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Effects of an immersive psychosocial training program on depression and well-being: A randomized clinical trial

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Abstract

Psychiatry stands to benefit from brief non-pharmacological treatments that effectively reduce depressive symptoms. To address this need, we conducted a single-blind randomized clinical trial assessing how a 6-day immersive psychosocial training program, followed by 10-min daily psychosocial exercises for 30 days, improves depressive symptoms. Forty-five adults were block-randomized by depression score to two arms: (a) the immersive psychosocial training program and 10-min daily exercise group (36 days total; total $n = 23$; depressed at baseline $n = 14$); or (b) a gratitude journaling control group (36 days total; total $n = 22$; depressed at baseline $n = 13$). The self-report PHQ-9 was used to assess depression levels in both groups at three time points: baseline, study week one, and study week six. Depression severity improved over time, with a significantly greater reduction in the psychosocial training program group (-82.7%) vs. the control group (-23%), $p = 0.02$ for baseline vs. week six. The effect size for this reduction in depression symptoms was large for the intervention group ($d = -1.3$; 95% CI, $-2.07, -0.45$; $p < 0.001$) and small for the control group ($d = -0.3$; 95% CI, $-0.68, 0.03$; $p = 0.22$). Seventy-nine percent (11/14) of depressed participants in the intervention condition were in remission (PHQ-9 ≤ 4) by week one and 100% (14/14) were in remission at week six. Secondary measures of anxiety, stress, loneliness, and well-being also improved by 15–80% in the intervention group (vs. 0–34% in the control group), p s < 0.05 . Overall, this brief, immersive psychosocial training program rapidly and substantially improved depression levels and several related secondary outcomes, suggesting

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Data and code availability

De-identified responses to the measures administered and code files used for data analysis are publicly available at the following link: <https://www.dropbox.com/sh/6e5xtovr8i9f921/AABqxqVveK61FTxXHse31Iia?dl=0>.

Declaration of competing interest

We have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2022.02.034>.

that immersive interventions may be useful for reducing depressive symptoms and enhancing well-being.

Keywords

Depression; Stress; Well-being; Intervention; Resilience; Health

1. Introduction

Depression is a leading cause of disability with over 280 million affected individuals worldwide, and mental health disorders more broadly have an annual economic impact of 2.5 trillion dollars (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018; Institute for Health Metrics and Evaluation, 2021; Malhi and Mann, 2018; Trautmann et al., 2016). Despite the high global burden of psychiatric disorders, current treatment options for reducing depressive symptoms have limited efficacy and remain inaccessible or unpalatable to many. Within the United States, for example, approximately 30% of adults and >60% of adolescents with depression are untreated (Fava et al., 2017; JAMA Network, 2016; Mental Health America, 2021). Among those who do receive treatment, up to 67% do not respond to the first medication attempted and 10–30% do not respond even with repeated attempts (Kudlow et al., 2014; Rush et al., 2009; Trivedi et al., 2006). Furthermore, even patients who receive combination treatment with both medication and psychotherapy exhibit an average symptom reduction of only 55–65% (Khan et al., 2012; Kudlow et al., 2014).

In addition to limited penetration and efficacy, antidepressants can have undesirable side-effects including weight gain, withdrawal symptoms at reduction or discontinuation of treatment, increased risk of suicide, loss of sexual desire, and fatigue, some of which overlap with depression symptoms (Cosci and Chouinard, 2020; Institute for Quality and Efficiency in Health Care (IQWiG), 2020; Khawam et al., 2006). These problems are magnified by the lack of clinical guidelines for selecting an appropriate medication, over 40 of which exist for major depressive disorder (MDD) alone. Novel approaches for reducing depressive symptoms could save lives and livelihoods. Moreover, treatments that reduce depressive symptoms while simultaneously enhancing psychosocial resilience and hope could give people a reason to live.

Personal development practices such as meditation, mindfulness, and gratitude have been around for years but recently increased in popularity (Shapiro and Weisbaum, 2020). In addition, millions of people each year attend immersive personal development seminars that aim to improve mental health through a structured curriculum in the context of a highly supportive community environment. Whereas many clinical interventions for reducing depressive symptoms are pathology-focused, immersive programs are often well-being oriented. Such well-being focused interventions may be equally or more effective than those focused on psychopathology; additionally, they may be more palatable and less stigmatizing for persons with depression who go untreated (Fava et al., 2017; JAMA Network, 2016; Mental Health America, 2021). Critically, although the success of immersive programs

indicates that they are very popular and highly desirable, there is currently no clear evidence for their effectiveness.

One such program is Date with Destiny (DWD), a six-day immersive training program that includes a subsequent 30-day daily psychosocial exercise follow-up period. DWD is popular with thousands of people using this intervention annually. The program combines a variety of lifestyle and psychological approaches that seek to improve well-being, including cognitive reframing, guided meditation and visualization, neurolinguistic programming, gratitude, goal setting, guided hypnosis, community belonging and engagement, and exercise. Although components of the program such as exercise, gratitude, and cognitive reframing have independently been found to improve mental health and wellness (Goyal et al., 2014; Kvam et al., 2016; Mikkelsen et al., 2017; Schuch et al., 2016), the effectiveness of the DWD program has not been investigated.

