Neurology, Psychiatry and Brain Research 34 (2019) 1–8

Contents lists available at ScienceDirect

Neurology, Psychiatry and Brain Research

journal homepage: www.elsevier.com/locate/npbr

Levels of perceived control and treatment response in a brief partial hospital setting

Lauren Wadsworth*, Inga Wessman, Courtney Beard, Thröstur Bjorgvinsson

McLean Hospital, 115 Mill St, United States

ARTICLE INFO

Keywords:
Transdiagnostic
Perceived control
Affective disorders
Anxiety
Depression

ABSTRACT

Background: Perceived internal and external control have long been theorized to relate to development and maintenance of anxiety (Barlow, 2002) and depression (Seligman, 1975). Experimental research studies investigating perceived control have largely focused on anxiety within cross-sectional samples and have shown that low levels of perceived internal and external control are associated with higher levels of anxiety (Gallagher et al., 2014) and depression (Brown & Siegel, 1988; Wardle et al., 2004). The majority of previous research has looked at the combined effects of perceived internal and external control and has not investigated these constructs as potential treatment targets in intensive, short-term clinical settings.

Methods: The current study examined the associations of perceived internal and external control as they relate to anxiety and depression symptom change in a partial hospital sample.

Results: Both perceived internal and external control increased significantly over brief, intensive treatment. Further, greater gains in internal perceived control were related to greater reductions in anxiety and depression symptoms.

Discussion: Our study was limited in that it did not include a control group or follow-up data. This study provides evidence that perceived internal control is related to change in symptoms in a diagnostically diverse and severe population, after very brief intensive treatment. Future studies should investigate if perceived internal control is a mechanism of change in treatment and explore how to maximize the development of perceived internal control in treatment, to maximize reduction in symptoms.

1. Introduction

Perceived control, or the extent to which one believes they have control over the environment and their emotional experiences, has been theorized to be a fundamental aspect of the development and maintenance of anxiety (Barlow, 2002) and depression (Seligman, 1975). Perceived control can be divided into perceived internal and external control. Perceived internal control describes the amount of control an individual perceives having over their emotional responses. Perceived external control refers to the amount of control individuals perceive having over their environment and anxiety provoking/difficult situations.

To date, the vast majority of research on perceived control has investigated the relation between anxiety and perceived control and has combined perceived internal and external control[1] . Low levels of perceived internal and external control have been linked to higher levels of anxiety (Brown, White, Forsyth, & Barlow, 2004; Gallagher, Bentley, & Barlow, 2014). Specifically, research studies have shown that low perceived control (internal and external combined) is linked to a variety of symptoms: greater anxiety sensitivity and avoidance (White, Brown, Somers, & Barlow, 2006); greater panic disorder severity (Bentley et al., 2013); greater obsessive-compulsive symptoms (Moulding & Kyrios, 2007; Sassaroli et al., 2015); increased anxious arousal (Gregor & Zvolensky, 2008); and the presence of Generalized Anxiety Disorder (GAD; Stapinski, Abbott, & Rapee, 2010). Moreover, studies have found that low perceived control uniquely predicts Obsessive Compulsive Disorder (OCD) and GAD even when controlling for neuroticism and extraversion (Brown & Naragon-Gainey, 2013). Further, a meta-analysis indicated low levels of perceived control as a transdiagnostic feature of anxiety disorders (Gallagher et al., 2014).

Findings from experimental studies suggest that increasing actual or perceived level of control may reduce levels of anxiety in the moment.

* Corresponding author.
E-mail address: lauren.p.wadsworth@gmail.com (L. Wadsworth).

[1] Throughout this manuscript, "perceived control" will be used to refer to the instances where the internal and external subscales were combined, or other measurements of perceived control without the internal/external subscales were used.

https://doi.org/10.1016/j.npbr.2019.08.001
Received 30 April 2019; Received in revised form 10 August 2019; Accepted 12 August 2019
Available online 28 August 2019
0941-9500/

For example, providing adults an escape route during exposure therapy (increasing environmental control) has been shown to decrease level of anxiety (Rachman, Craske, Tallman, & Solyom, 1986; Sanderson, Rapee, & Barlow, 1989) during the exposure. Similarly, providing adults with an illusion of control in a CO_2 challenge (participants misled to believe they could change CO_2 level via a dial) resulted in participants experiencing significantly less severe panic responses compared to a control group (Sanderson et al., 1989). It should be noted, however, that while engaging in subtle to major escape behaviors (also referred to as safety behaviors) reduces anxiety in the short-term, they have been shown to maintain/increase anxiety disorders in the long-term (Kim, 2005; Wells et al., 1995).

There is also some evidence that perceived control is a involved in the development and maintenance of depression. Theoretical models, such as Seligman's (1975) learned helplessness theory, have long conceptualized depression as a response to perceived low control over one's environment (Weiner & Litman-Adizes, 1980; Wortman & Dintzer, 1979). Specifically, Seligman (1975) proposed that individuals experiencing a series of events where they perceive a lack of control, leads to predicting that future events will also be uncontrollable, leading to decreases in motivation and depression. Abramson, Seligman, and Teasdale (1978) expanded on this model to propose that low perceived control can be understood as perceived non-contingency between actions and outcomes. Brown and Siegel (1988) investigated and found support for Abramson's model, where individuals who attributed important life events to uncontrollable causes were more likely to report higher levels of depression symptoms. The reverse was also true, where important life events that were perceived as linked to controllable causes, individuals reported lower levels of depression symptoms. Since then, multiple reports have further shown association between low perceived control and higher symptoms of depression (Brown & Naragon-Gainey, 2013; Liu, Zhu, & Wang, 2016; Wardle et al., 2004).

