The Effects of Acceptance Versus Suppression of Emotion on Subjective and Psychophysiological Response to Carbon Dioxide Challenge in Patients With Panic Disorder

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The effects of acceptance versus suppression of emotion were examined in 60 patients with panic disorder. Prior to undergoing a 15-minute 5.5% carbon dioxide challenge, participants were randomly assigned to 1 of 3 conditions: a 10-minute audiotape describing 1 of 2 emotion-regulation strategies (acceptance or suppression) or a neutral narrative (control group). The acceptance group was significantly less anxious and less avoidant than the suppression or control groups in terms of subjective anxiety and willingness to participate in a second challenge, but not in terms of self-report panic symptoms or physiological measures. No differences were found between suppression and control groups on any measures. Use of suppression was related to more subjective anxiety during the challenge, and use of acceptance was related to more willingness to participate in a second challenge. The results suggest that acceptance may be a useful intervention for reducing subjective anxiety and avoidance in patients with panic disorder.

Patients with panic disorder (PD) often avoid situations and sensations that have been associated with fear or anxiety. Apprehension or avoidance of situations is termed agoraphobic avoidance, while avoidance of internal sensations that might trigger panic attacks is often referred to as interoceptive avoidance.

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avoidance (Barlow, 2002). It has been suggested that in patients with PD, fear becomes a conditioned response to the experience of somatic sensations such as a racing heart or breathlessness. This theory suggests that conditioning occurs as a result of repeated associations between mild somatic sensations and states of panic which then serve to intensify the feared somatic cues (Bouton, Mineka, & Barlow, 2001). As a result, somatic sensations become both the stimulus and the response. Through interoceptive conditioning, an individual will learn to associate internal bodily sensations that accompany the early onset of a panic attack with the rest of the attack. As a result of interoceptive conditioning, modest changes in heart rate or the onset of shallow breathing might become signals that can later trigger a full-blown attack, and therefore patients with PD typically attempt to avoid such internal cues (Barlow, 2002).

Interoceptive avoidance is conceptualized as playing a significant role in the development and maintenance of PD, and is specifically targeted in cognitive behavioral treatments for this disorder. Few experimental studies directly examine the effect of avoidance of internal sensations on panic symptoms or associated anxiety. However, research in related areas indicates that experiential avoidance, or avoidance of unwanted internal experience such as thoughts, feelings, and sensations, often increases, rather than decreases, the intensity of the unwanted experience. Experiential avoidance is said to occur when a person “is unwilling to remain in contact with particular private experiences (e.g., bodily sensations, emotions, thoughts, memories, behavioral predispositions) and takes steps to alter the form or frequency of these events and the contexts that occasion them” (Hayes, Strosahl, & Wilson, 1999, p. 58).

One type of experiential avoidance involves suppression of emotions or thoughts. Research on emotion regulation suggests that efforts to inhibit, rather than express, both positive and negative emotions leads to an increase in sympathetic activation (Gross & Levensen, 1997). In a related line of research on thought suppression, Wegner and colleagues have found that direct efforts to rid oneself of a thought or an emotional state can often backfire, leading to increased accessibility of the unwanted thought, or an exacerbation of the unwanted emotion. Specifically, research in nonclinical populations indicates that efforts to suppress thoughts under mental load can create increased accessibility of the suppressed thought (Wegner & Erber, 1992), attempts to concentrate under load can increase the accessibility of distractors (Wegner, 1997a), intended mood control under mental load can lead to greater accessibility of thoughts relevant to the unwanted mood (Wegner, Erber, & Zanakos, 1993), and intended relaxation under load can promote arousal (Wegner, Broome, & Blumberg, 1997).

Although research on emotion and thought suppression has primarily involved nonclinical populations, it seems likely that repeated attempts to avoid negative thoughts and emotions through the use of suppression could exacerbate psychological symptoms in clinical samples as well. Indeed, the paradoxical effects of thought suppression have been implicated in cognitive-behavioral
models of several psychological disorders (Abramowitz, Tolin, & Street, 2001). Specifically, suppression is believed to contribute to the development or maintenance of depression (Wegner, 1994), generalized anxiety disorder (Becker, Rink, Roth, & Margraf, 1998), specific phobias (Thorpe & Salkovskis, 1997), and posttraumatic stress disorder (Ehlers & Steil, 1995). In addition, related research on coping skills indicates that greater use of avoidant coping (including various experiential avoidance strategies) is related to greater symptoms of depression (DeGenova, Patton, Jurich, & MacDermid, 1994), and increased symptoms related to childhood sexual abuse (Cloitre, Miranda, & Levitt, 2003; Leitenberg, Greenwald, & Cado, 1992).

Wegner (1997b) has suggested that suppression may also contribute to the maintenance of PD whereby an individual who has a panic attack, who then tries to avoid or eliminate anxious thoughts and feelings related to the attack, might paradoxically increase the accessibility of such internal experience, and thus increase the likelihood of future attacks. This possibility is interesting, particularly in light of the fact that patients with PD often attempt to avoid interoceptive cues that might trigger panic attacks (Barlow, 2002). The ironic effects of suppression might also help explain the phenomenon of relaxation-induced anxiety in both PD (Adler, Craske & Barlow, 1987; Cohen, Barlow & Blanchard, 1985) and generalized anxiety disorder (Borkovec et al., 1987; Heide & Borkovec, 1983).