To address this issue, we conducted a randomized clinical trial comparing this immersive psychosocial training program (i.e., 6-day program + 10-min daily psychosocial exercises for 30 days = 36 days total) with a 36-day gratitude journaling control. This control was selected to compare the immersive training program with an alternative complementary treatment that has been shown to have clinical benefit for depression (Gander et al., 2013). The primary objective of this single-blind randomized clinical trial was to evaluate the effectiveness of the training program for reducing depressive symptoms. The primary hypothesis was that the immersive psychosocial training program would improve the primary outcome of depression severity, as compared to an active control. The secondary hypotheses were that the training program would improve secondary depression-related outcomes including anxiety, stress, loneliness, and general well-being. These secondary outcomes were chosen because they are well-known robust risk factors for depression or because they have been shown to be strong predictors of well-being, morbidity, and mortality (Tamosiunas et al., 2019; Slavich and Irwin, 2014).

2. Methods

2.1. Participants and study design

A randomized clinical trial was conducted in which 45 participants were randomized at 1:1 ratio to DWD ($n = 23$) or a gratitude journaling control group ($n = 22$) (Fig. 1). Depressed individuals ($n = 27$), as assessed by the Patient Health Questionnaire-9 (PHQ-9; see below), and those without depression ($n = 18$) were recruited by email, flyers, and physician referral in the U.S. Inclusion criteria were age 18+, English speaking, and living in Florida or able to travel to Florida. The exclusion criteria were taking antidepressant medications, having previously attended the training program, and being a European Union citizen, due to data privacy and Institutional Review Board (IRB) requirements. Participants were told they would be randomly assigned to either attend the immersive retreat at no cost or a control group, and that the control group would be given a ticket to attend a later event. The study was approved by the IRBs at IntegReview and Stanford University, and registered at clinicaltrials.gov as [NCT04172051](https://clinicaltrials.gov/ct2/show/study/NCT04172051). Written informed consent was obtained from all participants.

2.2. Randomization and masking

Block randomization was conducted in depression-score-based blocks generated ahead of participant assignment by a Stanford researcher. For each depression score block (i.e., Minimal, Mild, Moderate to Moderate Severe, and Severe, as assessed by the PHQ-9), random numbers were used to assign participants as they entered the study to either the training program or gratitude journaling control group. Only one participant with severe depression enrolled and was assigned to the training program. At baseline, there were no statistically significant differences between groups with respect to any of the outcomes assessed (Supplementary Table 12).

2.3. Procedures

Participants in both groups were profiled concurrently, at the same time points: namely, a few days before the training program, two days after the training program ended (study week one), and one month after the final day of the training program (study week six). Participants in the intervention group attended a 6-day immersive psychosocial training program followed by a 10-min daily exercise for 30 days (36 days total; $n = 23$). The control group performed a “three good things” gratitude journaling exercise in which they journaled about three positive experiences for 10 min each day over the 36-day duration of the study (Gander et al., 2013; Mongrain and Anselmo-Matthews, 2012; Seligman et al., 2005). Recruitment took place between November 22, 2019 and December 3, 2019. The psychosocial training program took place from December 5th to December 10th, 2019 in Miami, Florida. At each time point, all participants completed surveys evaluating their mental health and social, emotional, and physical well-being (see below).

2.4. Outcomes

The primary outcome, depression severity, was assessed using the PHQ-9, a standardized 9-item scale for determining the presence of depression and estimating depression severity. The PHQ-9 is widely used by medical professionals to make diagnostic decisions (Kierce et al., 2019; Dejesus et al., 2007) and has high correspondence with clinician-rated diagnoses of depression (Kroenke et al., 2001). Each question is scored on a 0–3 scale, for a maximum score of 27. Scores of 5–9, 10–19, and 20–27 indicate mild, moderate, and severe depression severity, respectively (Kroenke et al., 2001).

Several key secondary outcomes related to depression were also assessed. First, changes in anxiety and stress were assessed given their frequent co-occurrence with depression.

In addition, although depression, anxiety, and stress can indicate a presence or absence of pathology, it is well-accepted that mental wellness goes beyond the absence of negative emotions (Butler and Kern, 2016). Therefore, ten positive indicators of mental wellness were also assessed: overall well-being, accomplishment, meaning, relationships, engagement, positive emotion, sexual satisfaction, satisfaction with life, hope, and gratitude. Given that cognitive reframing is a part of the DWD program, Primal World Beliefs were used to assess the magnitude of belief change. Primal World Beliefs describe beliefs that an individual holds about the world, in general. Four primal beliefs were assessed: *Good, Safe, Enticing,*

and *Alive*. A detailed description of the instruments used to assess the secondary outcomes is provided in the Supplementary Materials.

