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Upregulating the Positive Affect System in Anxiety and Depression: Outcomes of a Positive Activity Intervention

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Abstract

Background: Research suggests that the positive affect system may be an important yet underexplored treatment target in anxiety and depression. Existing interventions primarily target the negative affect system, yielding modest effects on measures of positive emotions and associated outcomes (e.g., psychological well-being). The objective of the present pilot study was to evaluate the efficacy of a new transdiagnostic positive activity intervention (PAI) for anxiety and depression.

Method: Twenty-nine treatment-seeking individuals presenting with clinically impairing symptoms of anxiety and/or depression were randomly allocated to a 10-session protocol comprised of PAIs previously shown in non-clinical samples to improve positive thinking, emotions, and behaviors (e.g., gratitude, acts of kindness, optimism; n=16) or a waitlist condition (n=13). Participants were assessed at pre- and post-treatment, as well as 3- and 6-month follow-up, on measures of positive and negative affect, symptoms, and psychological well-being. ClinicalTrials.gov Identifier: NCT02330627

Results: The PAI group displayed significantly larger improvements in positive affect and psychological well-being from pre- to post-treatment compared to waitlist. Post-treatment and follow-up scores in the PAI group were comparable to general population norms. The PAI regimen also resulted in significantly larger reductions in negative affect, as well as anxiety and depression symptoms, compared to waitlist. Improvements across all outcomes were large in magnitude and maintained over a 6-month follow-up period.

Conclusions: Targeting the positive affect system through a multi-component PAI regimen may be beneficial for generating improvements in positive emotions and well-being, as well as reducing negative affect and symptoms, in individuals with clinically impairing anxiety or depression.

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Conflict of Interest: Charles T. Taylor declares that he has no conflicts of interest. Sonja Lyubomirsky declares that in the past 3 years she has been a paid lecturer for the Cleveland Clinic and Healthworld Ltd., as well as a paid consultant for Biogen Idec. Murray B. Stein declares that in the past 3 years he has been a paid consultant for Janssen, Pfizer, and Resilience Therapeutics, and receives payment for editorial work for *UpToDate* and the journal *Biological Psychiatry*.

All procedures performed involving human participants were in accordance with the ethical standards of the University of California San Diego Human Research Protection Program and with the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Keywords

Anxiety; depression; transdiagnostic; positive activities; positive intervention; positive affect; well-being; randomized controlled trial

Anxiety and depressive disorders are the most common mental health conditions[1] and represent a major public health concern worldwide[2, 3]. These conditions frequently co-occur[4], significantly impair functioning, and diminish quality of life and well-being[5, 6]. Recent efforts to integrate advances in neuroscience with clinical psychiatry suggest that anxiety and depression can be conceptualized along partially distinct biobehavioral dimensions of positive and negative affect domains7, 8 [Footnote 1]. The negative affect system regulates responses to cues that signal potential danger or loss, and is characterized by negative emotions (e.g., fear, sadness), cognitions (e.g., rumination), and inhibitory/avoidance behaviors. In contrast, the positive affect system guides people toward situations with reward potential, and is characterized by positive emotions (e.g., joy, excitement, happiness), cognitions (e.g., attentional bias for reward-relevant stimuli), and approach behaviors (e.g., curiosity, social initiation) that together facilitate the acquisition of psychosocial resources that promote overall health and well-being[9, 10]. Features of the negative affect system are centrally positioned within prevailing diagnostic classification systems[11] and conceptual models of anxiety and depression[12, 13], and thus serve as primary targets of existing psychosocial intervention approaches[14–18]. However, accumulating research suggests that the positive affect system may serve as an important yet underexplored target in facilitating recovery from anxiety and depression[9, 19–21].

Positive emotions serve a number of functions that both mitigate the adverse effects of negative emotions, the defining features of anxiety and depressive disorders, as well as garner positive outcomes that promote resilience and psychological well-being. For example, positive emotions down-regulate the physiological and psychological effects of negative emotions[22–25] – theorized to occur in part through counteracting the narrow, inflexible, and negatively biased patterns of cognition and behavior (e.g., avoidance) that perpetuate negative mood states[26–30] (see[9] for a review). The positive affect system also fosters approach-oriented behaviors, such as exploration and social initiation, that increase exposure to potentially rewarding outcomes,[31] thereby facilitating the acquisition of social, physical, and intellectual resources[9, 10, 32] that promote resilience during stress and overall well-being[33]. The unique link between positive emotions and subjective well-being above and beyond negative affect and psychopathology symptoms[34, 35] suggests that interventions targeting the positive emotion system may fill a particularly important gap left by extant treatments.

Evidence across multiple units of analysis reveals that depression[19], and some forms of anxiety (e.g., social anxiety[36, 37]; posttraumatic stress disorder[38]) are associated with aberrant functioning of the positive emotion system, including low positive affect[39–41], diminished approach motivation and behavior[42–46], biased processing of reward-related

[1]Although we refer to positive and negative affect systems throughout the paper for consistency, we are speaking to the broader empirical literature on bivariate theories of human motivation and behavior[7, 31, 74, 112–116]

cues[47–50] and reduced behavioral[51] and neural reactivity to rewards[52–55] (for reviews see[8, 56]). Existing interventions for anxiety and depression emphasize negative affect reduction as the central treatment goal. Given that positive and negative affect arise from partially distinct biobehavioral systems[57, 58], decreases in negative affect and symptoms may not result in concomitant increases in positive affect and related outcomes. Consistent with this proposal, prevailing intervention approaches for anxiety and depression display modest effects on the positive affect system and associated outcomes (e.g., psychological well-being)[6, 59–62], and in some cases, have failed to show evidence of changes following treatment, despite significant reductions in anxiety and depression[63]. For example, a large randomized controlled trial comparing cognitive therapy, pharmacotherapy, and their combination for depression revealed that participants displayed post-treatment levels of positive affect that were significantly below community norms, despite returning to normative levels of negative affect[64]. Thus, the limited evidence that exists suggests that current intervention approaches for anxiety and depression may not be sufficiently targeting the biobehavioral processes that are important for building positive emotions and well-being.

