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ORIGINAL ARTICLE

Do Changes in Panic Appraisal Predict Improvement in Clinical Status Following Cognitive-Behavioral Treatment of Panic Disorder?

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Abstract The effects of changes in panic appraisal dimensions during cognitive-behavioral treatment (CBT) on both short- and long-term improvement in panic disorder symptoms were examined. Panic disorder severity and panic appraisal measures were collected from 120 CBT-treated patients at pretreatment, post-treatment, and 6-month follow-up. Several panic appraisal dimensions investigated in panic disorder and agoraphobia include (a) perceived *likelihood* of panic occurrence (i.e., anticipated panic), (b) perceived negative *consequences* of panic occurrence, and (c) perceived panic coping efficacy. Of those panic appraisal dimensions studied, change in anticipated panic during treatment emerged as the most potent predictor of short-term improvement across each of the major clinical status measures (i.e., panic attack frequency, agoraphobic avoidance, and anxiety). Change in perceived consequences of panic uniquely contributed to short-term improvement in both anxiety and global disability, and reduction in perceived panic coping efficacy was unique predictor of short-term improvement in only agoraphobic avoidance. Both changes in perceived consequences of panic and in anticipated panic uniquely contributed to long-term improvement in agoraphobic avoidance and anxiety, respectively. In addition, only change in perceived consequences of panic uniquely

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contributed to long-term improvement in global disability. In contrast, perceived panic coping efficacy was generally a weak predictor of long-term improvement in any measures of clinical status. These results suggest that changes in cognitive appraisal factors predict both short- and long-term improvement during CBT of panic disorder.

Keywords Panic appraisal · Panic disorder · Cognitive-behavioral treatment · Predictors of treatment outcome · Anticipated panic · Perceived consequences of panic · Perceived panic coping efficacy

Introduction

Several psychological theories emphasize that cognitive factors play a central role in the etiology and maintenance of panic disorder and agoraphobia (Barlow, 1988; Beck, Emery, & Greenberg, 1985; Clark, 1986; Foa & Kozak, 1986; Goldstein & Chambless, 1978; McNally, 1994). Consistent with these theories, evidence for the role of cognitive factors in the development and maintenance of panic and panic-related avoidance has accumulated. Particularly, several panic-related appraisal dimensions have been investigated in panic disorder and agoraphobia (Telch, Brouillard, Telch, Agras, & Taylor, 1989). These include: (a) perceived *likelihood* of panic occurrence (i.e., anticipated panic); (b) perceived negative *consequences* of panic occurrence (e.g., ''I'm losing my mind,'' ''I will humiliate myself''); and (c) perceived panic coping efficacy.

There is now ample evidence suggesting that anticipation of panic best predicts the severity of agoraphobic avoidance (Cho, 2005; Cox, Endler, & Swinson, 1995; Craske, Rapee, & Barlow, 1988; Telch et al., 1989). Apprehension about future panic attacks (i.e., fear of panic) and panic-related avoidance were influenced by one's estimate of the negative consequences that may result from that attack as well as one's belief in the likelihood of a panic attack occurring in a specific situation (Feske & de Beurs, 1997; Telch et al., 1989). The significance of perceived negative consequences in the development of agoraphobic avoidance is highlighted in one study in which patients who attributed a life-threatening consequence to their panic displayed a significantly more rapid onset of agoraphobia compared with those who accurately understood their first panic attack to be an anxiety reaction (Breier, Charney, & Heninger, 1986). In addition to these two appraisal dimensions, one's sense of efficacy to control or manage panic when it occurs also influenced panic-related avoidance and fear of panic (Feske & de Beurs, 1997; Telch et al., 1989). More recently, both catastrophic misinterpretation of bodily sensations and panic self-efficacy independently predicted panic severity and the influence of panic self-efficacy upon panic severity remained significant even after controlling for the presence or absence of agoraphobia (Casey, Oei, Newcombe, & Kenardy, 2004). Similarly, perceived panic coping efficacy as well as anticipated panic significantly predicted daily life impairment in a sample of nonclinical panickers (Cho, 2005).