Increasing perceived internal and external control might be an adaptive coping strategy for enduring stressful contexts. Weems, Silverman, Rapee, and Pina (2003) suggests that individuals in adverse conditions might fare better with higher levels of perceived control. Indeed, in a sample of adults with low and high incomes, lower income levels were associated with worse health and well-being. However, researchers found a moderating effect of perceived control, where participants in the low-income group who rated a high sense of control showed levels of health and wellbeing similar to the high-income group (Lachman & Weaver, 1998).

Perceived internal and external control might increase as a result of people benefiting from therapy and learning about emotion management skills. A limited number of studies have explored the association between levels of perceived control and treatment response. In a sample of children receiving Cognitive Behavioral Therapy (CBT) for anxiety, increases in perceived control mediated reductions in anxiety symptoms across treatment (Pereira et al., 2017). In a treatment for Panic Disorder, larger perceived control gains were associated with better treatment outcomes (Meuret, Hofmann, & Rosenfield, 2010). In a study comparing CBT or Acceptance and Commitment Therapy (ACT) for Social Anxiety Disorder, Craske et al. (2014) found that higher perceived control predicted greater treatment response across both treatment groups. Thus, previous research suggests that gains in perceived internal and external control are associated with better treatment response.

The overall aim of the present study was to fill several gaps in knowledge regarding perceived internal and external control as potential transdiagnostic treatment targets. First, there is a lack of research testing theoretical models linking depression and low perceived internal and external control. Thus, the current study examined how perceived internal and external control relate to anxiety and depression symptoms. Next, although a few studies have examined changes in perceived control after treatment, none have focused on acute psychiatric treatment settings. No studies to date have tested whether meaningful changes in perceived external and internal control are possible after short-term treatment. The current study investigated perceived external and internal control in a partial hospital setting where patients received intensive group and individual treatment over 7–10 days. Third, previous research studies have largely combined the internal and external subscales of perceived control, not investigating potential unique effects of each on symptoms. Understanding more about the unique impacts of perceived internal and external control on symptoms could inform treatment targets.

In the present study, we assessed perceived internal and external control in individuals attending a brief partial hospital program. The treatment is delivered to a diagnostically diverse group of patients and focuses on psychoeducation, and teaching CBT, Dialectical Behavior Therapy (DBT), and ACT skills. First, we hypothesized that levels of both internal and external control would show significant associations with both anxiety and depression symptoms at the onset of treatment (at admission). Second, we hypothesized that internal and external control would increase significantly after partial hospital treatment, presumably due to learning CBT and DBT skills for symptom management. Third we hypothesized that greater gains in perceived internal and external control would predict greater reduction in anxiety and depression symptoms.

2. Method

2.1. Participants

Of the 447 partial hospital patients who were offered participation in the study, 384 (85.9%) provided informed consent. Of the 384 participants who consented, 51 (13.3%) were excluded due to concerns about the validity of their answers (i.e., participants who failed validity checks, which included three questions such as "please select 'good' for this item") at admission (n = 45, 11.7%) or discharge (n = 6, 1.6%). Additionally, 67 participants (17.4%) did not complete post-treatment assessment due to the following reasons: hospitalized (n = 30, 7.8%), discharged unexpectedly (n = 18, 4.7%), incarcerated (n = 1, .3%), exempt by treatment providers from assessment (n = 1, 0.3%), missed discharge assessment for unexpected (n = 9, 2.3%) or unknown reasons (n = 8, 2.1%). Therefore, a total of 266 adults admitted to a brief partial hospital program were included in the current study. Due to missing data on the main study measures some participants were not included in all main analyses (anxiety main analyses, n = 20; depression main analyses, n = 23).

This study was approved by the hospital's Institutional Review Board. Demographic characteristics are presented in Table 1. The sample was largely white (85.7%) and highly educated, with most participants having completed at least some college education, associate's degree, or trade school (91.0%).

Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV; American Psychiatric Association, 2000) diagnoses for the present sample can be found in Table 2. Mood disorders (n = 128, 63.0%) and GAD (n = 89, 43.8%) were the most common diagnoses given by clinicians after administering the MINI. On average, patients met criteria for two disorders (M = 2.14, SD = 1.47, ranging from none to seven Axis I disorders), with 128 (63.1%) patients meeting criteria for two or more disorders.

2.2. Treatment

Participants attended a Partial Hospital Program on weekdays (Monday-Friday). The program includes group and individual therapy, pharmacological treatment, and case management. Patients meet with their therapist, case manager, and psychiatrist in one-on-one meetings approximately every other day. Case managers meet with patients to perform an intake interview, develop a case conceptualization, treatment plan, individual therapy recommendations, and a group therapy

Table 1
Sample demographic characteristics.

Characteristic	*M (SD)*
Age	33.4 (13.1)
Frequency (%)	
Gender	
Female	140 (52.6%)
Male	126 (47.4%)
Race[a]	
White	228 (85.7%)
Black	12 (4.5%)
American Indian/Alaskan Native	3 (1.1%)
Asian	26 (9.8%)
Other	12 (4.5%)
Unknown	3 (1.1%)
Latinx	12 (4.5%)
Education	
Some high school or GED	4 (1.5%)
High school/GED	20 (7.5%)
Some College/Associate Degree/Trade School	107 (40.2%)
4-Year College Graduate	62 (23.3%)
Post-College Education	73 (27.4%)
Employment and student status[b]	
Employed part or full-time	141 (53.4%)
Not student	109 (41.3%)
Student	32 (12.1%)
Unemployed	123 (46.6%)
Not student	65 (24.6%)
Student	58 (22.0%)
Marital status	
Never married	167 (62.8%)
Separated/divorced/widowed	28 (10.5%)
Married/living with a partner	71 (26.7%)

[a] Not mutually exclusive categories.
[b] Two participants did not answer employment or student status.

Table 2
DSM-IV Axis I Diagnoses.

