates of the prevalence of panic disorder in COPD have ranged from 6% to 67%.^{8,23} The wide range may reflect methodological differences between studies in regard to sample selection and size, measurement methods, and thresholds for syndrome identification.^{8,14,23–26} Nevertheless, the prevalence is clearly considerably higher than that of 1.5–3.5% for the population in general, perhaps as much as 10 times so.^{11,12} This higher prevalence of panic disorder in COPD also contrasts with the repeated finding in community-based studies that rates of panic disorder in older adults are lower than those in younger and middle-aged adults, and in the range of 0.04–1.0%.^{19,27} The authors of some epidemiological studies have commented on the high comorbidity between panic disorder and chronic physical illness in the elderly.^{27–29} Such comorbidity has been noted to contribute to the chronicity of panic disorder, and to complicate its treatment.^{16,30,31}

The majority of studies thus far investigating the impacts of anxiety on COPD patients have only measured anxiety symptoms by self-report questionnaire. Questionnaire based data does not allow diagnosis of panic disorder, or indeed any psychiatric disorder. However, high scores on

standardized anxiety questionnaires are still indicative of clinically significant anxiety symptoms, and a subset of COPD patients with such scores would meet DSM-IV criteria for panic disorder if a formal diagnostic interview was administered. When present, symptoms of anxiety have been found to influence self-management of COPD, and even influence mortality.^{32–35} Anxiety symptoms and panic attacks have been found to predict increased duration and frequency of hospital admissions for acute exacerbations of COPD, and high utilization of medical services, at significantly increased financial cost.^{15–17,36–41} Yellowlees and colleagues found that COPD patients with comorbid panic disorder had more frequent hospital admissions than other COPD patients, and the admissions were twice as lengthy.¹⁴

The cognitive model of panic-spectrum psychopathology and its applicability in COPD

Panic attacks and panic disorder have, for the past three decades, been the subject of considerable theoretical controversy. Biological theories have primarily linked panic with disorders of respiration: in particular, hyperventilation.^{42–45} These theories have been criticized on the grounds that hyperventilation has not been found to be particular to patients with panic disorder, and that carbon dioxide concentrations used in supporting experiments have been higher than those that could arise naturally.^{46–48} Psychological theorists have argued that biological models are neither necessary nor sufficient to explain the occurrence of panic attacks, and the development of panic disorder.^{47,49,50} The most widely accepted theory of panic-spectrum psychopathology, which has risen to prominence in the last 20 years, is Clark's cognitive model (see Fig. 1).^{51,52} This model is based on Beck's (1976) formulation of an individual's beliefs as providing the causal basis for misappraisals, which then lead to the development of emotional disorders.⁵³ In the model, catastrophic misinterpretations of ambiguous bodily sensations (such as shortness of breath, rapid heart rate and light-headedness) increase arousal, creating a positive feedback loop that results in a panic attack. Such sensations may be interpreted as meaning that the individual may die (for example, by suffocation, heart attack, or "stroke" respectively), become insane, or otherwise lose control. A

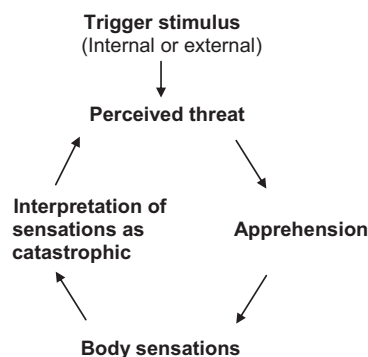


Figure 1 Clark's model of the suggested sequence of events in a panic attack. From Clark (1986, p. 463).

substantial number of studies with physically healthy younger adults have provided support for the cognitive model.^{54–60} The model has also provided the rationale for cognitive behavior therapy (CBT) for panic-spectrum psychopathology, a treatment of proven efficacy in the physically healthy.^{61–63} CBT is an action-oriented treatment in which both cognitive (e.g. identification and challenging of interpretation errors) and behavioral (e.g. planned exposure to avoided sensations and situations) strategies are used to interrupt the panic cycle and facilitate more adaptive responses.^{61–63} There is increasing evidence that CBT for panic-spectrum psychopathology is effective because it is able to successfully decrease catastrophic beliefs about ambiguous physical sensations, as predicted by the cognitive model.^{60,64}

A crucial difference between physically healthy people and those with COPD is that in the latter, breathing, the most basic of all physical functions necessary for life, is objectively threatened (as measured by tests of lung function) and subjectively difficult. Dyspnea can be an unpleasant and potentially frightening experience at any time, and, as the key symptom of an eventually fatal illness like COPD, it is an ambiguous sensation open to catastrophic interpretation. Clinical and experimental studies have found that people with panic disorder are more likely to direct their attention toward ambiguous physical sensations, and to interpret such sensations as threatening.^{57,58,64–67} The threat presented by dyspnea in COPD is consistent with the high prevalence of comorbid panic disorder in this patient group.