Acknowledging panic-related appraisal as a maintaining factor in panic disorder, cognitive-behavioral treatment (CBT) aims to train patients in identifying their panic triggering cues, and provide patients with techniques that facilitate the elimination

of faulty emotional responding to these cues. Specific procedural components in contemporary CBT manuals for panic disorder include (a) education about the nature and physiology of panic and anxiety; (b) cognitive restructuring aimed at teaching patients to identify and correct faulty threat perceptions that contribute to their panic and anxiety; (c) breathing retraining designed to assist patients in learning to control hyperventilation; (d) interoceptive exposure aimed at reducing patients' fear of harmless bodily sensations associated with physiological activation, and (e) fading of maladaptive defensive behaviors such as avoidance of external situations (Barlow, Craske, Cerny, & Klosko, 1989; Clark et al., 1994; Telch et al., 1993).

The efficacy of CBT for panic disorder has been examined in numerous controlled randomized trials. The findings indicate that CBT results in significant and durable improvement in panic disorder symptoms (Barlow, Gorman, Shear, & Woods, 2000; Clum, Clum, & Surls, 1993; Gould, Otto, & Pollack, 1995) and improves patients' quality of life (Telch, Schmidt, Jaimez, Jacquin, & Harrington, 1995). Moreover, preliminary findings suggest that these treatments are as effective when delivered in community settings (Penava, Otto, Maki, & Pollack, 1998; Stuart, Treat, & Wade, 2000; Wade, Treat, & Stuart, 1998).

Although the evidence supporting the efficacy and effectiveness of CBT continues to accumulate, there are a few studies investigating the mechanism of action of CBT. Based on contemporary psychological theories of panic disorder, it makes sense to ask whether the improvement resulting from CBT is influenced by changes in panic-related appraisal. The cognitive theory of panic predicts that sustained improvement after the end of any treatment (whether psychological or pharmacological) will depend on cognitive change following the course of therapy (Clark, 1986). Indeed, several findings implicate change in cognitive appraisal as a predictor of treatment outcome. First, correcting patients' catastrophic misinterpretations of bodily sensations results in significant reductions in panic (Taylor, 2000). Similarly, post-treatment measures of faulty threat appraisals of bodily sensations predict outcome status at follow-up (Clark et al., 1994, 1999). Second, the increase in perceived self-efficacy of coping with panic attacks, together with the decrease in catastrophic misinterpretations of bodily sensations, emerged as a key predictor of improvement with CBT for panic (Bouchard, Gauthier, Valliere, Ivers, & Simard, 1996; Casey, Newcombe, & Oei, 2005). Third, in a clinical trial comparing cognitive therapy with guided mastery therapy for panic disorder, changes in catastrophic beliefs during treatment predicted improvement in panic disorder symptoms from post-treatment to 1-year follow-up (Hoffart, 1998).

In an earlier report (see Smits, Powers, Cho, & Telch, 2004), we obtained support for the hypothesis that reduction in fear of fear would mediate the short-term (i.e., posttreatment) effects of CBT for panic disorder. In this article, we attempted to shed further light on possible cognitive change mechanisms governing CBT treatment of panic by examining whether changes in each of three distinct cognitive appraisal dimensions of panic (perceived panic likelihood, perceived panic consequences, and perceived panic coping) predicts changes in clinical status at both posttreatment and at a 6-month treatment-free follow-up. A secondary aim of the study was to examine the relative contributions of changes in each of the three panic appraisal dimensions to short- and long-term improvement across each of the four major panic disorder symptom facets (i.e., panic attacks, anticipatory anxiety, panic-related avoidance, and global disability).