Diagnosis	*Frequency (%)*
Major depressive disorder	98 (48.3%)
Bipolar I disorder	
Current depressive episode	21 (10.4%)
Current manic/hypomanic episode	3 (1.5%)
Bipolar II disorder	
Current depressive episode	6 (3.0%)
Current hypomanic episode	0 (0.0%)
Psychotic disorder	9 (4.4%)
Panic disorder (with or without agoraphobia)	36 (17.7%)
Social anxiety disorder	68 (33.5%)
Posttraumatic stress disorder	30 (14.8%)
Generalized anxiety disorder	89 (43.8%)
Obsessive compulsive disorder	22 (10.8%)
Body dysmorphic disorder	14 (6.9%)
Alcohol abuse/dependence	37 (18.2%)

Notes. 203 patients were administered the MINI. Percentages exceed 100% due to comorbidity.

schedule based on patient needs. Patients attend up to 5 group therapy sessions per day that focus on psychoeducation, CBT, DBT, and ACT skills. Each day patients typically attend one behavioral activation group (adapted from Martell, Dimidjian, and Herman-Dunn (2010) and one cognitive restructuring group (identifying or challenging Negative Automatic Thoughts, informed by Beck, Rush, Shaw, & Emery, 1979). Patients attend additional groups on DBT skills (e.g. mindfulness, distress tolerance, emotion regulation, and interpersonal effectiveness; Linehan, 1993) and other CBT skills (e.g. self-assessment, psychoeducation; Beck, Emery, & Greenberg, 1985). According to biannual adherence ratings, on average group leaders address 95% of components in the group protocols. In the present sample, participants were in the program for an average 13 days (SD = 4.3, including non-treatment days such as weekends or holidays), with the stay ranging from three to 23 days (excluding one patient who was in the program for 46 days). For a full review of the treatment approach, see Beard and Björgvinsson (2013).

2.3. Measures

2.3.1. The mini international neuropsychiatric interview (MINI; Sheehan et al., 1998)

The MINI is a semi-structured diagnostic interview performed by individual therapists (supervised clinical psychology doctoral students and interns) during the initial treatment session. Each diagnostic section is comprised of a series of screening questions followed by measures of symptomatology frequency. The MINI has shown strong reliability and validity with the Structured Clinical Interview for DSM-IV (SCID-IV), with inter-rater reliabilities ranging from kappas of .89–1.0 (Sheehan et al., 1998). Also, previous research has indicated good inter-rater reliability between the partial hospital program psychiatrist and MINI diagnosis, with scores of .69 for MDD and .75 for Bipolar Disorder-Depressed (Kertz, Bigda-Peyton, Rosmarin, & Björgvinsson, 2012). MINI assessors meet monthly for supervision and twice yearly to rate a recorded MINI interview. Reliability ratings in the present study yielded strong diagnoses agreement (Cohen's Kappa = .91).

2.3.2. The body dysmorphic disorder module (BDD-M; Phillips, 2005)

The BDD-DM is a brief, semi-structured diagnostic interview that assesses the presence of BDD, which is not assessed by the MINI. In collaboration with the author of BDD-DM, Dr. Katharine Phillips, one question regarding BDD behaviors (e.g., mirror checking) was added to the BDD-DM in order to diagnose BDD according to the DSM-V (American Psychiatric Association, 2013). The BDD-DM has been found to have good psychometric properties, including high interrater reliability (κ = .96; Phillips, 2005). The assessors were thoroughly trained in the administration of the BDD-DM (modeled on the MINI training) and supervised by a post-doctoral fellow in the diagnosis of BDD.

2.3.3. The patient health questionnaire-9 (PHQ-9; Kroenke, Spitzer, & williams, 2001)

The PHQ-9 is a nine item self-report measure that assesses frequency of depression symptoms in the past two weeks. Each item assesses for symptoms of depression (e.g., "feeling down, depressed, or hopeless") on a 4-point scale that ranges from zero *(not at all)* to three *(nearly every day)*. Total scores on the PHQ-9 can range from zero to 27, where higher scores indicate a higher symptom severity. The PHQ-9 has been well validated in psychiatric populations as a screen for depressive episodes and severity (Beard, Hsu, Rifkin, Busch, & Björgvinsson, 2016). In the present study, the PHQ-9 showed high internal consistency (pre-treatment, α = .87; post-treatment, α = 0.88).

2.3.4. The 7-item generalized anxiety disorder scale (GAD-7; Spitzer, Kroenke, Williams, & löwe, 2006)

The GAD-7 is a 7-item self-report questionnaire that measures symptoms of anxiety (Spitzer et al., 2006). Participants are asked "over the last two weeks, how often have you been bothered by the following problems," (e.g., nervous, worrying too much, trouble relaxing). Participants respond on a 4-point Likert scale, from zero (*not at all*) to three (*nearly every day*). Total scores can range from 0 to 21, with higher scores indicating greater anxiety symptom severity. The GAD-7 has demonstrated good reliability and construct validity in previous studies (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007; Löwe et al., 2008; Spitzer et al., 2006), and has performed well as a measure of general anxiety in an acute psychiaitric population (Beard & Björgvinsson, 2014). In the present study, the GAD-7 showed high internal consistency (pre-treatment, α = 0.88; post-treatment, α = .88).

2.3.5. The anxiety control questionnaire (ACQ; Rapee, Craske, Brown, & Barlow, 1996)

The ACQ was designed as a 30-item questionnaire to assess the extent to which individuals perceive control over their environments (external control) and their internal response to distressing situations (internal control). While the ACQ was designed to measure anxiety control, most items do not specifically refer to anxiety, and therefore, can be applied to other types of distress. Participants are asked to rate on a 6-point Likert scale how much they agree with statements such as, "How well I cope with difficult situations depends on whether I have outside help," and "When I am put under stress, I am likely to lose control." In 2004, Brown, White, Forsyth, and Barlow validated a 15-item version of the ACQ, which was used for the present study due to testing battery space limits. The 15-item ACQ showed good internal consistency in the present study (pre-treatment, $\alpha = .86$; post-treatment, $\alpha = .87$), and includes 7 items from the internal subscale and 8 items from the external subscale.