A number of clinical researchers have studied the effects of therapies that include acceptance-based interventions, which are designed to reduce experiential avoidance and facilitate behavior change. Linehan’s dialectical behavior therapy for the treatment of borderline personality disorder incorporates a strong affect tolerance and experiential acceptance component (Linehan, 1993). Marlatt (1994) has added techniques drawn from Eastern psychology to promote acceptance of urges (i.e., “urge surfing”) as a component of relapse prevention in substance abuse treatment. Jacobson and colleagues have incorporated the notion of acceptance in behavioral marital therapy (Jacobson & Christensen, 1996; Koerner, Jacobson, & Christensen, 1994), and Roemer and Orsillo (2002) have recently piloted a new treatment for generalized anxiety disorder that integrates mindfulness/acceptance-based approaches with existing cognitive-behavioral models.

Hayes, Strosahl, and Wilson (1999) designed a treatment entitled “Acceptance and Commitment Therapy” (ACT), which is based on the idea that experiential avoidance is what underlies many types of psychopathology, and that acceptance is an effective alternative approach to coping with thoughts and feelings. ACT challenges the idea that internal experiences need to be regulated in order for clinical improvement to occur, and, in contrast, suggests that attempts at internal control may be the problem, not the solution. In ACT, patients are taught to feel emotions and bodily sensations fully and without avoidance, and to focus on behavior change in valued directions, rather than the modification of thoughts and feelings. While many cognitive behavioral treatments for PD aim to reduce avoidance of sensations and situations, the explicit goal
of these treatments is to reduce the frequency and intensity of panic attacks, and thus certain aspects of these interventions are control-oriented (e.g., breathing retraining, cognitive restructuring). In contrast, the explicit goal of ACT is to reduce attempts at internal control and experiential avoidance, while increasing behavioral control and willingness.

Two very recent experimental studies directly compare the effects of suppression of emotion versus acceptance/observation on response to emotion induction. In one study, participants with anxiety and mood disorders were instructed to accept or suppress emotional responding while watching upsetting film clips (Campbell-Sills, Barlow, Brown, & Hofmann, 2003). Suppression, as compared with acceptance, was associated with increased sympathetic responding and slower recovery from changes in self-reported distress. Feldner and colleagues examined the effects of suppression versus acceptance/observation on response to an anxiety-producing carbon dioxide (CO₂) challenge in a sample of undergraduates who scored either low or high on a measure of emotional avoidance (Feldner, Zvolensky, Eifert, & Spira, 2003). Individuals high in emotional avoidance reported significantly greater levels of anxiety when suppressing compared to observing bodily sensations. However, no significant differences were found among those low in emotional avoidance. Although each of these studies compared suppression to acceptance/observation instructions, neither included a no-instruction control group, making interpretation of the findings difficult. Nevertheless, the collective results seem to suggest that acceptance instructions lead to less subjective distress and sympathetic responding than suppression instructions, particularly in individuals who are highly emotionally avoidant.

Eifert and Heffner (2003) compared a brief acceptance intervention to breathing retraining in a sample of undergraduates with high anxiety sensitivity in the context of a CO₂ challenge. They hypothesized that the acceptance intervention would be more useful in the reduction of anxious avoidance than direct attempts to control the effects of the gas. In fact, individuals in the acceptance group exhibited less avoidance behavior, and reported less intense fear and fewer catastrophic thoughts than those in the breathing retraining and no-instruction conditions in response to the CO₂ challenge. No significant differences were found among the groups on intensity of self-report panic symptoms or on any objective physiological measures. The results indicate that a brief acceptance intervention may attenuate anxious responding in a nonclinical population, and may facilitate willingness to engage in future aversive interoceptive tasks.

The current study examines the effects of acceptance versus suppression of emotions and thoughts in the context of a CO₂ challenge in a sample of patients diagnosed with PD. The purpose of the study is to better understand the effects of these two emotion-regulation strategies in a clinical sample during an aversive interoceptive task. It was hypothesized that participants randomized to a brief acceptance intervention would be significantly less anxious and less avoidant than those who received a brief suppression intervention or
no intervention, as indicated by subjective anxiety, self-report panic symptoms, physiological measures, and willingness to participate in a second challenge. In addition, suppression participants were expected to be more anxious and more avoidant than no-instruction control participants. Although previous studies have not found an effect of acceptance or suppression instructions on physiological response to CO₂ challenge (e.g., Eifert & Heffner, 2003; Feldner et al., 2003), heart rate and skin temperature measures were included in the current study in order to evaluate the effects of acceptance and suppression instructions on a variety of dependent measures.

Method

Participants

Sixty adults, ages 18 to 65, with a principal diagnosis of panic disorder with or without agoraphobia (PD/A) participated in this study. Seven (12%) had a diagnosis of PD without agoraphobia, and 53 (88%) had a diagnosis of PD with agoraphobia. Thirty-four (57%) participants had at least one additional current DSM-IV diagnosis at a clinical severity rating (CSR) of 4 or above. The most frequent co-occurring DSM-IV diagnoses were social phobia (23%) and specific phobia (22%). Women constituted the larger portion of the sample (63%); average age was 33.08 (SD = 12.17 years, range = 18 to 62). The racial/ethnic breakdown of the sample was as follows: Caucasian (85%), African American (5%), Hispanic American (5%), Asian American (3%), Native American (2%). Seventy-five percent (n = 45) of the sample were individuals who sought treatment at the Center for Anxiety and Related Disorders (CARD) at Boston University, and 25% (n = 15) of the participants responded to newspaper advertisement for this study.