The cognitive model of panic in COPD is supported by the findings that pulmonary function and response to bronchodilators do not differ between COPD patients who experience panic attacks and those who do not.^{21–23,25,26,68} Physiological research has demonstrated both that respiratory rate is increased by anxiety, and that the resulting rapid, shallow breathing pattern markedly worsens dyspnea in COPD.^{69,70} In healthy individuals, hyperventilation lowers the level of carbon dioxide in the blood, leading to typical panic symptoms such as light-headedness, numbness, tingling sensations, and shortness of breath.⁷⁰ For patients with lung disease, in addition hyperventilation can directly produce bronchoconstriction, probably by exposing the airways to cool, dry air.⁷¹ Increased frequency of breathing also predisposes to dynamic hyperinflation, due to the slow time constant for lung deflation. Hyperinflation increases the elastic load and work and effort of breathing, reduces inspiratory reserve capacities, and exacerbates dyspnea.⁷² The cognitive model predicts that only those individuals with COPD who interpret their physical symptoms catastrophically should experience panic attacks.

Porzelius and colleagues (1992) and Moore and Zebb (1999) investigated the presence of catastrophic cognitions in COPD patients.^{21,25} The first group reported that the 37% of their subjects who had experienced panic attacks had significantly more catastrophic thoughts about somatic symptoms (as measured by questionnaire) than subjects who had not experienced panic attacks.²¹ Thirty two percent of subjects in Moore and Zebb's study reported symptoms compatible with a diagnosis of panic disorder, and these subjects also had significantly higher rates of catastrophic cognitions than subjects without panic-

spectrum psychopathology.²⁵ The results of these two studies provide some support for the cognitive model of panic disorder in patients with COPD. However, neither study included formal diagnoses of panic attacks and panic disorder, thereby limiting the applicability of the findings. In Voegelé and von Leupoldt's (2008) study of 20 hospitalized patients with COPD, 11 (55%) were diagnosed with an anxiety disorder, eight of these with panic disorder.²⁶ Those COPD patients with an anxiety disorder reported significantly higher levels of physical symptom perception, despite their lung function being no worse than that of patients without an anxiety disorder.²⁶ This study indicates that heightened symptom perception and misinterpretations of physical sensations are associated with panic disorder in COPD, with the qualification that patients were tested during an exacerbation.

Recently, 20 clinically well COPD patients with panic-spectrum psychopathology were compared on a test of dyspnea perception with 20 age-matched COPD patients without psychopathology and 20 healthy, age-matched matched control subjects.⁶⁸ The COPD panic group rated themselves as more short of breath during inspiratory resistive loading than did the COPD group without panic, despite there being no differences between the two in respiratory function.⁶⁸ This heightened dyspnea perception in the COPD panic group provides evidence of the somatosensory amplification that would be predicted by the cognitive model of panic anxiety.

In summary, dyspnea in COPD lends itself to interpretation as an extreme and frightening symptom. Anxiety increases respiratory rate, and the hyperventilation that results will significantly exacerbate dyspnea in the disease.^{69–72} Catastrophic interpretation may then follow, as in the vicious cycle of panic, and agoraphobic avoidance behavior may also ensue.⁷³

Cognitive behavior therapy for panic-spectrum psychopathology in COPD

Simon and Fischmann brought to attention the concept that "COPD with comorbid panic disorder provides an example of a case in which the medical disorder is chronic, yet intervention for panic disorder may provide symptomatic relief for both disorders" (2005, p. 9).¹⁶ As stated above, CBT is a treatment of proven efficacy for panic disorder, and other anxiety disorders, in the physically healthy.^{61–63} CBT interventions for anxiety symptoms in COPD patients *not* selected on the basis of existing psychopathology have been evaluated in four randomized controlled trials.^{41,74–76} One further randomized controlled trial of CBT has included COPD patients with clinically significant anxiety and/or depressive symptoms.⁷⁷