2.5. Statistical analysis

A blinded analysis was performed by two independent Stanford researchers who had no involvement with the study design or data collection. The researchers were given deidentified data with group names ‘A’ and ‘B.’ First, means and standard deviations were calculated for each outcome measure, at each time point, for each group. For the statistical analyses below, the significance level was set *a priori* at $\alpha = 0.05$, and all tests were two-tailed. One individual in each group did not complete the week one surveys and was therefore not included in analyses involving those surveys.

2.6. Analysis of changes in psychosocial outcomes

Absolute Change Analysis: For each outcome, the data were split by group (A and B). Absolute changes between time points were calculated for each participant in each group. These absolute changes were compared between groups using Welch’s *t*-test for unequal variances (parametric) as well as the Wilcoxon rank sum test (non-parametric). Overall, 3 time frames were considered: week one versus baseline, week six versus baseline, and week six versus week one. Analyses involving all primary and secondary outcomes were adjusted for multiple comparisons using the Benjamini-Hochberg method.

Percent Change Analysis: This analysis was similar to the absolute change analysis. However, “1” was added to all psychometric scores to prevent dividing by zero. Moreover, only the (non-parametric) Wilcoxon test was used because adding 1 to initial values inflated the values.

One participant in the psychosocial training program had a high unmatched PHQ-9 score. To ensure this individual did not exert an undue influence on any results, the absolute and percent change analyses were conducted again while excluding this case. All change analyses (absolute and percent; parametric and non-parametric; with and without the unmatched participant) led to similar results (Tables 2-3, Supplementary Tables 1-2 and 6-11).

2.7. Effect size calculations

Effect sizes displayed in Fig. 2B and Supplementary Figs. 1-5 were calculated using the *cohen.d* function from the *effsize* package in R. Paired effect sizes were used for all within-subjects analyses (Supplementary Figs. 3-5).

3. Results

3.1. Study and participant characteristics

The CONSORT Flow Diagram is shown in Fig. 1. The composition of the two cohorts (psychosocial training program and control) did not differ significantly for any of the baseline characteristics assessed, including age, ethnicity, and income (Table 1). Assessment

response rates were high: 100% at baseline and study week six, and 95–98% at study week one.

3.2. Overview of psychosocial results

Supplementary Table 2 shows the group means at each time point for each outcome assessed. Table 2 shows percent changes in these means between the time points. Table 3 and Supplementary Tables 6 and 11 show the results of the parametric and non-parametric statistical tests comparing the two groups in terms of the magnitude of absolute and percent changes in each outcome assessed (see below).

In the text below, p -values correspond to the results of the parametric tests comparing absolute changes (Table 3, Supplementary Table 11) and changes in the outcomes assessed are presented in terms of percent changes in group means over time (Table 2) because they are easiest to interpret. Supplementary Figs. 7-12 display box plots for each outcome at each time point. Fig. 2B and Supplementary Figs. 1-5 display effect sizes (with 95% confidence intervals) for the absolute changes in each outcome, both within each group and when comparing intervention to control.

3.3. The psychosocial training program reduced depressive symptoms

As hypothesized, depression severity, as assessed by the PHQ-9, improved from baseline to study week one in both the training program and control group, with a greater decrease in the psychosocial training program group (–69.3%) versus the control group (–39.3%), though this difference between groups was not statistically significant, $p = 0.14$. Depression severity remained decreased at study week six in both groups, and the overall reduction from baseline was significantly greater in the training program (–82.7%) versus control group (–23%), $p = 0.02$. Notably, although depression severity improved substantially from week one to week six in the training program group (–43.5%), depression severity increased by +27% in the control group. The relative effect size between the training program and control group for baseline versus week six was –0.85 (95% CI: 1.47, $-p = 0.02$). Among initially depressed participants, the relative effect size was even greater: 1.58 (95% CI: 2.48, –0.67; $p = 0.002$) (Tables 2-3, Fig. 2, and Supplementary Figs. 1-2).

At study week one, 79% of initially depressed participants in the psychosocial training program (11/14) were in remission (PHQ-9 score <5). By study week six, 100% of these participants (14/14) were in remission versus only 31% (4/13) of initially depressed participants in the control group. Additionally, by week six, no participants in the training program expressed suicidal ideation (Supplementary Table 1)

3.4. The psychosocial training program reduced anxiety and stress

Both anxiety and perceived stress levels improved from baseline to study week one in the training program group. The mean anxiety score decreased by 62.9% and the mean perceived stress score decreased by 56%. Both anxiety and perceived stress remained decreased in the training program group at study week six, and the overall reductions from baseline were significantly greater in the training program versus control group (Anxiety: 80% vs. –33.8%, $p = 0.05$; Perceived Stress: 67.4% vs. –6.6%, $p < 0.001$). Similar results

were observed for other negative indicators of mental health—namely, loneliness, negative emotion, attachment avoidance, attachment anxiety, and dysfunctional attitudes (45–75% reduction in training program group, $p \leq 0.05$) (Tables 2-3, Fig. 2, and Supplementary Figs. 1-2).