Participants met several inclusion and exclusion criteria that were assessed by initial telephone screening and reassessed and confirmed during the diagnostic interviews. Because the CO₂ challenge has the potential to elicit physiological changes, including elevated respiration and heart rate, several medical ruleouts were specified. In keeping with standard policy at CARD, patients who were taking an unstable dose of psychotropic medication were excluded from participation. Specifically, individuals were not able to participate if they had been taking a benzodiazepine for less than 1 month, a serotonin-specific reuptake inhibitor, tricyclic antidepressant or monoamine oxidase inhibitor for less than 3 months, had been in psychotherapy regularly for less than 3 months, or had ceased any of these treatments during the month prior to the assessment. In addition, potential participants were excluded if any of the following were present: (a) principal diagnosis other than PD/A; (b) current evidence of psychotic symptoms; (c) current substance abuse or dependence; (d) current suicidal intent; (e) current respiratory or cardiovascular illness, migraine headaches, pregnancy, or recent concussion. Individuals that were eligible for the study and agreed to participate were randomly assigned to one of the three instruction conditions.
Measures

Diagnostic measures. As part of the initial assessment procedure at CARD, individuals were screened by trained doctoral students or doctoral-level psychologists using the Anxiety Disorders Interview Schedule for DSM-IV: Lifetime Version (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994). The ADIS-IV-L is a semistructured diagnostic interview designed to assess anxiety and mood disorders and associated conditions. The interview also includes diagnostic sections for substance use and somatoform disorders, and screening questions for psychosis.

Participants recruited through newspaper advertisement were interviewed using the nonlifetime version (current diagnoses only) of the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, Di Nardo, & Barlow, 1994). Diagnoses and CSRs were assigned for all participants. CSRs range from 0 to 8, where 0 = no interference/distress and 8 = very disturbing/disabling (CSR ≥ 4 denotes a clinical diagnosis). A diagnosis was considered “principal” when it had the highest CSR among the assigned diagnoses. Agoraphobia severity was computed by averaging avoidance ratings (0 to 8 scale) on 22 situations (e.g., driving, malls) that were assessed during the ADIS-IV and the ADIS-IV-L. Reliability data for the ADIS-IV-L indicates excellent reliability for the diagnosis of PD/A (κ = .79) and for dimensional ratings of agoraphobia severity and CSR within the panic disorder section (Brown, Di Nardo, Lehman, & Campbell, 2001).

Laboratory measures. Throughout the procedure, participants were asked by the experimenter to state their level of anxiety (“anxiety rating”) on a 0 to 8 scale (0 = not at all anxious, 8 = extremely anxious). An anxiety rating was obtained once per minute throughout the CO2 challenge (challenge anxiety) and during the last 5 minutes of the final recovery period (resting anxiety).

The Mood and Anxiety Symptom Questionnaire—Anxious Arousal scale (MASQ-AA; Watson & Clark, 1991) is a self-report measure of autonomic arousal that has been used to measure response to CO2 challenge (e.g., Lehman, Brown, Palfai, & Barlow, 2002). Only the Anxious Arousal scale of the MASQ was included in this study. This scale consists of 22 items, which are rated on a 1 (not at all) to 5 (extremely) scale, yielding a possible range of scores between 22 and 110. The items on the MASQ-AA are all physiological or cognitive symptoms of anxiety (e.g., pounding heart, shortness of breath, fear of dying). Good reliability and validity of the MASQ-AA have been reported with student, adult, and patient populations (Watson, Clark, et al., 1995; Watson, Weber, et al., 1995). Two different forms of the MASQ-AA (instructions worded differently) were utilized in the present study. Form A asked about current sensations/cognitions and was used to assess autonomic arousal during the resting period. Form B asked participants to rate the symptoms they experienced during the challenge and was administered immediately following the CO2 inhalation.

Psychophysiological measures. Previous research has demonstrated that heart rate is positively correlated with anxiety and panic (Cohen et al., 1985).
It is also often utilized as a dependent measure in CO₂ challenge studies (e.g., Beck, Shipherd, & Read, 1999) and as a measure of sympathetic activation in suppression studies (e.g., Gross & Levenson, 1993). Therefore, heart rate was measured continuously throughout the study. Heart rate (beats per minute) was measured by the MP100 (Biopack Systems, Inc.) with the use of an amplifier (ECG100B), two shielded leads, and one ground.

Skin temperature is also often measured as an index of autonomic arousal in CO₂ challenge studies (e.g., Beck, Shipherd, & Read, 1999), and in research on emotional suppression (e.g., Gross & Levenson, 1993; Wegner, 1997a). Skin temperature was measured using the MP100 (Biopack Systems, Inc.) as the data collection unit (amplifier model #: SKT100 B; digit probe thermometer model #: TSD102D). The digit probe thermometer was attached to the first finger of the nondominant hand.

Avoidance measure. Willingness to participate in a second CO₂ challenge was assessed as the dependent measure of avoidance. Following the first CO₂ challenge, participants were asked to rate their willingness to participate in a second challenge on a 5-point (0 to 4) scale.

Manipulation checks. Two author-constructed measures were created to assess participants' understanding of the instructions (or neutral narrative) delivered prior to the CO₂ challenge. The control group measure consisted of two questions, each of which had one correct and four incorrect multiple-choice answers on the content of the National Geographic article, which was used as the neutral narrative. The measure administered to the two instruction groups consisted of three questions, each of which had five possible multiple-choice answers. The first two questions related specifically to the instructions for the challenge, the third question assessed how useful participants expected the instructions to be for them during the challenge.

An additional author-constructed measure was created to assess strategies that were used during the CO₂ challenge in order to determine the extent to which participants made use of the information that they listened to on the audiotapes, and to determine which strategies were utilized by the no-instruction control group. This manipulation check measure consisted of 6 items, and was administered to all three groups. The instructions asked the participant to rate how much he or she used the given strategy during the CO₂ challenge. Three of the items reflected suppression strategies (e.g., “How much did you tell yourself to not feel anxious”) and 3 items reflected acceptance strategies (e.g., “How much did you allow yourself to experience whatever emotions came up for you”). The measure for the two instruction groups also included a seventh question asking participants how much they typically use the approach they learned on the tape. This question was added in order to obtain descriptive information regarding the day-to-day use of acceptance and suppression strategies in patients with PD/A.