The central aim of the current pilot study was to test the efficacy of a psychosocial treatment protocol designed to upregulate the positive affect system in a sample of individuals seeking treatment for anxiety or depression. The intervention is grounded in research demonstrating that people can increase their levels of positive thinking, emotions, and behavior through engaging in simple, intentional, and repeated activities[65, 66], for example, performing acts of kindness, expressing gratitude, and practicing optimism (see Table 1). Studies supporting the efficacy of positive activity interventions (PAIs) have been primarily conducted in unselected (non-clinical) community samples and examined single positive activities in isolation (for a meta-analysis, see[66, 67]). Although some evidence suggests that integrated, multi-session PAIs may be beneficial for individuals with mild-to-moderate depression[68] or other health-related conditions (e.g., cardiovascular disease[69], suicide[70], and HIV[71]), to our knowledge, no studies have examined PAIs in psychiatric treatment-seeking samples. That was the central goal of the current study.

Method

Participants

The sample comprised *N*=29 individuals seeking treatment for anxiety and/or depression. Participants were recruited through clinical referrals as well as posted announcements in community and online settings (e.g., ResearchMatch.org). Participants were required to be between the ages of 18 to 55 and present with clinically elevated symptoms of anxiety or depression, defined by a score of 8 or higher on the Overall Anxiety Severity and Impairment Scale (OASIS[72]) or a score of 10 or higher on the Patient Health Questionnaire-9 (PHQ-9[73]), respectively. Exclusion criteria were used to ensure that participants could safely complete the procedures and to minimize confounding interpretation of our findings[Footnote 2]: (1) pharmacological treatments that could affect brain functioning (e.g., anxiolytics, antidepressants; past 6 weeks); (2) concurrent

[2]Participants completed a functional magnetic resonance imaging (fMRI) scan at pre- and post-assessment (data presented elsewhere). Hence, several of the exclusion criteria were implemented to ensure MRI safety and minimize confounding of the imaging findings.

psychotherapy, or empirically supported treatments for anxiety or depression (e.g., cognitive behavioral therapy; past 6 weeks); (3) current active suicidal ideation; (4) history of major neurological disorder or moderate to severe traumatic brain injury; (5) moderate alcohol or marijuana use disorder (past year); mild substance use disorder (all other drugs; past year); (6) bipolar I or psychotic disorders; and (7) characteristics that compromise MRI safety (e.g., metal in body).

Diagnostic assessment was based on a structured diagnostic interview for DSM-5, Mini International Neuropsychiatric Interview (MINI Version 7.0.0.0). Participant enrollment statistics and progress through the study are summarized in Figure 1. Participants were enrolled in the study between June 2014 and March 2015. Of the 29 participants who were randomized to the PAI (n=16) or waitlist group (n=13), one participant in the PAI group discontinued treatment following session 7, reportedly due to increased commitments at work, and one participant in the waitlist condition initiated treatment following the pre-assessment and was excluded from the analyses[Footnote 3]. Thus, 28 participants (n=16 in the PAI group and n=12 in the waitlist group) were included in the intent-to-treat analysis. The demographic and clinical composition reflected a diverse, community-based treatment-seeking sample (see Table 2).

Measures

Participants completed a battery of reliable and valid self-report measures at pre-, post-, and follow-up assessment points (3 and 6 months following the post-assessment).

Positive and Negative Emotions.—Participants completed the 20-item Positive and Negative Affect Schedule - Trait (PANAS)[74] to assess activated forms of positive and negative affect; and the 20-item Modified Differential Emotions Scale (mDES)[24] to assess a broader array of discrete positive (e.g., joy, love, awe) and negative emotions (e.g., guilt, anger, fear). Participants responded according to how they felt *during the past week*.

Psychological Well-Being.—Participants completed the Quality of Life, Enjoyment, and Satisfaction Questionnaire – Short Form (Q-LES-Q-SF)[75] to measure perceived overall enjoyment and satisfaction across numerous life domains (e.g., work, health, relationships)[76]; and the Satisfaction With Life Scale (SWLS)[77], a well-established measure of global judgments of satisfaction with one's life[78, 79].