Method

Participants

The sample consisted of 120 participants (99 women and 31 men) who had taken part in one of two clinical trials (Telch et al., 1993, 1995).[1] Participants were recruited through local media channels and a letter requesting referrals for a study of psychological treatments for panic disorder to physicians and mental health professionals in the Austin area. The screening consisted of two stages. During Stage 1, potential participants underwent a 15 min structured phone interview conducted by a trained doctoral student in clinical psychology. Respondents reporting panic attacks within the past month and who agreed to participate in Stage 2 were scheduled for a comprehensive clinical screening evaluation at our laboratory.

All participants met the following entry criteria: (a) principal Axis I diagnosis of panic disorder with agoraphobia as determined by the SCID (Spitzer, Williams, Gibbon, & First, 1992), (b) at least one panic attack during the past 30 days, (c) age 18–65, (d) no recent change in psychotropic medications, and (e) negative for current psychosis, bipolar disorder and substance use disorder. Mean symptom duration was 8.28 years (SD = 9.38, range = 0–52) and mean age was 34.39 years (SD = 9.63, range = 18–62). Of the participants, 75.0% were female, 85.0% were Caucasian, 58.3% were married, and 59.2% were employed.

Treatment

All the participants received group CBT treatment (Telch et al., 1993; 1995). This multi-component treatment consisted of four major treatment components: (a) psycho-education concerning the nature, causes, and maintenance of anxiety and panic, (b) cognitive therapy techniques aimed at helping the patient identify, examine, and challenge faulty appraisals of threat associated with panic, anxiety, and phobic avoidance; (c) breathing retraining to help patients eliminate hyperventilation symptoms and reduce physiological arousal; (d) interoceptive exposure exercises designed to reduce patients' fear of somatic sensations through repeated exposure to feared bodily sensations, and (e) self-directed exposure to patients' feared situations designed to reduce agoraphobic avoidance.

Treatment consisted of 12 90-min. highly structured sessions conducted over an 8-week period. Sessions were conducted twice weekly for the first 4 weeks and then once each week for the remaining 4 weeks. All sessions were led by an experienced doctoral level clinician and co-led by a doctoral student. A 65-page treatment manual (Telch, M. J., & Schmidt, N. B. (1990). Cognitive-behavioral treatment for panic disorder and agoraphobia: Panic inoculation treatment manual. Unpublished manuscript) describes the specific goals and strategies for each session.

Independent evaluators rated adherence to the treatment manual on a random sample of videotaped sessions. Compliance with the treatment manual was high

[1] There was a 57.5% overlap between the sample used in the Smits et al. (2004) investigation and the current study. However, none of the data reported in the current study on patients' clinical status at the 6-month follow-up was reported in the Smits et al. (2004) report. Moreover, the panic appraisal data—the major focus of this investigation—were also not reported in the Smits et al. report.

(i.e., 177 of 180 exercises rated as completed, 177 of 177 exercises rated as consistent with manual description) across all sessions assessed ($N = 36$).

Measures

A comprehensive assessment battery tapping the major clinical dimensions of panic disorder and panic-related appraisal dimensions was administered at week 1 (pre-treatment), week 10 (post-treatment), and week 36 (6-month follow-up).

Clinical Status

Texas panic attack record form Panic attacks were assessed using a prospective self-monitoring approach similar to that used in the Upjohn Cross National Study (Ballenger et al., 1988). Participants were provided with daily panic diary forms. For each panic episode, participants were instructed to record the (a) date, (b) time, (c) duration, (d) severity, (e) symptoms experienced, and (f) setting parameters (e.g., place, activity, presence of others). Panic attacks with three or fewer symptoms (i.e., limited symptom attacks) were not included in the panic attack count. Instructions stressed the importance of recording participants' panic episodes immediately to increase the accuracy of their recollection of the panic attack.