Procedure

Adaptation period. After signing a consent form, the participant was seated in the laboratory, the physiological equipment was attached, and the mask was
secured. The first author conducted all aspects of the study and all instructions were scripted. A general description of the phases of the study was given to the participant, and the experimenter left the room for 10 minutes in order to allow the participant to accommodate to the unfamiliar apparatus prior to starting the experimental portion of the study. The experimenter sat in an adjoining room connected by intercom and a one-way mirror throughout the study.

Audiotaped emotion-regulation interventions. Following the adaptation period, all participants received an introduction to the audiotaped emotion-regulation intervention or the National Geographic article. Participants in the acceptance and suppression groups were told that they would be listening to an audiotape describing a way to cope with any symptoms they might experience during the CO₂ challenge. Participants were told to listen carefully to the tapes, as they would be given a brief quiz on the main ideas. All three tapes lasted 10 minutes. The acceptance and suppression tapes contained similar examples and the phrasing and organization of the messages were similar. The acceptance tape was based on ACT (Hayes, Strosahl, & Wilson, 1999), and the main message of this intervention was that attempts to suppress or control emotions and thoughts may be futile, while focusing on behavior change in valued directions is a more functional way of living. For example, acceptance participants were told, “Being willing to experience your thoughts and feelings, good and bad, can free you up to focus on what really matters in your life. If you are willing to feel happy, sad, anxious, unsure, joyful and any other emotions that come up for you, you can choose the activities that you want to participate in, so that you ultimately choose your directions in life, instead of letting your fear of anxious thoughts and feelings make those choices for you.” The acceptance tape did not attempt to normalize or decatastrophize symptoms of panic, nor did it imply that panic symptoms are not dangerous or threatening. The suppression tape encouraged participants to gain control over their thoughts and feelings by pushing negative thoughts and emotions away. Suppression participants were told, “When you are feeling anxious, but you know you have to do something, you can push the feelings away in order to accomplish the task. That’s what I am going to encourage you to do today. Try not to feel anxious, try not to think anxious thoughts, try to just get through the task with as little anxiety and discomfort as possible.” Each tape contained a number of examples of situations in which the given strategy could be useful. The acceptance and suppression groups were instructed to use the given strategy to cope with symptoms of anxiety that might arise during the challenge. The no-instruction control group listened to a 10-minute tape of a National Geographic article to control for attention during this time. When the audiotapes were finished, participants completed the respective quiz on the instructions, and began the CO₂ challenge.

CO₂ panic challenge. Participants were administered 5.5% CO₂-enriched air for 15 minutes. This concentration produces its effect gradually rather than abruptly, and produces significant symptoms in patients with PD
(Zvolensky & Eifert, 2001). The 5.5% concentration and the 15-minute duration were chosen because it was essential that participants had an opportunity to apply the given directions during a moderately aversive interoceptive challenge. In addition, while the intention was to produce physical sensations, it was not necessary that the symptoms mimicked a full-blown panic attack (as is more characteristic of brief exposure to higher concentrations). A Downs continuous positive air pressure mask (Vital Signs, Inc., Model No. 9000) was attached to the participant’s face for the entire experimental procedure. A premixed, compressed solution of 5.5% CO₂, 21% oxygen, and 73.5% nitrogen was housed in a gas storage tank from which the gas was led through a vinyl tube to a large rubber balloon. Between the tank and the balloon was a container partially filled with water, used to moisten the gas mixture traveling into the balloon. From the balloon, vinyl tubing carried the gas mixture to a gas mask with continuous positive air pressure, worn by the participant, at a rate determined by the individual’s own breathing. In addition, a Y valve was used by the experimenter to switch between CO₂-enriched air and room air when necessary. End-tidal CO₂ pressure (pCO₂) was monitored within the mask via a pCO₂ monitor (Puritan-Bennet/Datex infrared digital monitor; Model P22378G). The pCO₂ ratings obtained during the CO₂ challenge were used as a manipulation check measure to confirm that all participants received the appropriate concentration of gas.

Challenge assessment. During the challenge, participants were asked for an anxiety rating once every minute through the intercom. Following this, participants completed the MASQ-AA Form B as a measure of symptoms experienced during the CO₂ challenge. Participants were then asked to remain seated for a 5-minute postchallenge recovery period.

Evaluation of willingness to participate. Following the recovery period, willingness to engage in a second CO₂ challenge was assessed. All participants were informed that it would be helpful if they could stay for another challenge, but that participation was optional. Furthermore, it was explained that participants would receive the same compensation if they participated or not, and that they would remain in the chair with the mask on for the same amount of time either way. After participants rated their willingness to engage in a second challenge, all individuals who agreed to participate in another challenge were told that in fact they did not need to participate, as enough data had already been collected on their responses, and they could therefore move on to the final resting period. Thus, regardless of willingness to participate, all individuals progressed to the final recovery and resting period assessment.