Symptoms.—Anxiety symptoms were assessed using the Overall Anxiety Severity and Impairment Scale (OASIS[72, 80]), a 5-item scale that measures the frequency and severity of anxiety symptoms, as well as level of avoidance, work/school/home interference, and social interference associated with anxiety during the past 2 weeks; and the State Trait Anxiety Inventory-Trait (STAI-T[81]), a well-established measure of general anxiety. Depressed mood

[3]We conducted a sensitivity analysis in which the participant who initiated treatment during the waitlist period was included. Results of the ANCOVAs conducted on the main outcome composite indices revealed a nearly identical pattern of findings to those reported in the main text: The PAI group significantly differed from the WL group on all outcomes (all ps < .05); the only exception being that the treatment group effect on the positive emotion composite was marginally significant (p = .065). The between-group effect sizes (Cohen's d) on the post-treatment covariance adjusted scores ranged from 0.72 to 1.28, which is comparable to those reported in Table 4.

during the past 2 weeks was assessed using the Patient Health Questionnaire-9 (PHQ-9[73, 82]) and the Beck Depression Inventory-II (BDI-II[83, 84]).

Treatment Credibility/Expectancy.—Following presentation of the treatment rationale, participants in the PAI group completed the Credibility and Expectancy Questionnaire[85], which asks about the logic of the intervention and its perceived likelihood of helping the participant and other people with anxiety or depression.

Procedure

Potential participants were given information about the study and provided informed written consent prior to completing the screening procedures, which comprised a MINI diagnostic interview and self-report assessments of anxiety and depression symptoms. Participants who met inclusion criteria and agreed to participate in the study were invited to complete a baseline evaluation session comprising self-report and behavioral assessments followed by a separate functional magnetic resonance imaging (fMRI) session, results of which will be reported separately. Following the MRI session, participants were randomly assigned to either the PAI group—that is, immediate treatment, or waitlist. Condition assignment was determined using a random number generator and revealed at the conclusion of the MRI session. Participants assigned to the PAI group completed 10 one-hour weekly sessions of the PAI protocol described below. Following the final treatment session (or approximately 10 weeks after the baseline MRI scan for the waitlist group), participants completed post-assessment sessions, which were identical to the pre-assessments. To establish the duration of treatment effects, participants in the PAI group completed self-report assessments 3- and 6-months following the post-assessment session. Waitlist participants were offered the PAI protocol following the post-assessment; however, their treatment data were not included in the analyses. Participants received monetary compensation for their participation in the assessment sessions. The procedures were approved by the University's Human Research Protections Program. ClinicalTrials.gov Identifier: NCT02330627

Treatment

Positive Activity Intervention (PAI).—The PAI comprised 10 one-hour sessions of individual therapist-delivered treatment (plus a 30-minute introductory module at the start of the first session to acquaint the therapist and patient, including a brief review of symptoms, past treatment experiences, and participant expectations and goals for treatment). A 71-page manual[86] that described the regimen in detail was developed based on prior literature on PAIs[21, 69–71, 87, 88] and emotion science findings regarding the function of positive thoughts, emotions, and behaviors[9, 20, 89–91]. Handouts accompanied each module, which included instructions for completing a given activity and text-fillable fields to allow participants to plan the activity and set goals, generate responses to the activity, and monitor their progress and observations.

Treatment began with education about the function of positive and negative emotions, and how anxiety and depression can disrupt positive experiences[20]. Emphasis was placed on generating upward spirals of positive thinking, emotions, and behaviors as a means to overcoming anxiety and depression. The core treatment exercises included specific PAIs

designed to increase positive thinking, emotions, and/or behavior. See Table 1 for details. The final module involved developing a personalized positivity activity plan wherein participants prepared for continued engagement in activities, building on gains made in treatment, and identifying strategies to minimize relapse. The structure of each session followed traditional behavioral treatment regimens—namely, review completion of the prior week's exercises, including self-monitoring of emotions and exercise completion; troubleshoot issues that arose during exercise completion; introduce material about a new PAI; and identify exercises to implement for the upcoming week.

Waitlist (WL).—Waitlist participants completed the pre- and post-assessments at a 10-week interval. Treatment was offered to these individuals after the post-assessment.

Therapists.—Therapists were one doctoral-level and one master's level clinician, each with over 10 years of experience treating individuals with anxiety or depression. Both therapists contributed to the development of the treatment protocol. Therapists met weekly to review ongoing cases to ensure that treatment material outlined in the manual was being appropriately covered and to discuss issues that arose in treatment. Treatment adherence was closely monitored during weekly supervision; however, it was not formally evaluated.

Statistical Analyses

Our primary outcome was positive emotions (composite of PANAS-PA and mDES-Positive Emotion scores). Secondary outcomes were: (1) negative emotions (composite of PANAS-NA and mDES-Negative Emotion scores); (2) psychological well-being (composite of Q-LES-Q-SF and SWLS scores); (3) anxiety (composite of OASIS and STAI-T scores); and (4) depression (composite of PHQ-9 and BDI-II scores). Analyses were conducted on an intent-to-treat (ITT) basis (PAI, n=16; WL, n=12). For the one participant who discontinued treatment following session 7, we used measures completed a mid-treatment (i.e., the last available assessment point) for post-treatment data[Footnote 4].