Emery and colleagues (1998) assigned 79 subjects with COPD to 10 weekly, group-administered sessions of combined physical exercise, education and stress management, education and stress management only, or waiting list control.⁷⁴ Mean anxiety scores for all three groups at baseline were below the clinically significant range. The stress management component was conducted by a clinical psychologist, and consisted of weekly sessions teaching progressive muscular relaxation, increased

awareness of thinking distortions about physical limitations in COPD, and the emotional effects of such distortions. At post-intervention, anxiety scores were significantly reduced only for the combined exercise, education and stress management condition, suggesting that physical exercise may itself be an important component of treatment.⁷⁴ Unfortunately, there was no physical exercise-only control condition, so it is unclear whether subjects' improvement can be solely attributed to the intensive exercise component of the program, or to exercise combined with other strategies. There were no post-intervention follow-up assessments.

In the trial conducted by Kunik and colleagues (2001), one session of CBT (conducted by a geropsychiatrist) was compared to a session of education about COPD.⁷⁵ Fifty-six (primarily male) unselected patients agreed to participate, and 48 took part in all assessments. Components of the group intervention included psycho-education about anxiety, and training in breathing, relaxation, and interruption of anxiety-provoking thoughts. Psycho-education was also provided about exposure therapy, a key CBT technique which involves patients systematically exposing themselves to safe, but avoided, anxiety-provoking situations (e.g. stair climbing) and symptoms until the intensity of their anxiety reaction decreases.⁶⁴ Intervention subjects were given a workbook, and contacted weekly by phone for six weeks to monitor their compliance in practicing skills. Mean scores for both groups before intervention on measures of anxiety and depression were in the low clinical range. Scores of intervention, but not control, subjects decreased significantly post-intervention to below the clinical range.⁷⁵ Kunik and colleagues' study is weakened by a follow-up period of only six weeks, and pulmonary rehabilitation attendance was not controlled for, but the study provides some of the first evidence that as little as two hours of group-administered CBT may have some impact on COPD patients' anxiety symptoms.

In de Godoy and de Godoy's (2003) study, 30 unselected patients (22 male) attending a pulmonary rehabilitation program were randomized into either 12 sessions of group psychotherapy, primarily comprising cognitive therapy, or routine care.⁷⁶ Both groups had mean scores in the lower end of the clinical range on measures of anxiety and depression at study entry. Post-intervention, while both groups had improved significantly on the six minute walking test,⁷⁸ only the CBT group had a significant decrease in anxious and depressive symptoms to below the clinical range. Unlike Emery and colleagues (1998), de Godoy and de Godoy (2003) controlled for attendance of pulmonary rehabilitation, so the decreases in anxiety and depression scores cannot be attributed to physical exercise.⁷⁶ However, the study would have been improved by the inclusion of follow-up assessments.

In the fourth study of unselected patients, the efficacy of a four session CBT intervention in preventing the development and/or worsening of panic-spectrum psychopathology and anxiety symptoms in COPD patients, over an 18 month follow-up period, was evaluated.⁴¹ The study's aim was to intervene early with individuals at risk of panic disorder, to prevent any personal and economic impacts of the disorder becoming established.^{15–17,30,31} Forty-one COPD patients (18 male) without panic disorder, who had

undergone pulmonary rehabilitation, were randomized to either a CBT self-management intervention or routine care condition. Components of the standardized, individually administered intervention, conducted by a clinical psychologist, included psycho-education, cognitive therapy, training in "pursed lip" breathing and activity planning and "pacing", and problem solving about barriers to physical exercise and good coping. There were no differences between the groups on outcome measures at baseline, with 19% ($n = 4$) of CBT and 30% ($n = 6$) of routine care participants having experienced at least one panic attack in the previous month. Mean scores for both groups on measures of anxiety and depression were below the clinical range. By 18 month follow-up assessment, 60% ($n = 12$) of routine care subjects had experienced at least one panic attack in the previous six months, and 17% ($n = 2$) of these were diagnosed with panic disorder. No subjects in the CBT group had any panic attacks during the follow-up period. Anxiety symptoms and catastrophic cognitions about breathing also increased in the routine care group and decreased in the CBT group, and there was a significant reduction in the number of COPD-related hospital admissions in the latter group between six and twelve month follow-ups. The absolute risk reduction provided by the intervention was 43%, with three patients being treated to prevent one case of panic attacks developing during the 18 month follow-up phase.⁴¹ While the relatively small sample is a limitation of the study, it provides the first evidence that a brief CBT self-management intervention, added to pulmonary rehabilitation, may help to prevent the high personal and social costs of comorbid panic-spectrum psychopathology in COPD.