Final recovery and resting period assessment. Immediately following the assessment of willingness, participants remained seated for a 5-minute recovery period followed by a 5-minute resting period where measures were obtained. The recovery period was included so that participants who became anxious in anticipation of participating in a second challenge could return to normal before resting measures were administered. Conducting a resting period evaluation after the experimental procedure is finished is considered to be a better
assessment of resting levels than measures taken prior to the experiment because the latter procedure potentially confounds resting measures with the assessment of anticipatory anxiety (Rapee, Brown, Antony, & Barlow, 1992). That is, had resting measures been taken in the beginning of the procedure, following informed consent and the description of the study, these measures would not be true resting measures, but would rather reflect anticipatory anxiety. Therefore, the last 5 minutes of the final 10-minute recovery (15 minutes after completion of the CO2 challenge) were used as the resting period assessment of physiological arousal and subjective anxiety. After the resting recordings were taken, participants completed the MASQ-AA Form A as a measure of resting period panic symptoms and the manipulation check questionnaire that assessed the strategies used (i.e., acceptance vs. suppression) during the CO2 challenge. Following the final resting period assessment, participants were compensated $40 for the two hour study and were fully debriefed.

Results

Random Assignment

To determine if random assignment was successful at equating the three groups (acceptance, suppression, no-instruction control group) during the resting period, analysis of variance (ANOVA) and χ² tests were conducted to detect any differences in age, gender, and race. In addition, ANOVA was used to compare the groups on PD/A CSR, agoraphobia severity, mean resting subjective anxiety rating, resting MASQ-AA form A, resting heart rate, and resting skin temperature. There were no group differences on any of the measures (Table 1). These results indicate that random assignment was successful

<table>
<thead>
<tr>
<th>Table 1: Scores and Resting Period Measures by Group</th>
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<tbody>
<tr>
<td>Acceptance</td>
</tr>
<tr>
<td>Mean (SD)</td>
</tr>
<tr>
<td>PD/A CSR</td>
</tr>
<tr>
<td>Agoraphobia score</td>
</tr>
<tr>
<td>Resting anxiety</td>
</tr>
<tr>
<td>Resting MASQ-AA</td>
</tr>
<tr>
<td>Resting heart rate</td>
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<td>Resting ST</td>
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</table>

Note. PD/A CSR = Panic Disorder with or without Agoraphobia Clinical Severity Rating; MASQ-AA = Mood and Anxiety Symptom Questionnaire—Anxious Arousal scale; ST = Skin Temperature. All between-group comparisons are nonsignificant. n = 20 per group except where noted.

* n = 17 (acceptance), n = 12 (suppression), n = 16 (control group).

* n = 19 (acceptance), n = 18 (suppression), n = 20 (control group).
in producing similar groups. Independent groups t-tests and χ² tests were also conducted to compare participants recruited from the community (n = 15) and CARD (n = 45) on these variables. The community group was found to have a greater proportion of women (93%) than the CARD group (53%), χ²(1, N = 60) = 7.75, p < .01. There were no group differences on other measures. These results suggest that, overall, participants recruited from CARD and the community were similar.

Manipulation Checks

Quiz on audiotaped instructions. Acceptance, suppression, and control groups were compared on their responses to each of the quiz items using χ² analyses. There were no significant group differences on the percentage of correct versus incorrect responses for item one, χ²(2, N = 60) = 2.11, ns, or item two, χ²(2, N = 60) = 2.14, ns, indicating that the three groups had equivalent comprehension of the audiotapes. In fact, at least 90% of each of the three groups answered all of the quiz questions correctly.

Expectancy. An independent samples t-test was used to compare the acceptance and suppression groups on the expectancy question (i.e., “How useful do you expect the instructions on the audiotape will be for you during the upcoming breathing exercise?”). No significant differences were found, t(38) = 0.79, ns, indicating that the groups expected the instructions to be equally useful. On average, both groups expected the instructions to be “very useful” (M = 3.53).

Everyday use of strategies. An independent samples t-test was also used to compare the acceptance and suppression groups on the extent to which they typically use the strategies they were taught on the tape in their everyday lives. As expected, a significant difference was found between the two groups whereby the suppression group reported typically using suppression (M = 4.30, “frequently”) more than the acceptance group reported typically using acceptance (M = 1.75, “some of the time”), t(38) = 3.59, p < .01.

Delivery of CO₂ during the challenge. ANOVA was used to determine whether any differences existed between groups on pCO₂ levels during the CO₂ challenge. Because the collection of pCO₂ data was initiated after the first 4 participants completed the study, data were recorded for only 56 participants. As expected, no significant differences were found between the acceptance (M = 68.47 mmHg), suppression (M = 70.75 mmHg), and control (M = 70.27 mmHg) groups, F(2, 53) = 0.95, ns, indicating that the groups did not differ in the concentration of CO₂ received.

Use of strategies during the challenge. ANOVA was also used to test whether the groups differed in their use of acceptance and suppression strategies during the CO₂ challenge. Acceptance and suppression scores were each computed as the sum of the three respective items on the manipulation check measure (possible range of sums: 0–24). As expected, significant differences were found between the groups on the acceptance measure, F(2, 57) = 17.86, p < .01, η² = .39. Simple effects analyses (t-tests using contrast codes and
TABLE 2
USE OF STRATEGIES AND CHALLENGE RESPONSE BY GROUP

<table>
<thead>
<tr>
<th></th>
<th>Acceptance Mean (SD)</th>
<th>Suppression Mean (SD)</th>
<th>Control Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance strategies</td>
<td>14.45 (6.19)</td>
<td>6.35 (4.92)</td>
<td>6.55 (3.03)</td>
</tr>
<tr>
<td>Suppression strategies</td>
<td>5.90 (4.17)</td>
<td>14.05 (5.87)</td>
<td>10.15 (5.58)</td>
</tr>
<tr>
<td>Subjective anxiety</td>
<td>2.45 (1.92)</td>
<td>3.32 (1.55)</td>
<td>3.20 (1.77)</td>
</tr>
<tr>
<td>MASQ-AA</td>
<td>40.90 (15.74)</td>
<td>36.15 (8.00)</td>
<td>37.21 (10.82)</td>
</tr>
<tr>
<td>Heart rate(^a)</td>
<td>76.61 (9.41)</td>
<td>76.26 (10.72)</td>
<td>73.83 (10.29)</td>
</tr>
<tr>
<td>Skin temperature(^b)</td>
<td>87.73 (5.06)</td>
<td>84.29 (8.77)</td>
<td>83.65 (7.57)</td>
</tr>
<tr>
<td>Willingness</td>
<td>2.05 (1.10)</td>
<td>1.30 (1.13)</td>
<td>1.10 (1.25)</td>
</tr>
</tbody>
</table>