2.4. Procedure

Data were collected via computers using Research Electronic Data Capture (REDCap), which is a secure, web-based application designed to support data capture for research studies (Harris et al., 2009). Measures were administered to patients at intake and discharge under supervision of a research assistant. All patients included in the present study consented to research.

2.5. Statistical analyses

To test our first hypothesis that levels of internal and external perceived control will be associated with anxiety and depression symptoms, we calculated correlations between perceived control and scores on the GAD-7 and PHQ-9 upon admission to the partial hospital program. To test the second hypothesis that internal and external perceived control would significantly increase as a result of treatment, we conducted paired *t*-tests and calculated Cohen´s *d* effect sizes. We used Cohen's (1992) criteria to characterize the effect sizes (.2 = small effect size, .5 = medium effect size, and .8 = large effect size).

To test the third hypothesis that gains in internal and external perceived control would predict anxiety and depression symptoms changes over treatment, we used multiple regression. To control for baseline scores, we calculated unstandardized residualized gain scores for anxiety and depression symptoms. Specifically, we used pre-treatment scores to predict post-treatment scores and calculated the difference between the predicted scores and the actual post-treatment scores. Therefore, gains scores indicate whether individuals have changed more or less than expected considering pre-treatment scores. Final models were selected by comparing the model fit criteria (i.e., Akaike Information Criterion; AIC[2]), regression coefficients, and significance tests results for effects between models. To decide whether demographic variables (i.e., age, sex, education, and race) should be included as covariates in the analyses, the relationship between demographic variables, predicting variables (i.e., gain scores for internal and external perceived control), and outcome variables (i.e., gain scores for anxiety and depression symptoms) was assessed. Out of 20 analyses only the test of education and external perceived control was significant. Including education as a covariate had no impact on the models. Therefore, no covariates were included in the analyses.

Prior to conducting these analyses, we assessed normality, homoscedasticity, outliers, linearity, and multicollinearity to ensure that the statistical assumptions of multiple regression were met. For both models (1. the association between perceived control gains and anxiety symptom gains; and 2. the association between perceived control gains and depression symptom gains), the residual distribution was close to normal and variability was similar across predicted values with no extreme outliers. Simulations of the distributions revealed that the observed deviations from normality, homoscedasticity, and no outliers are common when statistical assumptions are satisfied. Residual plots indicated that the relationship between perceived control, and anxiety and depression symptoms, is linear. Multicollinearity was not of concern since bivariate correlations between internal and external perceived control were not high (ranging from .12 to .47). Tolerance values were adequate, ranging from .66 to .83, indicating that between 66 to 83% of the available information was used in calculating the parameter estimates, confidence intervals, and significance tests for each predictor variable.

3. Results

3.1. Correlations at baseline

The first hypothesis was supported, as both subscales of perceived control (i.e., internal and external) correlated negatively with anxiety and depression symptoms at baseline (see Table 3). Larger perceived internal and external control scores were associated wither lower anxiety and depression symptoms.

3.2. Changes in perceived control, and anxiety and depression symptom change

Consistent with our second hypothesis, participants reported significant changes in perceived internal and external control. Specifically, descriptive and inferential statistics (see Table 4) revealed that perceived control, significantly increased from admission to discharge. Anxiety (GAD-7), and depression (PHQ-9) symptoms significantly decreased. According to Cohen´s *d* the effect sizes were medium to large for perceived internal control, anxiety and depression symptoms. For perceived external control, the effect size was small.

3.3. Relationship between changes in perceived control and anxiety symptoms

The third (exploratory) hypothesis tested the relation between gains in perceived control (i.e., internal and external perceived control) and reduction in anxiety symptoms. The model with the lowest AIC value (i.e., 609.80) included the main effect of gains in internal perceived control. However, the AIC value (i.e., 610.87) for the model including both the main effects of gains in internal *and* external perceived control was only 1.07 points higher than the model with the lowest AIC value. Because the models were within 2 points, both models could describe the association between gains in perceived control and gains in anxiety symptoms in the population without under- or over-fitting the model to the sample data (see Table 5).

The variability of internal perceived control gain scores explained a significant proportion of the variability of anxiety gain scores

[2] Akaike's information criterion (AIC) compares how good the quality of different statistical models is to each other, that is, the best model will be the one that neither under-fits (excludes important independent variables) or over-fits (includes independent variables that will over fit the model to the sample data instead of representing the population data). Models with lower AIC are believed to be better fits and in general the model with the lowest AIC of a series of models is considered the "best model." A two points or greater difference between models is deemed meaningful, and therefore, the "best model" can have competing models if the AIC difference between models is less than two points since that suggests both models have substantial evidence (Burnham & Anderson, 2004). In instances in which models are competing to be the "best model", assessing differences in regression coefficients between models (e.g., excluding a main or moderation effect can lead to an overestimation of another effect, indicating that including an effect although it might have a higher AIC value might be valuable) and considering theoretical reasons for including or excluding effects is important.

Table 3
Baseline associations between perceived control, and anxiety and depression symptoms.

Variable	ACQ Total	ACQ Internal	ACQ External	GAD-7	PHQ-9
ACQ Total	———				
ACQ Internal	.88****	———			
ACQ External	.91****	.60****	———		
GAD-7	−.54****	−.59****	−.40****	———	
PHQ-9	−.42****	−.44****	−.32****	.63****	———

Notes. ACQ = Anxiety Control Questionnaire; PHQ-9 = Patient Health Questionnaire.
9-items; GAD-7 = Generalized Anxiety Disorder, 7-item.
Significance: ****$p < .001$. ***$p < .01$. **$p < .05$. *$p < .1$.