In the only randomized controlled trial yet conducted that has included some patients with diagnosed psychological disorders, Kunik and co-workers' (2007) conducted a large trial comparing 8 sessions of multi-component group CBT to 8 sessions of group COPD education. The sample comprised 238 (primarily male) COPD patients with at least moderate anxiety and/or depressive symptoms.⁷⁷ The CBT intervention included psycho-education, relaxation training, cognitive therapy, problem solving, and sleep management skills. Patients in both CBT and COPD education conditions showed similar, albeit limited, improvements (from the "moderate" to the "mild" category) on measures of anxiety and depressive symptoms that were maintained over a 10 month follow-up period. While at baseline assessment 38% of subjects were diagnosed with unspecified anxiety disorders, diagnostic information post-intervention was not reported.⁷⁷ There are a number of possible reasons for the lack of superiority of CBT over COPD education in this study. First, the education condition is likely to have had some inadvertent anxiety-reducing effect, as it included breathing management strategies, along with discussion of physical exercise.⁷⁷ Also, the CBT intervention, which was designed to treat both anxiety and depressive symptoms, may have been too general in content to fully benefit patients with moderate levels of psychopathology.⁷⁹ The group-administered format may have also had insufficient flexibility to address the needs of a heterogeneous sample of COPD patients with mixed psychopathologies.⁸⁰ Once anxiety disorders have developed comorbidly with respiratory diseases (as in nearly 40%

of Kunik and colleagues' subjects) treatment may be more difficult and an eight session group intervention insufficient for complete symptom resolution.^{16,30,79}

In summary, three of the four studies of unselected patients outlined above have supplied evidence that group or individually administered CBT can effectively reduce anxiety symptoms in COPD patients who do not yet meet DSM-IV criteria for the diagnosis of panic disorder, and may also prevent panic-spectrum psychopathology developing.^{41,75,76} However, from the study conducted by Kunik and colleagues (2007), there is little evidence to date that CBT, when group administered and not specifically targeted toward particular disorders, is effective for diagnosed panic disorder or other psychiatric disorders in COPD patients.⁷⁷ There is clearly considerable need for the first randomized controlled trials of CBT specific for panic disorder in COPD, with the CBT initially being individually administered.

Cognitive behavior therapy for panic-spectrum psychopathology in COPD: special issues

The treatment of two COPD patients with comorbid panic disorder has been described in detail.⁷⁹ On the basis of these case studies, and in the absence of any specifically targeted randomized controlled trials, we make some preliminary suggestions about CBT for panic disorder in COPD. Planned exposure to avoided situations and physical sensations, providing evidence that disconfirms catastrophic interpretations, is one of the primary components of CBT for panic disorder in the physically healthy.^{60,64} Such exposure is consequently also necessary in CBT for panic disorder in COPD, to help modify any heightened perception and catastrophic interpretations of dyspnea associated with activities of daily life. Twelve or more sessions of individual treatment could therefore be required, a finding that may in part account for the disappointing results of the randomized controlled trial by Kunik and colleagues (2007) discussed above.^{77,79} Graded exposure programs should be developed in consultation with patients' respiratory physicians, and only commence after medical treatment has been optimized. Realistic goals for situational exposure, which take into account patients' stage of illness, need to be set. Interoceptive exposure tasks (e.g. planned hyperventilation) can be undertaken, but only when patients are not unwell with an infective exacerbation. Regular, systematic exposure to experiencing and managing dyspnea during physical exercise can also be achieved via pulmonary rehabilitation programs, which are therefore likely to assist in the treatment of panic-spectrum psychopathology in COPD.⁸¹

Pulmonary rehabilitation has itself been associated with at least short-term reductions in symptoms of anxiety and depression.⁸² Coventry (2009) concluded that exposure to intensive physical exercise is the pulmonary rehabilitation component likely responsible for decreasing anxious and depressive symptoms in patients.^{81,83} However, these psychological benefits have declined in the 6–12 months following attendance (more quickly than the physical benefits) and are no longer evident by 12 month follow-up.^{81,82,84,85} Further, there is no evidence thus far that pulmonary rehabilitation alone can decrease symptoms of

clinically significant anxiety or depression.⁸¹ Additional intervention from mental health specialists will be required in these circumstances.