Note. MASQ-AA = Mood and Anxiety Symptom Questionnaire–Anxious Arousal scale. n = 20 per group except where noted.
\(^a\) n = 17 (acceptance), n = 12 (suppression), n = 16 (control group).
\(^b\) n = 19 (acceptance), n = 18 (suppression), n = 20 (control group).

\(M_{\text{error}}\) from the omnibus analysis; cf. Jaccard, Turrisi, & Wan, 1990) indicated that the acceptance group scored significantly higher on the acceptance measure than the suppression group, \(t(38) = -5.24, p < .01\), and the control group, \(t(38) = -5.11, p < .01\). No significant differences were found between the suppression and control groups on the acceptance measure, \(t(38) = 0.13, ns\). Similarly, significant differences were found among the three groups on the suppression measure, \(F(2, 57) = 12.02, p < .01, \eta^2 = .30\). The suppression group scored significantly higher on the suppression measure than the acceptance group, \(t(38) = 4.9, p < .01\), and the control group, \(t(38) = -2.35, p < .05\). Interestingly, the no-instruction control group scored significantly higher on the suppression measure than the acceptance group, \(t(38) = 2.56, p < .05\). The results indicate that participants followed the audiotaped instructions during the CO2 challenge (see Table 2 for group means).

Analyses of Predictors of Challenge Response

Multiple regression analyses were used to test many of the primary hypotheses. Group was dummy-coded and utilized as a predictor of challenge response. In each hierarchical regression, scores on the respective resting measures were entered into the first step in order to partial out the effects of these variables (for all criterion variables except willingness, as there was no resting measure of willingness), and group was entered on the second step.

Primary hypotheses. The hierarchical multiple regression for predicting challenge subjective anxiety from resting subjective anxiety and group was significant, \(F(3, 56) = 29.60, p < .01, R^2 = .613\). As expected, a hierarchical F-test revealed a significant main effect of group on challenge subjective anxiety, controlling for resting subjective anxiety, hierarchical \(F(2, 56) = 4.49, p < .05, f^2 = .16\). Simple effects analyses (significance tests of the regression weights for the dummy codes) indicated significant differences
between the acceptance and suppression groups, $t(38) = 2.82, B = 1.01, p < .05$, whereby the acceptance group was significantly less anxious than the suppression group, controlling for resting anxiety. In addition, the acceptance group was significantly less anxious than the control group, $t(38) = 2.32, B = 0.83, p < .05$. However, there were no significant differences between the suppression and control groups, $t(38) = -0.50, B = -0.18, ns$. Table 2 contains group means on all measures of challenge response.

There was no main effect of group on self-report panic symptoms during the challenge, controlling for resting panic symptoms. The hierarchical multiple regression for predicting challenge MASQ-AA from resting MASQ-AA and group was significant, $F(3, 56) = 25.97, p < .01, R^2 = .582$. However, the hierarchical $F$-test from Step 2 revealed that the main effect of group on challenge MASQ-AA, controlling for resting MASQ-AA, was not significant, hierarchical $F(2, 56) = 1.8, ns, f^2 = .07$. In addition, group did not predict physiological response to the challenge. There was no main effect of group on challenge heart rate or challenge skin temperature, controlling for respective resting period variables. Although the hierarchical multiple regression for predicting challenge heart rate from resting heart rate and group was significant, $F(3, 41) = 20.86, p < .01, R^2 = .60$, the hierarchical $F$-test for the main effect of group on challenge heart rate, controlling for resting heart rate, was not significant, hierarchical $F(2, 41) = 1.08, ns, f^2 = .05$. Similarly, the hierarchical multiple regression equation regressing challenge skin temperature on resting skin temperature and group was significant, $F(3, 56) = 79.67, p < .01, R^2 = .82$, but the hierarchical $F$-test from Step 2 revealed that the main effect of group on challenge skin temperature, controlling for resting skin temperature, was not significant, hierarchical $F(2, 53) = 0.59, ns, f^2 = .02$.

One-way ANOVA was used to test whether the groups differed in their willingness to participate in a second challenge. As hypothesized, there were significant differences between the groups, $F(2, 57) = 3.72, p < .05, \eta^2 = .12$. Simple effects analyses ($t$-tests using contrast codes and $MS_{error}$ from the omnibus analysis) revealed significant differences between acceptance and suppression groups, $t(38) = -2.04, B = -0.75, p < .05$, and acceptance and control groups, $t(38) = -2.59, B = -0.95, p < .05$, on willingness to participate in a second challenge, whereby the acceptance group was significantly more willing to participate in a second challenge than the suppression or control groups. There were no significant differences between the suppression and control groups on the willingness measure, $t(38) = -0.54, B = -0.2, ns$.