Analysis of covariance (ANCOVA) was used to test group differences at post-treatment controlling for participants' pre-treatment scores for the measure of interest[92, 93]. We tested and confirmed that all assumptions underlying ANCOVA were met (e.g., independence of the covariate [pre-treatment scores] and treatment group; homogeneity of regression slopes such that the covariate and treatment group do not interact in predicting the outcome). Following prior studies[94–96], conceptually related measures were combined using Rosenthal and Rosnow's[97] procedure to create a composite index for each outcome domain. This approach arguably creates a more robust outcome index, and constrains type I error rate inflation. Participants' scores on each scale were first standardized (M = 0, SD = 1) across assessment sessions by converting to Z scores. The composite index at each assessment point was the mean of the Z scores for that occasion. The magnitude of treatment response was established by calculating (a) within-group effect sizes = ([post-assessment mean minus

[4]We conducted a sensitivity analysis in which the participant who discontinued treatment prematurely was removed from the analysis. Results of the ANCOVAs conducted on the main outcome composite indices revealed the same pattern of findings to those reported in the main text: The PAI group significantly differed from the WL group on all outcomes (all ps < .05), and the between-group effect sizes (Cohen's d) on the post-treatment covariance adjusted scores were similar to those reported in Table 4 (range = 0.95 to 1.53).

pre-assessment mean]/[pre-assessment standard deviation + post-treatment standard deviation]/2) (referred to as Cohen's d_{av}; see[98]); and (b) between-group controlled effect sizes = (post-assessment PAI covariance adjusted mean minus post-assessment WL covariance adjusted mean)/pooled standard deviation. All analyses were conducted using SPSS version 18.0.

Results

Preliminary Analyses

Table 2 presents descriptive data for demographic and clinical characteristics for each group at baseline. Groups did not differ on gender, age, years of education, race, ethnicity, or past psychotropic medication use (all *p*s > .10). However, participants in the PAI group were significantly more likely to have reported prior psychosocial treatment use compared to participants in the waitlist group, Fisher's exact test significant = .044[Footnote 5]. Credibility and Expectancy Questionnaire ratings obtained from participants in the PAI group following the first treatment session revealed high treatment rationale credibility (*M* = 7.6, *SD* = .96) and expectancy (*M* = 6.8, *SD* = 2.0; range of possible scores = 1–9).

Main Treatment Effects

Table 3 presents the means, standard deviations, and results of the ANCOVAs for the main outcomes. Results of the ANCOVA for our primary outcome revealed that individuals in the PAI group demonstrated significantly greater positive emotions at post-treatment compared to participants in the WL group[Footnote 6]. ANCOVA results for our secondary outcomes revealed that the PAI group reported experiencing significantly fewer negative emotions and symptoms of anxiety and depression, as well as significantly greater psychological well-being, at post-treatment relative to participants in the WL group. The magnitude of both within- and between-group treatment effects was large for the PAI group. See Table 4.

Maintenance of Treatment Gains

Table 5 presents the means, standard deviations, and results of the repeated measures ANOVAs (Time: pre, post, 3- and 6-month follow-up) conducted on the main outcomes in the PAI group[Footnote 7]. All treatment completers (*n*=15) finished at least one follow-up assessment [*n*=14 at 3- and 6-month follow-up sessions]. Missing data at a given follow-up assessment point were substituted using data from a participant's last available assessment point (i.e., last observation carried forward). Results of the repeated measures ANOVAs conducted on the composite outcome indices all revealed significant main effects of Time.

[5]We conducted a sensitivity analysis for the main outcome variables in which history of prior psychosocial treatment was included as a covariate. Results revealed that psychosocial treatment history did not account for group differences observed across the main outcome indices.

[6]We also examined post-treatment (covariance adjusted) between-group effect size estimates of specific positive emotion items on the mDES to determine whether, for example, low activation positive emotions were more affected by the intervention. For 9 of 10 positive emotion items, results revealed medium to large between-group effects (Cohen's *d* range = 0.54 to 1.02), with lower activation positive emotion items showing large effects comparable to the full mDES positive emotion index (i.e., serene/content/peaceful, *d* = 0.82; grateful/appreciative/thankful, *d* = 0.79). The only exception to this pattern of findings was the item, amused/fun-loving/silly, which yielded a small between-group effect (*d* = 0.17).

[7]Given that the waitlist group did not complete follow-up assessments, composite scores used for the follow-up analyses were computed in the PAI group only across the four assessment sessions. Thus, mean composite index values differed for the PAI group for the between-group comparisons versus the follow-up analysis.

Follow-up contrasts using the Sidák adjustment for multiple comparisons indicated that the PAI group displayed significant changes on all outcome measures from pre- to post-assessment (all *p*s < .05), and from pre-assessment to each of the follow-up assessment points (all *p*s < .05). Post-treatment and follow-up scores did not significantly differ (all *p*s > .05), which indicated that initial gains were maintained up to 6-months following the end of treatment.

Discussion

The positive affect system is increasingly recognized as a potentially valuable treatment target for psychiatric conditions traditionally defined by heightened negative emotions, including anxiety and depression[19–21]. We developed a multi-component protocol comprised of positive activity interventions (PAIs) designed to upregulate the positive emotion system, and took the first step in evaluating the efficacy of this regimen in individuals seeking treatment for anxiety or depression. The high treatment credibility and expectancy ratings as well as high completion rate suggests that the treatment regimen was well-received by the current sample, many of whom had received prior psychosocial and/or pharmacological treatment. The PAI protocol resulted in significantly greater increases in positive emotions and psychological well-being compared to a no intervention control group. Interestingly, targeting the positive affect system generalized to negative affect-related outcomes, including reductions in negative emotions, anxiety, and depression. Treatment effects were large in magnitude and persisted up to 6-months following termination of acute treatment. Thus, the current preliminary findings underscore the potential value of directly targeting the positive affect system in treatment[19–21], and add to a nascent empirical literature[99, 100] suggesting that PAIs may be beneficial for individuals with clinically impairing symptoms of anxiety or depression.