Sheehan patient-rated anxiety scale (SPRAS) The SPRAS (Sheehan, 1983) is a 35-item self-report scale for assessing the intensity of anxiety symptoms. Each of the 35 symptoms (e.g., shaking or trembling) is rated on a 5-point scale ranging from 0 (not at all distressing) to 4 (extremely distressing). The instructions were modified so that symptom ratings were based on a 1-week time frame as opposed to the original 6-month time frame. The total score is computed by summing the responses to the 35 items. The SPRAS has demonstrated adequate psychometric properties (Sheehan, 1983).

Fear questionnaire-agoraphobia subscale (FQ-Ago) The FQ (Marks & Mathews, 1979) was used to assess participants' level of agoraphobia. The FQ consists of 15 items representing three separate phobia types (agoraphobia, blood-injury phobia, and social phobia). For each item, the participant rates the degree of avoidance to the object or situation. The five-item agoraphobia subscale (FQ-Ago) has demonstrated adequate psychometric properties and is the most widely used self-report measure for assessing agoraphobia in treatment outcome research (Jacobson, Wilson, & Tupper, 1988).

Sheehan disability scale (SDS) The SDS is a four-item self-report measure of global impairment created by the presenting problem. The SDS was used in the Upjohn Cross-National Collaborative Panic Study (Ballenger et al., 1988). Three items assess impairment: (a) work activities, (b) social life and leisure activities, and (c) family life and home responsibilities. Each item is rated on an 11-point Likert scale (0 = not at all, 1–3 = mild, 4–6 = moderate, 7–9 = marked, 10 = severe). One item assesses overall work and social disability and is scored on a 5-point scale. The mean of the first three items of the SDS was used as global disability index in this study.

Panic Appraisal Measures

The panic appraisal inventory-panic likelihood scale (PAI-1) The PAI-1 (Telch et al., 1989) is a 15-item scale that measures the perceived likelihood of panic attacks in agoraphobic situations (e.g., public transportation) as well as situations that elicit emotional or physiological arousal (e.g., losing a loved one, aerobic exercise). The scale

has demonstrated adequate psychometric properties (Feske & de Beurs, 1997; Telch et al., 1989).

The panic appraisal inventory-panic consequence scale (PAI-2) The PAI-2 (Telch et al., 1989) is a 15-item measure tapping three domains of possible negative consequences of panic attacks: (1) physical (i.e., I may have a heat attack); (2) social (i.e., People may laugh at me); and (3) loss of control (i.e., I may scream). The scale has demonstrated good psychometric properties (Feske & de Beurs, 1997; Telch et al., 1989).

The panic appraisal inventory-panic coping scale (PAI-3) The PAI-3 (Telch et al., 1989) is a 15-item scale that measures the participant's degree of confidence in coping with future panic attacks. The scale has adequate psychometric properties (Feske & de Beurs, 1997; Telch et al., 1989).

Results

Statistical Analyses

First, short-term (pre/post) and long-term (pre/6-month) changes in four major clinical status measures (i.e., panic attack frequency, agoraphobic avoidance, anxiety, and global disability) as well as panic appraisal factors were assessed via paired *t*-tests and effect sizes. The latter were calculated as Cohen's d' (Cohen, 1988), which corrects Cohen's d for the correlation between pre- and post-treatment or follow-up data.

Second, we computed residual change scores for each of the panic appraisal dimensions and the four major clinical status measures. This was done by regressing the post-treatment scores on the pre-treatment scores for all study participants. Residual change scores control for initial differences between individuals and measurement error inherent in the use of repeated measures on the same instrument (e.g., Beutler & Hamblin, 1986; Manning & DuBois, 1962; Steketee & Chambless, 1992).

Third, we correlated the pre-post residual change scores of each of the PAI scales with the pre-post residual change scores of the clinical status measures in order to examine the effects of treatment changes in panic-related appraisal dimensions on short-term changes in treatment outcome measures. In addition, to examine the effects of changes in panic-related appraisal dimensions on long-term changes in the clinical status measures, we correlated the pre-post residual change scores of each of the PAI scales with the residual change scores of the clinical status measures from the pre-treatment to the 6-month follow-up interval.