Additional hypotheses. Additional analyses were conducted to determine whether the particular strategies used by participants predicted response to the challenge. It was expected that greater use of acceptance strategies would be related to greater willingness to participate in a second challenge, and that greater use of suppression strategies would be related to greater anxiety during the challenge, controlling for resting anxiety and group. Hierarchical multiple regressions were conducted in order to test these hypotheses. Group
and the respective resting covariate (e.g., resting subjective anxiety) were entered on Step 1, and use of acceptance or suppression was entered on Step 2. Greater use of suppression was related to greater subjective anxiety. The multiple regression equation from Step 2, regressing challenge subjective anxiety on resting subjective anxiety, group, and suppression strategies was significant, $F(4, 55) = 26.83, p < .001, R^2 = .66,$ and the main effect of suppression, was significant, $t = 2.79, p < .01, f^2 = .15.$ However, use of suppression was not related to willingness to participate in a second challenge. The overall regression equation was significant, $F(3, 56) = 3.31, p < .05, R^2 = .15,$ but the main effect of suppression on willingness, controlling for group, was not significant, $t = -1.5, ns, f^2 = .04.$ Interestingly, the opposite pattern was found for the use of acceptance. The regression equation from Step 2, regressing willingness on group and acceptance strategies, was significant, $F(3, 56) = 4.26, p < .01, R^2 = .19,$ and greater use of acceptance was related to greater willingness to participate in a second challenge, controlling for group, $t = 2.2, p < .05, f^2 = .09.$ However, use of acceptance was not related to challenge subjective anxiety, controlling for group and resting subjective anxiety, $t = -1.57, ns, f^2 = .04,$ although the regression equation from Step 2 was significant, $F(4, 55) = 23.40, p < .001, R^2 = .63.$

Discussion

This study is the first to compare the effects of acceptance versus suppression of emotions and thoughts in a clinical sample of patients diagnosed with PD/A. The design of the current study represents a significant improvement upon that of previous studies because there was a no-instruction control group, there were a number of manipulation check measures, and the acceptance and suppression interventions were presented in an elaborated form so as to increase external validity. In addition, the interventions were audiotaped and therefore consistent across participants so as to increase internal validity, and finally, descriptive information regarding the use of acceptance and suppression strategies in the everyday life of patients with PD/A was collected.

It was predicted that individuals in the acceptance group would report less subjective anxiety and less intense panic symptoms and would evidence less physiological responding and less avoidance related to the 5.5% CO$_2$ challenge than participants in the suppression or control groups. It was also hypothesized that individuals in the suppression group would report more subjective anxiety and more intense panic symptoms and would evidence more physiological responding and more avoidance related to the challenge than participants in the control group. In support of the primary hypotheses, individuals in the acceptance group reported less subjective anxiety and less avoidance (more willingness to participate in a second challenge) than did participants in the suppression or control groups. Contrary to this hypothesis, there were no significant differences between the three groups on self-report panic symptoms or physiological arousal as indexed by heart rate or skin temperature.
In addition, there were no significant differences between suppression and control groups on subjective anxiety or willingness to participate in a second challenge.

Consistent with the findings of Eifert and Heffner (2003), the current results indicate that while participants in the three groups did not differ in their experience of panic sensations (self-report panic symptoms or physiological arousal), they did differ in their report of subjective anxiety and in their willingness to participate in another challenge. The MASQ-AA is a measure of self-report autonomic arousal, and was used to assess how much participants experienced specific sensations during the challenge (e.g., racing heart, shortness of breath), while the 0-to-8 anxiety rating used in this study was a self-report rating of subjective anxiety or distress. The results imply that while acceptance participants experienced symptoms that were similar to those of other participants, the acceptance group did not evaluate these symptoms as negatively as did the other groups (i.e., participants reported feeling less subjective anxiety/distress during the challenge), and acceptance participants were more willing to engage in a second challenge. These results are consistent with two of the goals of acceptance-based interventions: (1) to encourage patients to experience emotions fully, without judging or evaluating them, and (2) to increase patients' willingness to participate in valued activities.

The results are also consistent with those of Hayes and colleagues, who found that although acceptance participants did not experience less pain than other participants during a cold pressor task, they were willing to remain in the situation longer (Hayes, Bissett, et al., 1999). The findings of the current study, like that of Hayes et al., suggest that the synchrony between physical sensations and overt behavior can be influenced by an acceptance rationale, and that emotional acceptance facilitates behavior change, while suppression may limit behavior change. Without the inclusion of the control group, it would be impossible to conclude whether differences between the acceptance and suppression groups were due to the anxiety- (and avoidance-) increasing effects of suppression or the anxiety- (and avoidance-) reducing effects of acceptance. However, because this study included a control group, we can conclude that a 10-minute acceptance intervention can significantly impact subjective anxiety and avoidance in a sample of patients with PD/A during a CO₂ challenge.

Analyses of the strategies used during the challenge indicate that greater use of acceptance strategies was related to more willingness to engage in another challenge, but not less subjective anxiety, while greater use of suppression strategies was related to greater subjective anxiety, but not less willingness. The manipulation check results suggest that acceptance instructions lead to both less subjective anxiety and more willingness, because acceptance participants used less suppression strategies (related to less anxiety) and more acceptance strategies (related to greater willingness) during the CO₂ challenge. This is again consistent with the idea that acceptance-based interventions work through at least two processes, one which serves to reduce experiential...
avoidance (in this case by reducing suppression), and the other which facilitates behavior change (in this case by increasing willingness).

Although group was a significant predictor of anxiety and avoidance, there were no significant differences between the suppression and control groups on any of the dependent measures. It is likely that this lack of differences between the suppression and control groups in response to the challenge is due to a lack of differences in the emotion-regulation strategies used by the two groups during the challenge. That is, both groups frequently used suppression to cope with symptoms during the challenge. Though participants in the control group received no specific instructions on how to approach the challenge, they used suppression strategies significantly more often than acceptance strategies, and significantly more often than those in the acceptance group. This is consistent with the idea that patients with PD/A often attempt to avoid interoceptive cues that might trigger panic attacks (Barlow, 2002). When participants were asked about their typical everyday use of the strategy taught on the audiotape, suppression participants reported using suppression strategies more than “frequently,” whereas acceptance participants reported using acceptance strategies less than “some of the time.” These collective results suggest that suppression may be the “default” emotion-regulation strategy in patients with PD.