The current sample was characterized by low levels of positive affect, and participants were, on average, dissatisfied with their lives upon entering treatment, scoring more than one standard deviation below normative general population means on both outcomes[101, 102103]. Following treatment, and persisting through the follow-up period, the PAI group scored near community normative means, suggesting that the PAI protocol restored positive emotional functioning to normative levels. Those findings are notable when considering that existing empirically supported interventions that primarily target the negative affect system display only modest effects in increasing positive emotions and well-being, even when resulting in significant and sometimes large reductions in negative affect[63, 64]. Not all participants in the current study, however, achieved average or higher levels of life satisfaction following treatment, suggesting that additional PAI sessions or alternative treatment may be needed for some people. Nevertheless, in light of existing treatment outcome data, the current findings are promising and suggest that the PAI regimen is worthy of further empirical scrutiny.

Negative affect and symptoms of depression and anxiety were not direct treatment targets. However, the PAI protocol resulted in large reductions in negative affect and symptoms, changes that were comparable to those observed with prevailing empirically established interventions[14, 15]. Those findings are consistent with prior studies demonstrating that positive emotions downregulate the adverse effects of negative emotions[22, 23], thinking (e.g.,

rumination[30]), and help people cope during times of stress[24]. It should be noted, however, that we administered broad measures of anxiety and depression, rather than assessing disorder-specific symptoms (e.g., panic, worry), and we did not conduct diagnostic assessments following treatment. Future research is needed to evaluate the effect of the PAI regimen on specific psychiatric conditions and symptom clusters, as well as to examine whether differential treatment response exists across disorders.

The current findings have clinical implications for emerging dimensional classification systems wherein the positive affect system is hypothesized to play a role across various forms of psychopathology, including anxiety and depression[7, 8]. Consistent with these conceptual models, our goal was to develop a transdiagnostic protocol that could readily be applied to a range of psychiatric conditions, including subsyndromal cases that fail to meet diagnostic thresholds but may nevertheless experience marked functional impairment. Although the background material of the current intervention was tailored to anxiety and depression, the activities themselves were agnostic about psychopathology or specific symptom domains. Thus, the PAI protocol could, with slight modifications, be applied to other forms of psychopathology characterized by heightened negative affect and/or blunted positive affect. Moreover, as noted elsewhere[104–106], transdiagnostic protocols have several advantages, including parsimony, reduced time and effort to train providers, and facilitating clinicians' ability to treat comorbid clinical presentations typically seen in community practice.

The current findings should be interpreted in the context of several caveats. First, the efficacy of the PAI protocol was evaluated in a small treatment-seeking sample in comparison to an assessment only condition. Small sample sizes are prone to sampling biases such that the chosen sample may not be representative of the target population, and may produce outcomes that over- or underestimate the true treatment effect. Future studies are needed in larger samples using more rigorous comparison groups to account for common therapeutic effects (e.g., therapist attention, patient expectations of improvement), as well as to evaluate potentially unique mechanisms of change (e.g., positive emotions) compared to established interventions. Second, although therapists followed a structured manual and were monitored closely during weekly supervision, treatment fidelity and adherence were not formally assessed. Third, treatment outcomes relied on participant report. Although several of the central outcomes were, by definition, subjective in nature (e.g., well-being), future research is needed using clinician-administered and other objective (e.g., behavioral) measures. Moreover, indices of clinically significant change[107] would provide a more standardized benchmark for establishing reliable individual participant treatment response. Research is needed to establish test-retest reliability estimates of the primary (positive emotion) outcome measures in the target population and over a timeframe comparable to the pre-post interval used in the current (and many other treatment outcome) studies. Fourth, outcomes were only examined at pre- and post-treatment, and during follow-up. Future studies should include multiple repeated assessments of the outcome variables throughout treatment and use longitudinal statistical models (e.g., multilevel modeling), which are the preferred statistical approach for clinical trials. Such models honor the ITT principle and are favored over other methods used to handle attrition (e.g., last observation carried forward)

that may over- or underestimate treatment effects. Larger sample sizes (cf. the current study) are needed to appropriately conduct multilevel modeling using longitudinal data[108].

It is notable that the waitlist group displayed medium-sized changes on the positive and negative emotion outcome measures, but minimal changes on symptoms and well-being. Those outcomes may reflect ordinary fluctuations in emotions (cf. symptoms or well-being), natural improvement in treatment-seeking individuals (e.g., treatment expectancy effects[109]), or sampling bias. Evaluating the PAI protocol in larger samples compared against active control conditions would help resolve these issues. Finally, concerns have been raised that PAIs may have adverse effects in some clinical disorders (e.g., depression) because focusing on positivity may invalidate one's suffering and distress (the Pollyanna problem[19]). Although we did not formally assess participant reactions to the individual positive activities, there was no evidence that participants deteriorated as a result of the intervention as a whole. The introductory psychoeducation session clarified that the aim of the intervention was *not* to feel positive emotions all of the time, nor to deny the existence of negative emotions or life experiences. Moreover, participants had freedom in choosing the activities that they ultimately incorporated into their daily lives. Nevertheless, the issue of person-activity fit[87, 110] and treatment personalization[111] is an important one in need of future study.