Table 4
Means, Standard Deviations, and Paired T-tests (one-tailed) results for Study Variables.

Measure	Pre-treatment *M (SD)* *n*	Post-treatment *M (SD)* *n*	*t* *(df)*	Cohen´s *d*
ACQ Total	34.00 (11.67) *251*	40.25 (11.45) *258*	9.07 (245) ****	−.58
ACQ Internal	11.88 (6.17) *257*	15.68 (6.47) *259*	10.46 (251) ****	−.66
ACQ External	22.02 (6.90) *253*	24.25 (5.97) *257*	6.35 (250) ****	−.43
GAD-7	10.50 (5.48) *263*	7.24 (4.74) *266*	−11.67 (249) ****	.74
PHQ-9	13.65 (6.51) *265*	9.45 (5.66) *263*	−12.59 (261) ****	.79

Notes. ACQ = Anxiety Control Questionnaire; PHQ 9 = Patient Health Questionnaire, 9-items; GAD 7 = Generalized Anxiety Disorder, 7-item.
Significance: ****$p < .001$. ***$p < .01$. **$p < .05$. *$p < .1$.

Table 5
Comparison of AIC values to select a model for the relationship between gains in perceived control and anxiety treatment outcome gains.

Model: Effects	AIC
Model 1: ACQ Internal	609.80
Model 2: ACQ External	632.61
Model 3: ACQ Internal + ACQ External	610.87

Notes. ACQ = Anxiety Control Questionnaire; AIC = Akaike Information Criterion.

Table 6
Regression coefficients for model (including main effect of internal perceived control) predicting anxiety symptom gains.

Coefficient	Estimate	Std. error	*t*	95% confidence interval	
				Lower limit	Upper limit
Intercept	.89	.26	3.44 ****	.38	1.41
ACQ Internal	−.23	.04	−6.22 ****	−.31	−.16

Notes. ACQ = Anxiety Control Questionnaire.
Significant codes: ****$p < .001$. ***$p < .01$. **$p < .05$. *$p < .1$.

[R^2 = 13.43%, F (1, 249) = 38.63, $p < .001$]. As shown in Table 6, the significance test for the main effect of internal perceived control gains was significant at a $\alpha = .05$ level. The variability of internal and external perceived control gain scores explained a significant proportion of the variability of anxiety gain scores [R^2 = 13.53%, F (2, 243) = 19.02, $p < .001$]. As shown in Table 7, the significance test for the main effects of internal perceived control gains was significant at $\alpha = .05$ level, however, the significance test for the main effects of external perceived control gains was not significant at a $\alpha = .05$ level. The regression coefficients (i.e., the main effects for internal perceived control) did not greatly differ (i.e., .02) between the two models (i.e., the model including internal perceived control, and the model including internal and external perceived control; see Tables 6 and 7). In sum, considering that the significance test for the main effect of external perceived control was not significant and the main effect for internal perceived control was not affected by excluding external perceived control, the model including only internal perceived control was the best fit. The results for the model including the main effect of internal perceived control gains indicate that as perceived internal control gains increase, anxiety symptoms show greater reductions (see Fig. 1).

Table 7
Regression coefficients for model (including main effects) predicting anxiety symptom gains.

Coefficient	Estimate	Std. error	*t*	95% confidence interval	
				Lower limit	Upper limit
Intercept	.90	.26	3.42 ****	.38	1.41
ACQ Internal	−.21	.04	−4.96 ****	−.29	−.13
ACQ External	−.05	.05	−.96	−.14	.05

Notes. ACQ = Anxiety Control Questionnaire.
Significant codes: ****$p < .001$. ***$p < .01$. **$p < .05$. *$p < .1$.

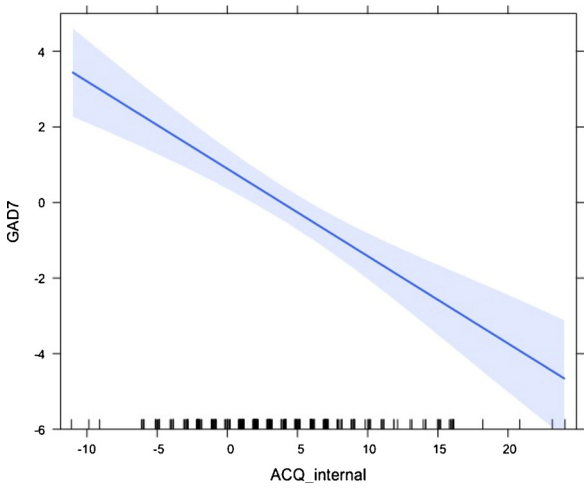

Fig. 1. The main effects of internal perceived control gains on anxiety gains. Higher levels of gains in perceived control and lower levels of gains in anxiety symptoms indicate better outcomes. With higher levels of perceived internal control anxiety symptom gains increase.

3.4. Relationship between changes in perceived control and depression symptoms

Next, we investigated the relation between gains in perceived control (i.e., internal and external perceived control) and reduction in depression symptoms. The model with the lowest AIC value (i.e., 704.81) included the main effects of gains in internal perceived control (and not external perceived control). However, the AIC value (i.e., 706.29) for the model including the main effects of gains in internal *and* external perceived control was only 1.48 points higher than for the model with the lowest AIC value. Therefore, both models could describe

Table 8
Comparison of the AIC values to select model for the relationship between gains in perceived control and depression treatment outcome gains.

Model: Effect	AIC
Model 1: ACQ internal	704.81
Model 2: ACQ external	718.53
Model 3: ACQ Internal + ACQ External	706.29

Notes. ACQ = Anxiety Control Questionnaire; AIC = Akaike Information Criterion.

Table 9
Regression coefficients along with the results for significance tests for depression symptoms gains.