Fourth, to examine the relative contributions of changes in panic-related appraisal dimensions to both short- and long-term improvement in clinical status, we conducted multiple regression analyses with the pre-post residual change scores of the PAI scales as predictors and the short-term (pre/post) or long-term (pre/follow-up) changes in each of the four major clinical status measures as dependent variables. In these analyses, changes in the three panic-related appraisal dimensions were entered simultaneously.

Changes in Clinical Status and Cognitive Appraisal Measures

Table 1 shows means, standard deviations, paired *t*-tests and effect sizes for the clinical status and panic appraisal measures at pre-treatment, post-treatment, and follow-up. Since the distribution of panic frequency scores was skewed, we performed a square

Table 1 Means (standard deviations), paired *t*-tests and effect sizes for the clinical status and panic appraisal variables at pre-treatment, post-treatment, and follow-up

Variable	Pre-mean (SD)	Post-mean (SD)	FU Mean (SD)	Pre-post analyses		Pre-FU analyses	
				t^a	ES[b]	t^a	ES[c]
Panic frequency[d]	3.18 (5.81)	0.49 (1.29)	0.58 (1.14)	10.13	1.14	9.04	1.06
FQ-Agoraphobia	15.04 (9.80)	5.62 (5.60)	5.89 (6.70)	12.01	1.18	11.47	1.09
SPRAS	59.10 (27.04)	20.30 (17.22)	23.61 (23.09)	17.66	1.71	15.57	1.41
SDS	4.83 (2.20)	1.79 (1.75)	1.93 (2.14)	16.01	1.53	14.62	1.33
PAI 1	44.64 (21.18)	17.45 (14.52)	18.08 (20.95)	15.70	1.50	12.67	1.26
PAI 2	36.80 (18.89)	8.48 (9.94)	8.97 (10.60)	16.57	1.88	15.51	1.82
PAI 3	28.93 (17.51)	72.10 (68.04)	68.04 (23.25)	–15.10	1.71	–17.59	1.90

Note: $N = 120$ for most measures, except that due to missing data, *N*s for panic frequency at post-treatment and follow-up and the SPRAS at follow-up are 119, 118, 119, respectively. Panic frequency = Number of panic attacks during the last week; FQ-Agoraphobia = Fear questionnaire-agoraphobia subscale; SPRAS = Sheehan patient-rated anxiety scale; SDS = Sheehan disability scale, average of first three subscales; PAI 1 = Panic appraisal inventory-anticipated panic attack subscale; PAI 2 = Panic appraisal inventory-panic attack consequences subscale; PAI 3 = Panic appraisal inventory-panic attack coping subscale; pre = pre-treatment; post = post-treatment; FU = Follow-up; ES = Effect sizes

[a] All *t* values indicated significant improvement, all *P*s $< .001$

[b] $= M_{pre}–M_{post}/SD_{pooled}$, where $SD_{pooled} = \sqrt{[(SD^2_{pre} + SD^2_{post})/2]}$

[c] $= M_{pre}–M_{f\text{-}up}/SD_{pooled}$, where $SD_{pooled} = \sqrt{[(SD^2_{pre} + SD^2_{f\text{-}up})/2]}$

[d] To achieve normality, analyses were performed with square root-transformed panic frequency scores

root transformation and used these transformed scores in the subsequent analyses. Paired *t*-tests indicated that participants' scores on the four major clinical status measures improved statistically from pre- to post-treatment, as did their panic appraisal dimensions. In addition, all the measures yielded large effect sizes from pre- to post-treatment.

Compared to pre-treatment, participants continued to improve significantly on all the measures at 6-month follow-up. In addition, all the measures yielded large effect sizes from pre-treatment to follow-up.