Conclusions

The benefits of positive emotions[9, 10] and their potential clinical utility for psychopathology[19–21] are increasingly well-documented. Results of the current pilot study provided initial support for the efficacy of a multi-component treatment protocol comprised of PAIs in increasing positive emotions and psychological well-being, as well as decreasing negative affect, anxiety, and depression in a treatment-seeking sample. Those findings support the potential value of explicitly targeting the positive emotion system in disorders classically defined and conceptualized according to heightened negative emotions. Future research in larger samples using more rigorous control conditions and moving beyond self-report measures is now needed.

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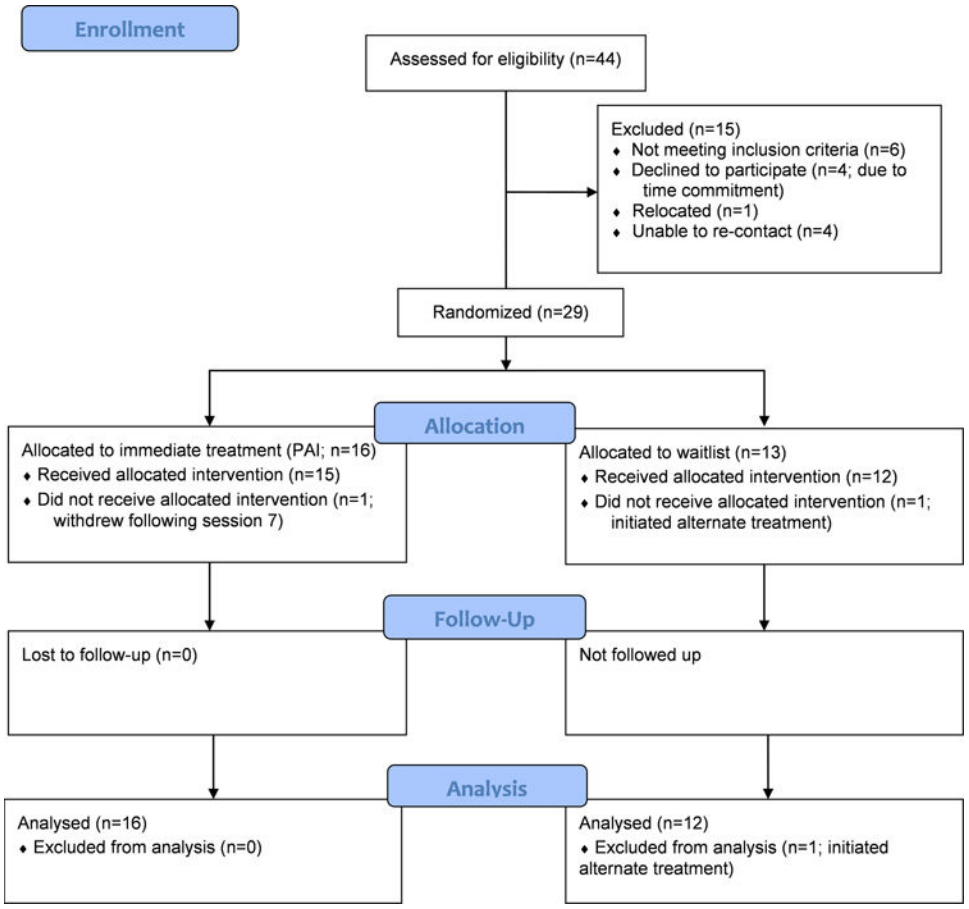

Figure 1.
CONSORT flow diagram illustrating participants' progress throughout the study.

Table 1

Positive Activity Intervention Protocol.

Module	Goal	Description
Psychoeducation Session 1	Present treatment rationale; self-monitoring of emotions.	Present model of emotions (downward spiral of negative emotions; upward spiral of positive emotions). Discuss the nature and function of positive emotions, and how anxiety and depression can disrupt positive experiences.
Noticing & Amplifying Positive Events Session 1, Exercise 1a Session 2, Exercise 1b	Train attention towards and increase awareness of positive events; intensify and prolong positive emotional experiences.	Participants monitor and note positive events throughout the week, and implement strategies to intensify and prolong positive emotions (e.g., savoring, reminiscing, writing about positive events, sharing positive events with others)[117, 118].
Gratitude: Counting One's Blessings Session 2; Exercise 2a Session 3; Exercise 2b	Direct attention to positive events.	Participants write about up to five things for which they are grateful, including events from the past week, or things in their life more generally[99, 119, 120].
Acts of Kindness Session 3; Exercise 3a Session 4; Exercise 3b	Increase prosocial behaviors.	Participants perform up to five kind acts for others within a single day[100, 121, 122].
Pleasurable, engaging, and meaningful activities Session 4; Exercise 4a Session 5; Exercise 4b	Increase participation in rewarding activities, both hedonic and eudaimonic.	Participants complete at least one pleasurable activity alone, one pleasurable activity with others, one highly engaging activity, and one meaningful or important activity[123, 124].
Strengths Session 5; Exercise 5a Session 5; Exercise 5b	Increase awareness of personal strengths and opportunities to use those strengths.	Participants identify opportunities to use at least one strength each day, and monitor the outcome[99].
Affirming Values Session 5; Exercise 5c	Strengthen commitment to personal values.	Participants identify a personal value (i.e., something that makes their life precious and worthwhile) and write about why that value is important to them, and how they use that value in their everyday life[125].
Optimism: Best Possible Future Session 6; Exercise 6a Session 7; Exercise 6b	Promote future-oriented positive cognitions and behaviors.	Participants imagine one's best possible future in chosen domain (e.g., school/career, social relationships, health), and consider how to actualize this future[126–128].
Make Someone Else Happier Session 7; Exercise 7a Session 8; Exercise 7b	Increase investment in relationships; increase prosocial behaviors and connection with others.	Participants invest time and effort throughout the week into making someone else happier[129, 130].
Live this Month Like It's Your Last in this Area Session 8; Exercise 8a Session9; Exercise 8b	Promote increased engagement in positive activities; increase anticipation, appreciation, and sustained responsiveness to positive events.	Participants consider what they like most about their current surroundings (e.g., special people, places, activities) and take part in activities as though they will be moving far away within the next month. Participants amplify those experiences through savoring and appreciation[131].
Gratitude: Gratitude Letter Session 9; Exercise 9a	Direct attention to another person's role in positive events; strengthen social connections.	Participants recall another person's kindness and write a letter that describes their gratitude (the letter can be sent if desired)[99, 126, 128].
Develop Personalized Positive Activity Plan Session 9; Exercise 9b	Maximize person-activity fit and continued engagement in activities; translate activities into habits.	Participants develop a positive activity plan by selecting activities that are the best fit (e.g., enjoyable, beneficial), and personalizing activities for continued improvement and lasting changes[110].