3.5. The psychosocial training program improved positive indicators of mental wellness

All ten positive indicators of mental wellness (overall well-being, accomplishment, meaning, relationships, engagement, positive emotion, sexual satisfaction, satisfaction with life, hope, and gratitude) improved from baseline to study week one in the psychosocial training program group. These positive psychological outcomes remained improved in the psychosocial training program group at week six. The overall reductions from baseline were significantly greater in the psychosocial training versus control group for all outcomes assessed ($p < 0.02$) except for gratitude and sexual satisfaction (Tables 2-3, Fig. 2, and Supplementary Figs. 1-2).

3.6. The psychosocial training program improved beliefs about the world, in general

All four primal beliefs (i.e., *Good*, *Safe*, *Enticing*, and *Alive*) increased from baseline to study week one in the psychosocial training program group (range 13–27%), and all of these changes were significantly greater in the psychosocial training versus control group ($p < 0.02$). Primal beliefs remained significantly increased in the psychosocial training program group relative to control at study week six ($p < 0.05$) (Tables 2-3, Fig. 2, and Supplementary Figs. 1-2).

3.7. The psychosocial training program improved role functioning

Physical and emotional role functioning refer to the ability of an individual to fulfill their social and professional roles without hindrance from physical or emotional problems, respectively (Ware and Sherbourne, 1992). Both measures increased from baseline to study week one in the psychosocial training program group (+27.9% and +31.1%, respectively). The increase in emotional role functioning was significantly greater in the psychosocial training program versus the control group ($p = 0.01$). Both measures remained increased at study week six, and the overall increase in emotional role functioning was significantly greater in the psychosocial training versus control group ($p = 0.03$) (Tables 2-3, Fig. 2, and Supplementary Figs. 1-2).

A summary of the changes for the subset of participants who began the study depressed (training program: $n = 14$; control group: $n = 13$) can be found in Supplementary Tables 3-5. Box plots are displayed in Supplementary Figs. 8, 10, and 12. Relative effect sizes between initially depressed training program and control participants are displayed in Supplementary Fig. 2.

4. Discussion

To our knowledge, this study is the first randomized clinical trial to evaluate the effectiveness of an immersive psychosocial training program for improving depression symptoms. The findings indicate that this immersive program rapidly and substantially

improved depression severity as assessed by the PHQ-9, as compared to a gratitude journaling control condition. By the end of the first week, 11 of the 14 training program participants who were depressed at baseline (79%) were in remission, as indicated by a PHQ-9 score of less than 5. By study week six, 100% of participants in the training program who were initially depressed were in remission. On average, these participants exhibited a 71.8% reduction in depression severity after one week and a 91.5% average reduction in depression severity by study week six. Notably, the training program was significantly more effective at reducing participants' depression severity than the active control condition, which itself improved depression. These findings thus suggest that immersive psychosocial training programs may be a potential alternative or adjuvant treatment for reducing depression.

Notably, the improvements documented here for the psychosocial training program are more pronounced than those typically seen with other treatments. For example, approximately 20–40% of patients exhibit improvements in depression with placebo, and 40–60% exhibit improvement with antidepressant medications (Menke, 2019). In a clinical trial with a similar sample size and study design, 71% of participants receiving psilocybin-assisted psychotherapy had a clinically significant response, defined as a 50% or greater decrease in depression severity at baseline; moreover, 54–58% of participants were in remission at weeks one and four (Davis et al., 2020). Moreover, roughly 30–60% of patients who take antidepressants exhibit remission in six weeks (Trivedi et al., 2006; Trivedi et al., 2006). In comparison, 79% of training program participants in the present study who were depressed at baseline exhibited a clinically significant treatment response and were in remission at study week one, and all participants in the treatment condition were in remission at study week six. These data suggest that high-intensity immersive psychosocial training programs such as DWD may be more effective at reducing depression than currently used pharmacological treatments. More research in diverse clinical populations with long-term longitudinal follow-up is needed to compare such training programs to the current standard of psychiatric care.

In addition to improving symptoms of psychopathology, the intensive psychosocial training program group enhanced feelings of overall well-being, accomplishment, meaning, relationships, engagement, positive emotions, satisfaction with life, and hope, as compared to the control group. Given that the training program aims to increase positive affect, it is possible that the improvements in depression severity may result in part from increases in well-being rather than vice versa (Fig. 2).