Relationship Between Changes in Panic Appraisals and Clinical Status at Posttreatment

To examine whether treatment changes in panic-related appraisal dimensions would influence short-term improvement in the clinical status measures, we correlated the pre-post residual change scores of each of the PAI scales with the pre-post residual change scores of the clinical status measures. As shown in Table 2, pre- to post-treatment change in anticipated panic was consistently correlated with each of the four major clinical status measures. Both changes in perceived consequences of panic and perceived panic coping efficacy were significantly correlated with changes in agoraphobic avoidance, anxiety, and global disability, respectively, but not with panic attack frequency.

We also conducted multiple regression analyses to examine the relative contributions of changes in panic-related appraisal dimensions to short-term improvement across the four major clinical status measures. As shown in Table 3, the percent variance accounted for by changes in panic appraisal dimensions during CBT ranged from 7.1% ($P < .05$) for improvement in panic attack frequency to 43.7% ($P < .001$) for reduction

Table 2 Correlations between pre-post residual change scores of each of the PAI scales with both short-term (pre/post) and long-term (pre/follow-up) changes of the clinical status measures

Variable	Pre-post residual change scores		
	PAI 1	PAI 2	PAI 3
Short-term changes			
Panic frequency	.26**	.09	–.03
FQ-Agoraphobia	.61***	.39***	–.40***
SPRAS	.59***	.56***	–.30***
Disability	.41***	.52***	–.28**
Long-term changes			
Panic frequency	.15	.18	–.10
FQ-Agoraphobia	.46***	.46***	–.26**
SPRAS	.40***	.38***	–.18
Disability	.34***	.35***	–.26**

Note: $N = 120$ for most measures, except that due to missing data, *N*s for panic frequency at post-treatment and follow-up and the SPRAS at follow-up are 119, 118, 119, respectively. Panic frequency = Number of panic attacks during the last week; FQ-Agoraphobia = Fear questionnaire-agoraphobia subscale; SPRAS = Sheehan patient-rated anxiety scale; SDS = Sheehan disability scale, average of first three subscales; PAI 1 = Panic appraisal inventory-anticipated panic attack subscale; PAI 2 = Panic appraisal inventory-panic attack consequences subscale; PAI 3 = Panic appraisal inventory-panic attack coping subscale; pre = pre-treatment; post = post-treatment

**$P < .01$; ***$P < .001$

Table 3 Regression of short-term improvement in the clinical status measures on changes in panic appraisal dimensions

Dependent variable and predictor	Mult R^2	*F*	df	β	Semi-partial correlation
Panic frequency	.07*	2.91	3, 115		
PAI 1				.30**	.25
PAI 2				–.06	–.05
PAI 3				.03	.03
FQ-Agoraphobia	.42***	28.13	3, 116		
PAI 1				.53***	.44
PAI 2				.02	.02
PAI 3				–.23**	–.22
SPRAS	.44***	30.05	3, 116		
PAI 1				.39***	.33
PAI 2				.33***	.27
PAI 3				–.07	–.06
Disability	.30***	16.65	3, 116		
PAI 1				.17	.15
PAI 2				.39***	.32
PAI 3				–.09	–.08

Note: Panic frequency = Number of panic attacks during the last week; FQ-Agoraphobia = Fear questionnaire-agoraphobia Subscale; SPRAS = Sheehan patient-rated anxiety scale; SDS = Sheehan disability scale, average of first three subscales; PAI 1 = Panic appraisal inventory-anticipated panic attack subscale; PAI 2 = Panic appraisal inventory-panic attack consequences subscale; PAI 3 = Panic appraisal inventory-panic attack coping subscale

* $P < .05$; ** $P < .01$; *** $P < .001$

in anxiety as measured with the SPRAS. More specifically, for improvement in panic attack frequency, only change in anticipated panic significantly accounted for unique variance ($\beta = .30$, $P < .01$). For change in agoraphobic avoidance, both reductions in

anticipated panic and perceived panic coping efficacy significantly accounted for unique variance ($\beta = .53$, $P < .001$; $\beta = -.23$, $P < .01$, respectively). For improvement in anxiety, both changes in anticipated panic and perceived consequences of panic significantly accounted for unique variance ($\beta = .39$, $P < .001$; $\beta = .33$, $P < .001$, respectively). For improvement in global disability, only perceived consequences of panic significantly accounted for unique variance ($\beta = .39$, $P < .001$).