Future research: where next?

Further experiments investigating aspects of the cognitive model in COPD patients with panic-spectrum psychopathology are of more than theoretical interest; they may also have implications for patient management. Some researchers have suggested parallels between dyspnea and chronic pain, with distinguishable sensory (intensity) and affective (unpleasantness) components that each contribute to the overall perception of the two sensations.^{86–89} Research on these two dimensions of dyspnea is in its preliminary stages. Most studies thus far have been conducted with healthy volunteers, although there are several with mixed samples of COPD patients^{90–93}

Studies of physically healthy patients with panic attacks/disorder, showing that these patients catastrophically overinterpret both the intensity and the dangerousness of ambiguous physical sensations, lead to the predictions that the correlation between the intensity and unpleasantness of dyspnea will be still be high in COPD patients with panic attacks/disorder (as it is in people generally), but that ratings of both intensity and unpleasantness will be higher than for COPD patients without panic.^{54–60} In the resistive loading experiment recently reported, COPD subjects with panic attacks were asked to rate only the sensory intensity of their dyspnea (using the Borg Scale) and rated it significantly more highly than did COPD subjects without panic attacks. This result indicated that COPD patients with panic share with healthy panic patients the bias toward a more extreme perception (somatosensory amplification) of an ambiguous physical sensation, in this case dyspnea. In future, having COPD patients with and without panic-spectrum psychopathology separately rate dyspnea intensity and distress could be useful, with both components potentially able to be decreased by psychological treatment.⁹⁴

Larger scale prevention trials for panic-spectrum psychopathology, with brief CBT self-management interventions for unselected COPD patients perhaps being linked to pulmonary rehabilitation programs, are warranted by the results of the study conducted by Livermore and colleagues.⁴¹ Whether this type of preventative intervention can be successfully implemented in a group format requires investigation, but even individual administration could be justified by cost savings to health agencies. Adding a preventative CBT intervention to pulmonary rehabilitation programs could lay the foundation for the treatment of panic disorder when this is required for some patients, while at the same time decreasing the possibility of the disorder developing in some others. The use of pre and post questionnaires could assist in identifying individuals who have clinically significant symptoms of psychological distress that necessitate further intervention, in line with the “stepped care” approach to CBT intervention with COPD patients suggested by Coventry and Hind (2007).⁸²

No randomized controlled trials of CBT specifically for panic disorder in COPD have yet been conducted, so the

primary clinical research need in the area is for such trials. The CBT should be specifically focused, as particular strategies and techniques are required for particular psychological disorders.⁹⁵ Treatment should be administered individually (rather than in a group format) initially, as doing so allows sufficient flexibility to meet the therapeutic needs of particular patients.⁸⁰ Trials of the efficacy of a group-administered format can then follow. Interventions should be specified clearly enough to allow replication studies. Researchers should ensure that participants master relevant techniques, such as breathing retraining, and that health professionals who implement interventions are themselves skilled in CBT.⁹⁶ Long-term follow-up is also required, to provide evidence as to whether any beneficial effects of CBT are maintained – only then will such treatments become viable additions to routine care.

Conclusions

Panic attacks and panic disorder are quite frequent comorbidities in COPD, and this high prevalence of panic-spectrum psychopathology in COPD is predicted by the cognitive model of panic anxiety. Randomized controlled trials of CBT, developed from the cognitive model, for panic disorder in COPD are yet to be conducted. However, in the meantime evidence has accrued that CBT with COPD patients is an effective intervention for anxiety symptoms and comorbid panic attacks, can prevent the development of panic disorder, and is also associated with cost savings to health agencies. Mental health professionals, in collaboration with multi-disciplinary pulmonary teams, have key roles to play in preventing and treating the added disability of comorbid panic-spectrum psychopathology in COPD.

Conflict of interest

The authors have no conflicts of interest to declare.

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