Additionally, as compared to participants in the control group, those in the training program exhibited significantly greater improvements in role functioning, defined as an individual's age- and social-responsibility specific capacity to perform activities (Anatchkova and Bjorner, 2010). The cost of depression in the United States alone surpasses \$200 billion dollars annually. In 2010, MDD cost \$102 billion dollars in absenteeism and presenteeism, with presenteeism alone equating to 37% of the 200-billion-dollar cost of MDD, due to lost productivity. The observed improvements in role functioning suggest that psychosocial training programs could help address costly public health ramifications of depression in addition to improving the primary symptomatology. According to the World Health

Organization, every \$1 put into scaled treatment for common mental health conditions returns \$4 in public health benefit (World Health Organization, 2019). Given that this psychosocial training program emphasizes peak performance training, it may uniquely benefit role functioning in ways that traditional psychotherapies and antidepressants do not, and improvements in emotional role functioning may in part explain the higher effectiveness of this intervention on depression as compared to medications and cognitive behavior therapy (Davis et al., 2020).

In addition to improvements in depression, the observed improvements in anxiety and perceived stress suggest that high-intensity immersive psychosocial training programs such as DWD may have therapeutic value across psychiatric conditions. This is perhaps not surprising given that the program includes several psychotherapeutic techniques. Notably, biological evidence links chronic stress to inflammation, which in turn has been implicated in the pathophysiology of depression and other health problems including cardiovascular disease, obesity, diabetes, and autoimmune and neurodegenerative disorders (Furman et al., 2019; Slavich and Irwin, 2014).

4.1. Strengths and limitations

Several strengths and limitations of this study should be noted. The strengths include a randomized clinical trial design, blinded analyses, high retention of study participants, and focus on depression, a leading cause of disability worldwide. The main limitations were the limited sample size of depressed participants ($n = 14$ in the intervention group; $n = 13$ in the control group) and the fact that depression was assessed using self-report. The PHQ-9 has high internal validity, reliability, and sensitivity (Kroenke et al., 2001). Moreover, scores on the PHQ-9 correspond closely with clinician-rated diagnoses of depression as obtained from diagnostic interviews (Kroenke et al., 2001) and the instrument is widely used by medical practitioners to make diagnostic decisions (Kierce et al., 2019; Dejesus et al., 2007). Nevertheless, future studies could improve upon this work by using structured clinical interviews conducted by clinicians who are blind to study participants' condition and depression status.

In addition, at the time of recruitment, participants were aware that they would be randomized to either the psychosocial training program or a control group, meaning that those who enrolled may have had positive expectancy around the program. Despite this fact, the large effect sizes observed suggest effects above and beyond positive expectancy, given that expectancy has been associated with only modest benefits. For example, placebo effects with antidepressant medications are associated with symptom reduction for roughly 20–40% of people over a six-week period (Whitlock et al., 2019). Moreover, trials of psychedelics, which have recently received FDA breakthrough designation for MDD, have the same limitation of having participants sign up who are interested in the treatment.

In addition, although the present study revealed improvements across mild, moderate, and severe depression, most depressed participants entered with mild symptoms of depression, and further studies are needed to understand which depressed populations benefit most from this intervention. Finally, we did not assess differences between participants based on different methods of recruitment. Overall, the beneficial effects identified here are promising

and suggest the need to conduct follow-up randomized clinical trials in larger populations and to compare immersive psychosocial training programs with standard treatments for depression, such as psychotherapy and antidepressant medications.