Coefficient	Estimate	Std. error	*t*	95% confidence interval	
				Lower limit	Upper limit
Intercept	.88	.32	2.73 ***	.25	1.51
ACQ Internal	−.23	.05	−4.89 ****	−.32	−.14

Notes: ACQ = Anxiety Control Questionnaire.
Significance: ****$p <$ .001. ***$p <$ .01. **$p <$ .05. *$p <$ .1.

the association between gains in perceived control and gains in depression symptoms in the population without under- or over-fitting the model to the sample data (see Table 8).

The variability of internal perceived control gain scores explained a significant proportion of the variability of depression gain scores [R^2 = 8.81%, F (1, 247) = 23.88, $p <$ .001]. A significance test (Table 9) for the main effects of internal perceived control gains was significant at α = .05 level. The variability of internal and external perceived control scores explained a significant proportion of the variability of depression scores [R^2 = 8.37%, F (2, 240) = 10.97, $p <$ .001]. A significance test (Table 10) for the main effects of internal perceived control gains was significant at α = .05 level, however, a significance test for the main effects of external perceived control gains was non-significant at α = .05 level. The regression coefficients (i.e., the main effects for internal perceived control) do not differ greatly (i.e., .03) between the two models (i.e., the model including internal perceived control, and the model including internal and external perceived control; see Tables 9 and 10). In sum, considering that the significance test for the main effect of external perceived control was not significant and the main effect for internal perceived control was not affected by excluding external perceived control, the model including only internal perceived control was the best fit. The results for the model including the main effect of internal perceived control indicate that as perceived internal control gains increase, depression symptoms show greater reductions (see Fig. 2).

Table 10
Regression coefficients along with the results for significance tests for depression symptoms gains.

Coefficient	Estimate	Std. error	*t*	95% confidence interval	
				Lower limit	Upper limit
Intercept	.91	.33	2.80 ***	.27	1.56
ACQ Internal	−.20	.05	−3.81 ****	−.30	−.10
ACQ External	−.04	.06	−.72	−.16	.07

Notes: ACQ = Anxiety Control Questionnaire.
Significance: ****$p <$ .001. ***$p <$ .01. **$p <$ .05. *$p <$ .1.

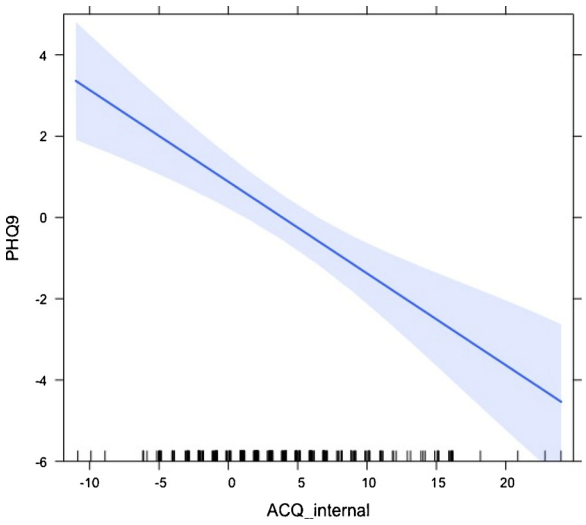

Fig. 2. The main effects of internal perceived control gains on depression gains. Higher levels of gains in perceived control and lower levels of gains in depression symptoms indicate better outcomes. With higher levels of perceived internal control depression symptom gains increase.

4. Discussion

The current study examined levels of perceived internal and external control before and after brief intensive partial hospital treatment in a diagnostically diverse sample. Consistent with our first hypothesis, baseline associations revealed that higher perceived external and internal control were associated with lower levels of anxiety and depression. These results are consistent with previous research indicating a negative correlation between perceived control and anxiety (Brown et al., 2004; Gallagher et al., 2014) and depression (Seligman, 1975). Our results add to the literature by showing that these relationships also exist and are similar in magnitude at severe levels of psychopathology. Further, our results provide unique correlations for both perceived internal and external control, which are typically combined in the literature.

Consistent with our second hypothesis, both perceived internal and external control increased significantly over the course of our 7–10 day partial hospital treatment. These findings suggest that gains in perceived internal and external control were a byproduct of our CBT/DBT/ACT group and individual therapy. Additionally, these gains were consistent across our diagnostically diverse sample, providing evidence that these constructs relate to treatment transdiagnostically.

Third, we investigated relations between gains in perceived internal and external control with improvement in anxiety and depression symptoms. For anxiety, we found that greater gains in both perceived internal and external control co-varied with greater reductions in anxiety symptoms after brief partial hospital treatment. Our results are in line with previous research indicating a negative correlation between perceived internal and external control on the one hand and anxiety symptoms on the other (Brown et al., 2004; Gallagher et al., 2014; Gregor & Zvolensky, 2008; White et al., 2006). Furthermore, it showed that gains in perceived control were associated with changes in anxiety symptoms after brief partial hospital treatment. These results are consistent with previous research indicating gains in perceived control as a result of anxiety treatment (Craske et al., 2014; Pereira et al., 2017), and show that the effects can even be seen after brief partial hospital treatment.

For depression symptoms, analyses revealed that greater gains in perceived internal and perceived external control co-varied with greater reductions in depression symptoms. Thus, in a brief partial hospital setting, increases in perceived internal and external control were related to depression symptom reduction. These results support

Seligman's (1975) model of depression development and provide support for the relation between gains in perceived control and reductions in depression symptoms. Additional research is warranted to evaluate which interventions contributed to gains in perceived internal and external control.