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Module	Goal	Description
Termination Plan Session 10; Exercise 10	Consolidate learning; develop plan to maintain/enhance gains.	Review material and exercises; identify lessons learned and most beneficial exercises; develop plan for continued commitment to engage in these activities.

Table 2

Patient Demographic and Clinical Characteristics

Variable	PAI (*n*=16)	WL (*n*=12)
Gender (% female)	50%	75%
Age	29.8 (12.2)	29.0 (12.0)
Years of Education	16.8 (2.7)	15.3 (2.9)
Race (%)		
Caucasian	75%	67%
Asian American	19%	25%
Native American	6%	0%
Pacific Islander	0%	8%
Hispanic (%)	19%	25%
Diagnoses (%)		
Major Depressive Disorder	56%	56%
Social Anxiety Disorder	56%	58%
Generalized Anxiety Disorder	31%	50%
Posttraumatic Stress Disorder	13%	33%
Panic Disorder	0%	17%
Obsessive Compulsive Disorder	0%	8%
Eating Disorder	0%	25%
Mild Alcohol Use Disorder	6%	8%
Mild Marijuana Use Disorder	0%	8%
Past Psychotropic Mediation Use (%)	38%	50%
Past Psychosocial Treatment (%)	88%	50%

Note. Standard deviations in parentheses. Percentages sum to > 100% given high comorbidity across the sample.

Table 3

Descriptive summaries of the treatment outcome measures for the PAI (n=16) and waitlist (n=12) groups.

	Pre-assessment *M* (*SD*)		Post-assessment *M* (*SD*)		Results[a] (Group)		
Measure	**PAI**	**WL**	**PAI**	**WL**	***F***	***p***	η^2_p
Positive Emotions Composite	−0.41 (.96)	−0.40 (.54)	0.73 (.87)	−0.02 (.79)	6.89	.015	.22
PANAS-PA	23.50 (8.43)	24.25 (5.79)	32.63 (7.36)	27.42 (6.87)			
mDES-Positive emotions	15.56 (8.04)	15.08 (3.20)	24.31 (7.73)	17.75 (6.41)			
Negative Emotions Composite	0.17 (.62)	0.70 (.89)	−0.91 (.40)	0.29 (1.11)	10.68	.003	.30
PANAS-NA	25.25 (7.04)	30.17 (9.43)	15.13 (3.56)	26.00 (9.53)			
mDES-Negative emotions	18.81 (6.83)	23.83 (7.85)	8.56 (4.59)	20.25 (12.02)			
Psychological Well-Being Composite	−0.25 (.77)	−0.34 (.81)	0.76 (.81)	−0.35 (.87)	16.91	.000	.40
SWLS	14.75 (6.94)	14.25 (6.41)	22.69 (6.83)	13.67 (6.68)			
QLES-Q	38.06 (7.46)	36.92 (9.22)	47.75 (9.75)	37.50 (9.65)			
Anxiety Symptoms Composite	0.14 (.54)	0.40 (.62)	−0.61 (.68)	0.23 (.91)	5.97	.022	.19
OASIS	10.89 (3.05)	10.33 (4.36)	5.25 (3.00)	8.92 (4.83)			
STAI-Trait	45.00 (7.25)	49.33 (2.67)	43.27 (7.47)	49.25 (6.34)			
Depression Symptoms Composite	0.29 (.90)	0.47 (.77)	−0.87 (.55)	0.29 (.97)	16.01	.000	.39
BDI-II	24.19 (11.73)	27.33 (9.59)	7.73 (5.79)	24.58 (14.38)			
PHQ-9	12.19 (5.84)	12.92 (5.09)	5.81 (4.04)	12.08 (5.25)			

Note. PAI = Positive Activity Intervention; WL = Waitlist; PANAS = Positive and Negative Affect Schedule; PA = positive affect; NA = negative affect; mDES = Modified Differential Emotions Scale; SWLS = Satisfaction with Life Scale; Q-LES-Q = Quality of Life Enjoyment and Satisfaction Questionnaire; OASIS = Overall Anxiety and Severity and Impairment Scale; STAI = Spielberger State-Trait Anxiety Inventory (STAI); BDI-II = Beck Depression Inventory II; PHQ-9 = Patient Health Questionnaire.