4.2. Conclusion

In conclusion, this single-blind randomized clinical trial of a brief immersive psychosocial intervention demonstrated rapid and substantial improvements in depression as compared to an active gratitude journaling control. Seventy-nine percent of initially depressed participants in the intervention group were in remission by study week one and all depressed participants in the intervention group were in remission by study week six. Future studies are needed to compare immersive psychosocial training programs with current standards of psychiatric care to determine whether they are a viable treatment for depression in lieu of, or as an adjuvant to, traditional psychological or psychopharmacological interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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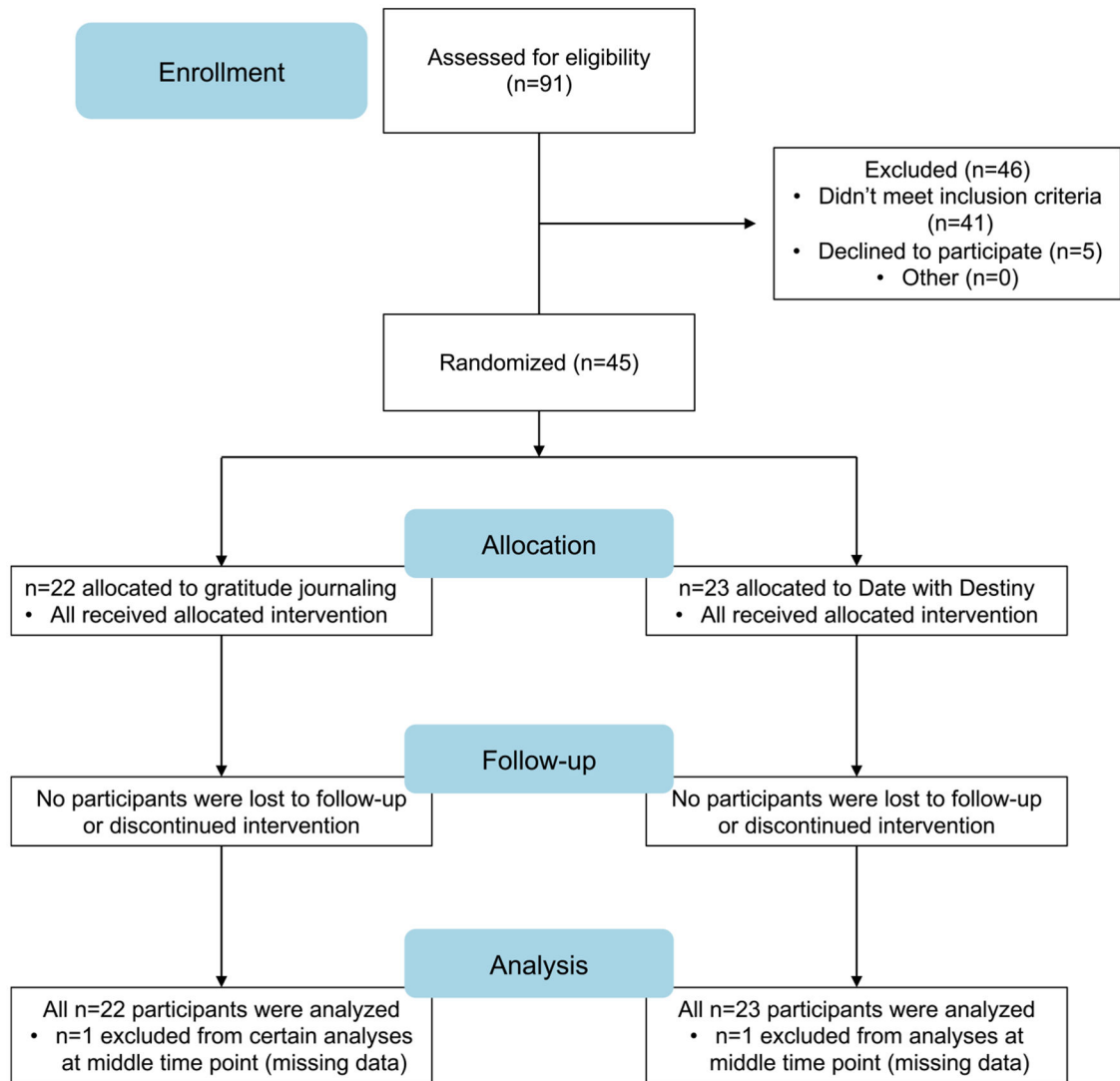


Fig. 1. CONSORT Flow Diagram describing phases of the randomized clinical trial.