In both the anxiety and depression regression models, perceived internal control had a stronger relationship with psychopathology than perceived external control. Additionally, the models with perceived external control were not significantly stronger, suggesting that perceived external control does not account for additional variance over and above perceived internal control. Perhaps one's level of perceived external control is less relevant because symptomatology is more strongly linked to how one copes internally with high or low levels of external control. For example, if an individual is in a low-control environment (e.g. an abusive home), but feels they have high levels of internal control/coping with stress skills, the environmental stress may not lead to psychopathology. This relationship supports models of resilience, that propose individuals can vary greatly on their ability to cope with stressful contexts (resilience), and that greater resilience is linked to less negative mental health outcomes (Bonanno, 2004; Davydov, Stewart, Ritchie, & Chaudieu, 2010; Huppert, 2005). These findings suggest that treatment interventions may be more effective if they focus on teaching individuals internal coping skills, as opposed to focusing on changing environmental stressors.

The findings of the present study should be considered in light of a few limitations. First, our data only include two time points of the ACQ, so we cannot determine direction of effects or causality. Also, our naturalistic treatment sample does not include a control group. Thus, we cannot conclusively attribute changes in symptoms or perceived control to the treatment, nor can we determine which aspects of treatment might drive change. We also do not have follow-up data, preventing us from assessing long-term effects. Further, our sample was majority White and European American, limiting the racial and ethnic generalizability.

Our findings are novel in that they investigate perceived control in a diagnostically diverse sample, compared to most previous literature which has focused largely on anxiety disorders. The results of the present study support continued attention to the role of perceived internal and external control in the treatment of anxiety, and increased attention to its role in the treatment of depression. The findings offer some support for designing clinical interventions aimed at increasing levels of perceived internal and external control for individuals experiencing severe psychopathology. Further, our results suggest that internal control is more strongly linked to decreases in psychopathology (anxiety and depression) than external control. Thus, the field would likely benefit from new interventions designed to increase perceived internal control quickly as these would likely result in efficient anxiety and depression symptom reduction in patient presenting with severe psychopathology.

Ethical statement

All authors: Lauren Wadsworth, PhD; Inga Wessman; Courtney Beard, PhD; Thröstur Bjorgvinsson, PhD

I testify on behalf of all co-authors that our article submitted to Neurology, Psychiatry, and Brain Research:

1) This material has not been published in whole or in part elsewhere;
2) The manuscript is not currently being considered for publication in another journal;
3) All authors have been personally and actively involved in substantive work leading to the manuscript, and will hold themselves jointly and individually responsible for its content. The contributions were as follows:

Author	Roles
Lauren Wadsworth, PhD	Methods, Analyses, Manuscript write-up
Inga Wessman	Statistical analysis and write-up
Courtney Beard, PhD	Methods, Data Collection, Manuscript Review
Thröstur Bjorgvinsson, PhD	Director of Research, Methods, Data Collection, Manuscript Review

Financial disclosure

We have no funding sources to acknowledge.

Declaration of Competing Interest

All authors declare that they have no conflicts of interest.

References

Abramson, L. Y., Seligman, M. E. P., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87*, 49–74.
American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author text rev.
American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
Barlow, D. H. (2002). *Anxiety and its disorders: The nature and treatment of anxiety and panic* (2nd ed.). New York: The Guilford Press.
Beard, C., & Björgvinsson, T. (2013). Commentary on psychological vulnerability: An integrative approach. *Journal of Integrative Psychotherapy, 23*, 281–283.
Beard, C., & Björgvinsson, T. (2014). Beyond generalized anxiety disorder: Psychometric properties of the GAD-7 in a heterogeneous psychiatric sample. *Journal of Anxiety Disorders, 28*(6), 547–552.
Beard, C., Hsu, K. J., Rifkin, L. S., Busch, A. B., & Björgvinsson, T. (2016). Validation of the PHQ-9 in a psychiatric sample. *Journal of Affective Disorders, 193*, 267–273.
Beck, A. T., Emery, G., & Greenberg, R. L. (1985). *Anxiety disorders and phobias: A cognitive perspective.* New York, NY: Basic Books.
Beck, A. T., Rush, J. A., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy for depression.* New York, NY: Guilford Press.
Bentley, K. H., Gallagher, M. W., Boswell, J. F., Gorman, J. M., Shear, M. K., Woods, S. W., et al. (2013). The interactive contributions of perceived control and anxiety sensitivity in panic disorder: A triple vulnerabilities perspective. *Journal of Psychopathology and Behavioral Assessment, 35*, 57–64.
Bonanno, G. A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *The American Psychologist, 59*, 20–28.
Brown, T. A., & Naragon-Gainey, K. (2013). Evaluation of the unique and specific contributions of dimensions of the triple vulnerability model to the prediction of DSM-IV anxiety and mood disorder constructs. *Behavior Therapy, 44*, 277–292. https://doi.org/10.1016/j.beth.2012.11.002.
Brown, J. D., & Siegel, J. M. (1988). Attributions for negative life events and depression: The role of perceived control. *Journal of Personality and Social Psychology, 54*, 316–322.
Brown, T. A., White, K. S., Forsyth, J. P., & Barlow, D. H. (2004). The structure of perceived emotional control: Psychometric properties of a revised Anxiety Control Questionnaire. *Behavior Therapy, 35*, 75–99.
Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: understanding AIC and BIC in model selection. *Sociological Methods & Research, 33*(2), 261–304.
Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.
Craske, M. G., Niles, A. N., Burklund, L. J., Wolitzky-Taylor, K. B., Vilardaga, J. P., Arch, J. J., et al. (2014). Randomized controlled trial of cognitive behavioral therapy and acceptance and commitment therapy for social phobia: Outcomes and moderators. *Journal of Consulting and Clinical Psychology, 82*, 1034–1048.
Davydov, D. M., Stewart, R., Ritchie, K., & Chaudieu, I. (2010). Resilience and mental health. *Clinical Psychology Review, 30*, 479–495.
Gallagher, M. W., Bentley, K. H., & Barlow, D. H. (2014). Perceived control and vulnerability to anxiety disorders: A meta-analytic review. *Cognitive Therapy and Research, 38*, 571–584.
Gregor, K. L., & Zvolensky, M. J. (2008). Anxiety sensitivity and perceived control over anxiety-related events: Evaluating the singular and interactive effects in the prediction of anxious and fearful responding to bodily sensations. *Behaviour Research and Therapy, 46*, 1017–1025.
Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics, 42*, 377–381.
Huppert, F. A. (2005). Positive mental health in individuals and populations. In F. A. Huppert, N. Baylis, & B. Keverne (Eds.). *The science of well-being* (pp. 307–340). New York, NY, US: Oxford University Press.
Kertz, S. J., Bigda-Peyton, J. S., Rosmarin, D. H., & Björgvinsson, T. (2012). The importance of worry across diagnostic presentations: Prevalence, severity, and associated symptoms in a partial hospital setting. *Journal of Anxiety Disorders, 26*,