Relationship Between Pre- to Posttreatment Changes in Panic Appraisals and Clinical Status at Follow-up

To examine the effects of treatment changes in panic-related appraisal dimensions on long-term changes in treatment outcome measures, we correlated the pre-post residual change scores of each of the PAI scales with the residual change scores of the clinical status measures from pre-treatment to follow-up. As shown in Table 2, pre- to post-treatment changes in anticipated panic and perceived consequences of panic were significantly correlated with changes in agoraphobic avoidance, anxiety, and global disability, respectively, but not with panic attack frequency. Change in perceived panic coping efficacy was significantly correlated with changes in agoraphobic avoidance and global disability, respectively.

We also conducted multiple regression analyses to examine the relative contributions of changes in panic-related appraisal dimensions to long-term improvement across the four major clinical status measures. As shown in Table 4, the percent variance accounted for by changes in panic appraisal dimensions during CBT ranged from 3.7% (not significant) for reduction in panic attack frequency to 28.1% ($P < .001$) for decrease in agoraphobic avoidance as measured with the FQ-Agoraphobia. More specifically, for long-term change in agoraphobic avoidance, both reductions in anticipated panic and perceived consequences of panic significantly accounted for unique variance ($\beta = .29$, $P < .01$; $\beta = .29$, $P < .01$, respectively). Likewise, for long-term improvement in anxiety, both changes in anticipated panic and perceived consequences of panic significantly accounted for unique variance ($\beta = .28$, $P < .01$; $\beta = .22$, $P < .05$, respectively). For long-term improvement in global disability, only perceived consequences of panic significantly accounted for unique variance ($\beta = .21$, $P < .05$). In contrast, change in no single variable of the panic appraisal dimensions emerged as a significant predictor of long-term improvement in panic attack frequency.

Discussion

The present study was conducted to shed some light on the mechanism governing change in panic disorder symptoms following CBT. Based on previous research findings implicating panic-related appraisal dimensions in the maintenance of panic disorder, we tested whether the short- and long-term improvement brought about by CBT would be predicted by reductions in panic appraisal. Moreover, we examined the relative contributions of changes in each of the panic appraisal dimensions to short- and long-term improvement in clinical status across the four major panic disorder symptom facets.

Our findings provide general support for the hypothesis that CBT exerts its short-term effects on panic disorder symptoms by reducing panic appraisal dimensions and are consistent with contemporary theories implicating cognitive appraisal factors in the etiology and maintenance of panic disorder (Beck et al., 1985; Clark, 1986; Goldstein

Table 4 Regression of long-term improvement in the clinical status measures on changes in panic appraisal dimensions

Dependent variable and predictor	Mult R^2	F	df	β	Semi-partial correlation
Panic frequency	.04	1.44	3, 114		
PAI 1				.08	.07
PAI 2				.12	.10
PAI 3				–.03	–.03
FQ-Agoraphobia	.28***	15.10	3, 116		
PAI 1				.29**	.24
PAI 2				.29**	.24
PAI 3				–.07	–.06
SPRAS	.20***	9.39	3, 115		
PAI 1				.28**	.23
PAI 2				.22*	.18
PAI 3				–.01	–.01
Disability	.17***	7.89	3, 116		
PAI 1				.19	.16
PAI 2				.21*	.17
PAI 3				–.13	–.12