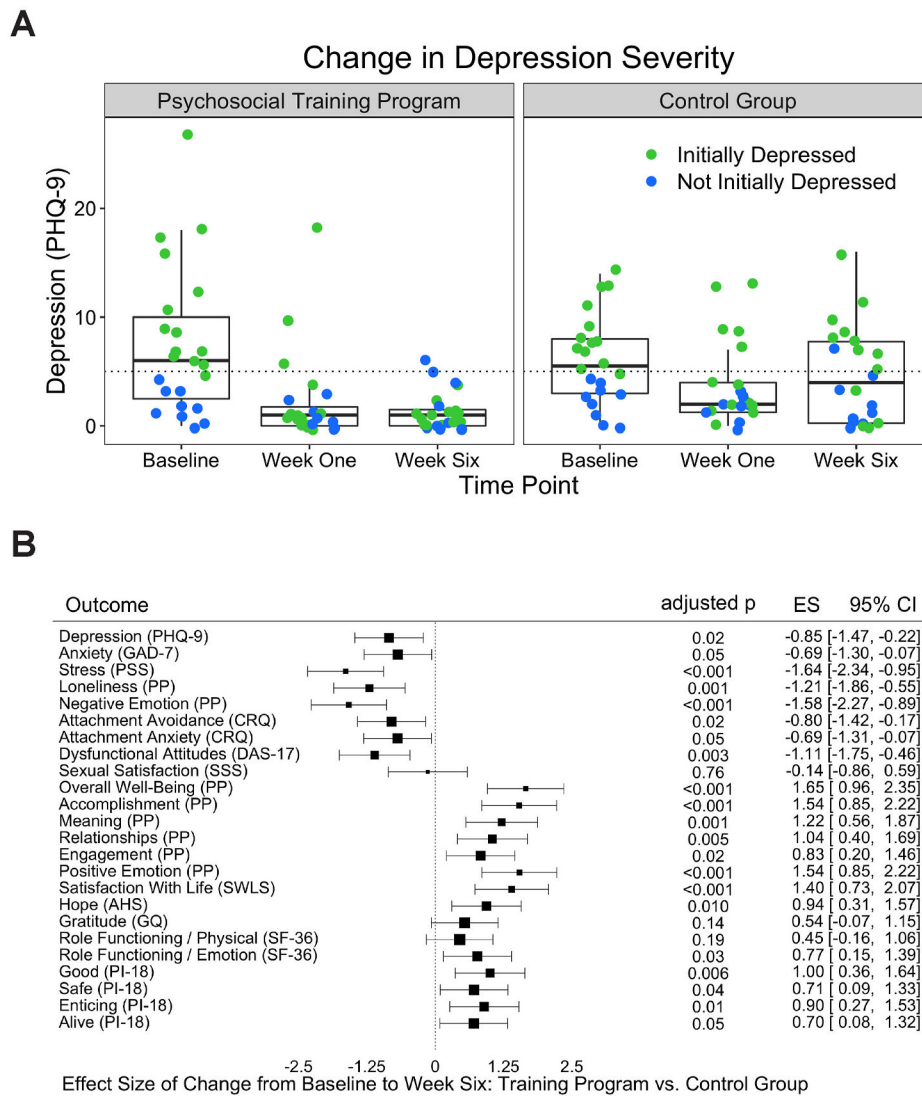


Fig. 2. Summary of changes in, and associations between, study outcomes. (A) Changes in depression severity over time for participants in the psychosocial training program (left) and control group (right). Points are colored by initial depression (green = initially depressed, PHQ-9 \geq 5; blue = not initially depressed). (B) Effect sizes for the outcome measures when comparing the change in the training program group to the change in the control group from baseline to week six.

Table 1

Baseline demographic and clinical characteristics of the sample by group.

Demographic & Clinical Characteristics	Mean/Count for Control Group	Mean/Count for Intervention Group	p-value
Age ¹	41.4	41.3	0.97
Sex ²			
Male	10	14	0.38
Female	12	9	0.38
Race ²			
Latino	3	8	0.17
Black	3	1	0.35
Asian	0	0	1
Native American	0	1	1
White	18	17	0.72
Native Hawaiian or Other Pacific Islander	0	0	1
Other	2	7	0.13
Education Level ²			
Below a Bachelor's Degree	10	8	0.55
Bachelor's Degree	7	8	1
Graduate School Degree	5	7	0.74
Annual Income ²			
<\$40k	4	3	0.7
Between \$40k and \$80k	9	11	0.77
\$80k	9	9	1
Participation in Assigned Programs After Treatment ^{2,3}			
Daily	11	18	0.07
Missed a day	5	1	0.10
Missed a few days	2	1	0.61
A few days	2	1	0.61
No participation	1	2	1
Employment ²			
Part-time	1	0	0.49
Full-time	8	11	0.55
Not employed; looking for work	1	1	1
Not employed; not looking for work	0	1	1
Self-employed	11	10	0.77
Homemaker	1	0	0.49
Retired	0	0	1

Demographic & Clinical Characteristics	Mean/Count for Control Group	Mean/Count for Intervention Group	<i>p</i> -value
Depression Severity (PHQ-9) ^{2,4}			
Not depressed (<5)	9	9	1
Mildly depressed (5-9)	9	8	0.76
Moderately depressed (10-19)	4	5	1
Severely depressed (20-27)	0	1	1
Adverse Childhood Experiences (ACE) ¹	2.9	4.1	0.16

¹ *p*-value assessed by Welch's *t*-test.

² *p*-value assessed by Fisher's exact test.

³ For the intervention (training program) group: indicates participation in the 30-day 10-min exercise after the training program; for the control group: indicates continued participation in the gratitude exercise.

⁴ PHQ-9 stands for Patient Health Questionnaire-9.

Table 2

Percent change in group means of the psychosocial outcomes assessed.