In support of this explanation, Campbell-Sills et al. (2003), found that clinical participants with anxiety and mood disorders who watched upsetting film clips reported engaging in significantly more suppression than nonclinical participants, although they had received no specific instructions. It seems possible, then, that the same suppression instructions may produce significant differences between suppression and control groups in nonclinical samples, while not resulting in differences in clinical samples, because clinical participants who receive no instructions may be suppressing anyway. Since participants in the current sample reported that they typically attempt to suppress or control anxious reactions, the addition of suppression instructions may not have produced any meaningful incremental effect, accounting for the nonsignificant differences between suppression and control groups. Although such group differences were not found, additional analyses indicated that greater use of suppression strategies during the challenge was related to greater subjective anxiety. Because these results are correlational, however, it is possible that greater anxiety during the challenge led to greater use of suppression, rather than vice versa.

The finding of nonsignificant differences among all three groups on heart rate and skin temperature is consistent with the results of Feldner et al. (2003), and Eifert and Heffner (2003), indicating that acceptance and suppression instructions do not have an impact on physiological response to CO₂ challenge. The results are in contrast to those of Gross and Levensen (1997) and Campbell-Sills et al. (2003), both of which used film clips to induce emotion and which found that suppression leads to an increase in sympathetic activation. It seems clear that the impact of emotion-regulation instructions on physiological response to emotion induction depends on the method.
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of induction. Interestingly, other CO₂ challenge studies have used heart rate and skin temperature as manipulation check measures of the challenge (e.g., Eifert & Heffner, 2003), suggesting that such physiological changes are a direct result of the CO₂ challenge, and not likely to be affected by psychological manipulations. It is noteworthy that the experimental manipulation (i.e., audiotapes) in the current study had a significant impact on subjective measures (anxiety and avoidance) without affecting objective measures (heart rate and skin temperature). The results suggest that it is possible to change the subjective experience of emotion without affecting the associated physiological arousal.

There are a number of limitations of the current study. First, although there were several manipulation checks, there was limited construct validation of the manipulations (acceptance and suppression instructions) or the manipulation check measures. In addition, though the CO₂ challenge is known to evoke anxious responding in patients with PD, it is a laboratory paradigm that may have limited generalizability. From an acceptance perspective, one limitation of the CO₂ challenge is that it has no obvious value to the participant. Acceptance-based interventions teach patients to face challenging situations and accept internal experience in order to live life in valued directions. It is very encouraging that after a 10-minute audiotaped acceptance intervention, individuals with a clinical diagnosis of PD were willing to participate in a second CO₂ challenge and knowingly experience anxiety, with no clear positive consequence. That is, it seems unlikely that those who agreed to participate in a second challenge were choosing to experience distress in order to be consistent with an identified value direction. Rather, they were simply choosing to accept their emotional experience. This fact makes the findings appear even more robust. On the other hand, on average, participants reported only mild to moderate levels of anxiety during the challenge. It is possible that the acceptance intervention would not have been as successful in the midst of a full-blown panic attack. Finally, although the study did include a clinical sample, participants were predominantly Caucasian, and well-educated, thus limiting the application of the findings to other populations.

Despite these limitations, the current findings suggest that acceptance may be a useful emotion-regulation strategy for patients with PD/A, and possibly other anxiety disorders. Descriptive information obtained during the study indicates that patients with PD/A frequently use suppression to manage negative emotions, and that an acceptance intervention leads to lower levels of subjective anxiety and avoidance as compared to a suppression intervention. Although the suppression instructions in this study did not have an effect on response to the challenge, greater use of suppression was related to greater subjective anxiety. It seems likely that the use of suppression contributes to the maintenance of PD/A, if not to the etiology. Perhaps if individuals with PD/A, and other anxiety disorders, could learn to respond to physiological symptoms with emotional acceptance rather than suppression, the cycle of anxiety that maintains the disorder might be disrupted. Although the acceptance
instructions utilized in this study lasted only 10 minutes, and were noninteractive, they had a significant effect on subjective anxiety and avoidance. If such a brief intervention can increase willingness to participate in an aversive interoceptive task, it is possible that an individually tailored, lengthier acceptance intervention may be a useful adjunct to cognitive behavioral treatment for PD. One of the central features of PD/A is a strong tendency to avoid fearful sensations and situations (Barlow, 2002). This study illustrates the effectiveness of a 10-minute intervention in reducing such avoidance in a clinical sample.

Future studies might attempt to replicate these findings in other anxiety disorder samples, using experimental stimuli that are closely related to each disorder. It would also be interesting to further explore the process by which acceptance affects subjective anxiety and avoidance in experimental studies. Future research might also aim to distinguish the effect of an acceptance manipulation from that of a traditional habituation rationale. When patients engage in traditional exposure exercises, they typically learn that the purpose of exposure is habituation, and that engaging in a given exercise repeatedly will lead to anxiety reduction, and eventually to decreased anticipatory anxiety. In contrast, the acceptance rationale does not make symptom reduction an explicit goal; rather, it focuses on behavior change and acceptance of internal experience. Although these interventions appear theoretically different, it will be important to determine whether the two rationales differentially impact anxiety and avoidance in a clinical population. Future research might compare the acceptance rationale to a traditional exposure (habituation) rationale, thus shedding light on the similarities and differences of these behavioral interventions.

References