[a]Analysis of covariance (ANCOVA) results comparing the PAI and WL groups at post-assessment controlling for pre-assessment dependent outcomes.

Table 4

Effect sizes for pre- to post-treatment change in the PAI and waitlist groups.

	Effect Size		
	Within-group[a]		Between-groups[b]
Measure	PAI	WL	
Positive Emotions Composite	1.25	0.57	1.00
PANAS-PA	1.16	0.50	0.87
mDES-Positive emotions	1.11	0.56	0.90
Negative Emotions Composite	−2.12	−0.41	−1.28
PANAS-NA	−1.91	−0.44	−1.43
mDES-Negative emotions	−1.80	−0.36	−1.12
Psychological Well-Being Composite	1.28	−0.01	1.57
SWLS	1.15	−0.09	1.73
QLES-Q	1.13	0.06	1.13
Anxiety Composite	−1.23	−0.22	−0.94
OASIS	−1.86	−0.31	−1.01
STAI-Trait	−0.24	−0.02	−0.48
Depression Composite	−1.60	−0.21	−1.54
BDI-II	−1.88	−0.23	−1.53
PHQ-9	−1.29	−0.16	−1.40

Note. PAI = Positive Activity Intervention; WL = Waitlist; PANAS = Positive and Negative Affect Schedule; PA = positive affect; NA = negative affect; mDES = Modified Differential Emotions Scale; SWLS = Satisfaction with Life Scale; Q-LES-Q = Quality of Life Enjoyment and Satisfaction Questionnaire; OASIS = Overall Anxiety and Severity and Impairment Scale; STAI = Spielberger State-Trait Anxiety Inventory (STAI); BDI-II = Beck Depression Inventory II; PHQ-9 = Patient Health Questionnaire.

[a]Within-group pre- to post-treatment effect sizes = ([post-treatment mean – pre-treatment mean]/[pre-treatment standard deviation + post-treatment standard deviation]/2).

[b]Between-group controlled effect sizes = (post-assessment PAI group covariance adjusted mean – post-assessment waitlist group covariance adjusted mean)/pooled standard deviation.

Table 5

Descriptive summaries of the treatment outcome measures at pre, post, and follow-up assessments for the PAI group (n=15).

Measure	Pre-assessment *M* (*SD*)	Post-assessment *M* (*SD*)	3-month follow-up *M* (*SD*)	6-month follow-up *M* (*SD*)	Results[a] (Time)		
					F	*p*	η^2_p
Positive Emotions Composite	−0.79 (.91)	0.26 (.82)	0.31 (.73)	0.21 (.85)	14.58	.000	.51
PANAS-PA	23.50 (8.43)	32.63 (7.36)	35.19 (6.22)	33.06 (7.11)			
mDES-Positive emotions	15.56 (8.04)	24.31 (7.73)	22.94 (7.40)	23.50 (8.07)			
Negative Emotions Composite	1.05 (.86)	−0.54 (.61)	−0.28 (.50)	−0.23 (.80)	19.10	.000	.58
PANAS-NA	25.25 (7.04)	15.13 (3.56)	17.19 (2.99)	17.50 (5.67)			
mDES-Negative emotions	18.81 (6.83)	8.56 (4.59)	9.19 (3.49)	9.44 (4.19)			
Psychological Well-Being Composite	−0.77 (.79)	0.22 (.84)	0.26 (.75)	0.28 (.86)	23.28	.000	.62
SWLS	14.75 (6.94)	22.69 (6.83)	22.94 (7.62)	23.06 (7.30)			
QLES-Q	38.06 (7.46)	47.75 (9.75)	48.06 (6.21)	48.25 (9.55)			
Anxiety Symptoms Composite	0.51 (.56)	−0.27 (.69)	−0.14 (.66)	−0.11 (.57)	9.21	.009	.40
OASIS	10.89 (3.05)	5.25 (3.00)	5.19 (4.10)	5.25 (4.20)			
STAI-Trait	45.00 (7.25)	43.27 (7.47)	44.75 (5.50)	45.00 (5.02)			
Depression Symptoms Composite	0.99 (1.04)	−0.33 (.64)	−0.32 (.59)	−0.33 (.78)	18.29	.000	.57
BDI-II	24.19 (11.73)	7.73 (5.79)	9.00 (6.63)	8.44 (8.79)			
PHQ-9	12.19 (5.84)	5.81 (4.04)	4.88 (3.52)	5.06 (4.11)			

Note. PAI = Positive Activity Intervention; WL = Waitlist; PANAS = Positive and Negative Affect Schedule; PA = positive affect; NA = negative affect; mDES = Modified Differential Emotions Scale; SWLS = Satisfaction with Life Scale; Q-LES-Q = Quality of Life Enjoyment and Satisfaction Questionnaire; OASIS = Overall Anxiety and Severity and Impairment Scale; STAI = Spielberger State-Trait Anxiety Inventory (STAI); BDI-II = Beck Depression Inventory II; PHQ-9 = Patient Health Questionnaire.

[a]Repeated measures analysis of variance (ANOVA) results for Time (pre-, post-, 3-month, 6-month follow-up) in the PAI group.