126–133.
Kim, E. J. (2005). The effect of the decreased safety behaviors on anxiety and negative thoughts in social phobics. *Journal of Anxiety Disorders, 19*(1), 69–86.
Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*, 606–613.
Kroenke, K., Spitzer, R. L., Williams, J. B., Monahan, P. O., & Löwe, B. (2007). Anxiety disorders in primary care: Prevalence, impairment, comorbidity, and detection. *Annals of Internal Medicine, 146*, 317–325.
Lachman, M. E., & Weaver, S. L. (1998). The sense of control as a moderator of social class differences in health and well-being. *Journal of Personality and Social Psychology, 74*, 763–773.
Linehan, M. M. (1993). *Cognitive-behavioral treatment of borderline personality disorder.* New York, NY: Guilford Press.
Liu, Y., Zhu, J., & Wang, A. (2016). The effect of perceived control on depression and health-related quality of life in patients with stroke. *Chinese Journal of Practical Nursing, 32*(1), 26–28.
Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., ... Herzberg, P. Y. (2008). Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Medical Care, 46*, 266–274.
Martell, C. R., Dimidjian, S., & Herman-Dunn, R. (2010). *Behavioral activation for depression: A clinician's guide.* New York, NY: Guilford Press.
Meuret, A. E., Hofmann, S. G., & Rosenfield, D. (2010). Catastrophic appraisal and perceived control as moderators of treatment response in panic disorder. *International Journal of Cognitive Therapy, 3*, 262–277.
Moulding, R., & Kyrios, M. (2007). Desire for control, sense of control and obsessive-compulsive symptoms. *Cognitive Therapy and Research, 31*(6), 759–772.
Pereira, A. I., Muris, P., Roberto, M. S., Marques, T., Goes, R., & Barros, L. (2017). Examining the mechanisms of therapeutic change in a cognitive-behavioral intervention for anxious children: The role of interpretation bias, perceived control, and coping strategies. *Child Psychiatry & Human Development, 49*(1), 1–13.
Phillips, K. A. (2005). *The broken mirror: Understanding and treating body dysmorphic disorder.* Oxford: University Press.
Rachman, S., Craske, M., Tallman, K., & Solyom, C. (1986). Does escape behavior strengthen agoraphobic avoidance? A replication. *Behavior Therapy, 17*, 366–384.
Rapee, R. M., Craske, M. G., Brown, T. A., & Barlow, D. H. (1996). Measurement of perceived control over anxiety related events. *Behavior Therapy, 27*, 279–293.
Sanderson, W. C., Rapee, R. M., & Barlow, D. H. (1989). The influence of an illusion of control on panic attacks induced via inhalation of 5.5% carbon dioxide-enriched air. *Archives of General Psychiatry, 46*, 157–162.
Sassaroli, S., Centorame, F., Caselli, G., Favaretto, E., Fiore, F., Gallucci, M., et al. (2015). Anxiety control and metacognitive beliefs mediate the relationship between inflated responsibility and obsessive-compulsive symptoms. *Psychiatry Research, 228*, 560–564.
Seligman, M. E. P. (1975). *Helplessness: On depression, development, and death.* San Francisco: Freeman.
Sheehan, D. V., Lecrubier, Y., Sheehan, H. K., Amorim, P., Janavs, J., Weiller, E., et al. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry, 59*, 22–33.
Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*, 1092–1097.
Stapinski, L. A., Abbott, M. J., & Rapee, R. M. (2010). Evaluating the cognitive avoidance model of generalized anxiety disorder: Impact of worry on threat appraisal, perceived control and anxious arousal. *Behaviour Research and Therapy, 48*, 1032–1040.
Wardle, J., Steptoe, A., Guliš, G., Sartory, G., Sêk, H., Todorova, I., et al. (2004). Depression, perceived control, and life satisfaction in university students from Central-Eastern and Western Europe. *International Journal of Behavioral Medicine, 11*, 27–36.
Weems, C. F., Silverman, W. K., Rapee, R. M., & Pina, A. A. (2003). The role of control in childhood anxiety disorders. *Cognitive Therapy and Research, 27*, 557–568.
Wells, A., Clark, D. M., Salkovskis, P., Ludgate, J., Hackmann, A., & Gelder, M. (1995). Social phobia: The role of in-situation safety behaviors in maintaining anxiety and negative beliefs. *Behavior Therapy, 26*(1), 153–161.
White, K. S., Brown, T. A., Somers, T. J., & Barlow, D. H. (2006). Avoidance behavior in panic disorder: The moderating influence of perceived control. *Behaviour Research and Therapy, 44*, 147–157.
Weiner, B., & Litman-Adizes, T. (1980). An attributional, expectancy value analysis of learned helplessness and depression. In J. Garber, & M. E. P. Seligman (Eds.). *Human helplessness: Theory and applications* (pp. 35–58). New York: Academic Press.
Wortman, C. B., & Dintzer, L. (1979). Is an attributional analysis of the learned helplessness phenomenon viable? A critique of the Abramson-Seligman-Teasdale reformulation. *Journal of Abnormal Psychology, 87*, 75–90.