Note: Panic frequency = Number of panic attacks during the last week; FQ-Agoraphobia = Fear questionnaire-agoraphobia subscale; SPRAS = Sheehan patient-rated anxiety scale; SDS = Sheehan disability scale, average of first three subscales; PAI 1 = Panic appraisal inventory-anticipated panic attack subscale; PAI 2 = Panic appraisal inventory-panic attack consequences subscale; PAI 3 = Panic appraisal inventory-panic attack coping subscale

* $P < .05$; ** $P < .01$; *** $P < .001$

& Chambless, 1978; McNally, 1994). Although the effects of changes in panic appraisal during CBT on the short-term improvement in all measures of clinical status were significant, they varied somewhat as a function of symptom facet. The most potent effects of changes in panic appraisal were observed for anxiety (44% of variance explained) and the least potent effects were observed for panic attack frequency (17% of variance explained). Of three types of panic appraisal dimensions, change in anticipated panic consistently made a unique contribution to short-term effects in panic attack frequency, agoraphobic avoidance, and anxiety. In contrast, reduction in perceived panic coping efficacy uniquely contributed to short-term change in only agoraphobic avoidance, and perceived consequences of panic was a significant unique predictor of short-term improvement in both anxiety and global disability.

The effects of changes in panic appraisal during CBT on the long-term improvement varied somewhat as a function of symptom facet. The most potent effects of changes in panic appraisal were observed for agoraphobic avoidance (28% of variance explained) and the least potent effects were observed for panic attack frequency (4% of variance explained). Of those panic appraisal dimensions studied, perceived consequences of panic consistently made a unique contribution to long-term effects in agoraphobic avoidance, anxiety, and global disability. Change in anticipated panic was a significant unique predictor of long-term improvement in both agoraphobic avoidance and anxiety, whereas change in perceived panic coping efficacy during CBT was generally a weak predictor of long-term improvement in any measures of clinical status. These results are similar to an earlier study that while self-efficacy change had no effects independent of those of catastrophic beliefs, changes in catastrophic beliefs during treatment predicted maintenance of treatment gains (Hoffart, 1998).

Our results suggest that among the several components of CBT, therapeutic interventions that correct panic disorder patients' faulty threat appraisals associated with panic attack occurrence (i.e., cognitive restructuring, interoceptive or in vivo exposures) are likely to yield the greatest benefit. Particularly, for short-term improvement of panic disorder, therapeutic interventions need to focus on correcting overestimated likelihood of panic occurrence, and for long-term improvement, treatments need to specifically target cognitions to reduce exaggerated negative consequences as well as overestimated likelihood of panic occurrence. On the other hand, the treatment components concentrating on teaching patients skills to cope with the symptoms of panic and anxiety and then enhancing patients' self-efficacy, for example, breathing retraining, may be less potent except for short-term improvement in agoraphobic avoidance. In one dismantling study, Schmidt et al. (2000) reported that breathing retraining did not yield any clear benefits to other components of the CBT intervention package. They have suggested that therapists refrain from the use of respiratory-control techniques as a means for coping with or managing anxiety.

Several limitations of the current study should be noted. First, our study design did not include a control or less powerful treatment condition which is required to test the mediation effect more directly (Baron & Kenny, 1986; DeRubeis et al., 1990; Kraemer, Wilson, Fairburn, & Agras, 2002). Thus, future studies examining the validity of panic appraisal as a mediator should include a control or less powerful treatment condition. Second, although the current findings are consistent with the hypothesis that reductions in panic appraisal may influence the effects of CBT for panic disorder, our design does not allow us to rule out the possibility that the change in panic appraisal was a consequence as opposed to a cause of panic disorder symptom reduction. Multi-time assessments during the course of treatment would have provided data for a finer analysis of the temporal precedence of panic appraisal. Moreover, newer statistical techniques (e.g., structural equation modeling) can examine the mediation effect of panic appraisal more accurately when conducting multi-time assessments throughout treatment.

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