Outcomes	Week One – Baseline		Week Six – Baseline		Week Six – Week One	
	Control % Change in Mean	Intervention % Change in Mean	Control % Change in Mean	Intervention % Change in Mean	Control % Change in Mean	Intervention % Change in Mean
Depression (PHQ-9)	-39.3	-69.3	-23	-82.7	27	-43.5
Anxiety (GAD-7)	-36.9	-62.9	-33.8	-80	4.9	-46.2
Stress (PSS)	-9.6	-5.6	-6.6	-67.4	3.3	-25.9
Loneliness (PP)	9.4	-47.9	28.1	-72.9	17.1	-48
Negative Emotion (PP)	-5	-60.4	-10	-75	-5.3	-36.8
Overall Well-Being (PP)	6.2	29	6.2	40.3	0	8.7
Accomplishment (PP)	4.9	26.7	8.2	46.7	3.1	15.8
Meaning (PP)	16.1	40.7	14.5	49.2	-1.4	6
Relationships (PP)	9.4	25.4	7.8	36.5	-1.4	8.9
Engagement (PP)	8.2	19.7	1.6	25.8	-6.1	5.1
Positive Emotion (PP)	3.2	42.9	9.7	55.4	6.2	8.7
Satisfaction With Life (SWLS)	5.8	46.6	13	54.5	6.8	5.4
Attachment Avoidance (CRQ)	-10.5	-26.4	-12	-45.1	-1.7	-25.4
Attachment Anxiety (CRQ)	-7.5	-37.8	-19.1	-46	-12.6	-13.1
Hope (AHS)	5.1	9.7	3.5	15	-1.6	4.9
Gratitude (GQ)	4.9	11.3	2.6	12.2	-2.2	0.8
Role Functioning/Physical (SF-36)	10.6	27.9	27.9	55	15.6	21.2
Role Functioning/Emotional (SF-36)	-0.7	31.1	9	37.3	9.8	4.8
Dysfunctional Attitudes (DAS-17)	-5.1	-41.5	-12.4	-48.3	-7.6	-11.6
Sexual Satisfaction (SSS)	-9.7	-34	-22.7	-28.1	-14.4	8.9
Good (PI-18)	2.7	16.2	8.1	21.6	5.3	4.7
Safe (PI-18)	9.4	27.3	18.7	33.3	8.6	4.8
Enticing (PI-18)	-2.4	12.8	0	17.9	2.5	4.5
Alive (PI-18)	0	16.2	7.9	21.6	7.9	4.7

Note: PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder-7; PSS=Perceived Stress Scale; PP=PERMA Profiler; SWLS=Satisfaction With Life Scale; CRQ=Close Relationships Questionnaire; AHS = Adult Hope Scale; GQ = Gratitude Questionnaire; SF-36 = Short Form Survey-36; DAS-17 = Dysfunctional Attitudes Scale-17; SSS=Sexual Satisfaction Scale; PI-18 = Primals Inventory-18. For more details about outcome assessment, please see Methods and Supplementary Methods.

Table 3

Significance of absolute change in the psychosocial outcomes assessed.

Outcomes	Week One – Baseline			Week Six – Baseline			Week Six – Week One		
	T-test p-value	Rank Sum p-value	Rank Sum p-value	T-test p-value	Rank Sum p-value	Rank Sum p-value	T-test p-value	Rank Sum p-value	Rank Sum p-value
Depression (PHQ-9)	0.14	0.20	0.02	0.02	0.02	0.02	0.15	0.46	0.46
Anxiety (GAD-7)	0.19	0.29	0.05	0.05	0.06	0.06	0.37	0.33	0.33
Stress (PSS)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.19	0.26	0.26
Loneliness (PP)	0.02	0.01	0.001	0.001	<0.001	<0.001	0.19	0.27	0.27
Negative Emotion (PP)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.39	0.72	0.72
Overall Well-Being (PP)	0.008	0.009	<0.001	<0.001	<0.001	<0.001	0.10	0.17	0.17
Accomplishment (PP)	0.02	0.05	<0.001	<0.001	<0.001	<0.001	0.07	0.24	0.24
Meaning (PP)	0.02	0.009	0.001	0.001	0.001	0.001	0.29	0.46	0.46
Relationships (PP)	0.07	0.17	0.005	0.005	0.008	0.008	0.13	0.23	0.23
Engagement (PP)	0.27	0.23	0.02	0.02	0.02	0.02	0.15	0.15	0.15
Positive Emotion (PP)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.38	0.60	0.60
Satisfaction With Life (SWLS)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.97	0.89	0.89
Attachment Avoidance (CRQ)	0.14	0.39	0.02	0.02	0.02	0.02	0.15	0.17	0.17
Attachment Anxiety (CRQ)	0.005	0.009	0.05	0.05	0.04	0.04	0.81	0.85	0.85
Hope (AHS)	0.15	0.10	0.010	0.010	0.010	0.010	0.02	0.02	0.02
Gratitude (GQ)	0.10	0.09	0.14	0.14	0.17	0.17	0.61	0.36	0.36
Role Functioning/Physical (SF-36)	0.52	0.63	0.19	0.19	0.24	0.24	0.65	0.89	0.89
Role Functioning/Emotional (SF-36)	0.01	0.008	0.03	0.03	0.04	0.04	0.97	0.98	0.98
Dysfunctional Attitudes (DAS-I7)	0.003	0.004	0.003	0.003	0.003	0.003	0.88	0.96	0.96
Sexual Satisfaction (SSS)	0.10	0.09	0.77	0.77	0.63	0.63	0.29	0.36	0.36
Good (PI-18)	0.002	0.006	0.006	0.006	0.009	0.009	0.77	0.61	0.61
Safe (PI-18)	0.02	0.02	0.04	0.04	0.04	0.04	0.95	0.89	0.89
Enticing (PI-18)	0.008	0.008	0.01	0.01	0.02	0.02	0.87	0.94	0.94
Alive (PI-18)	0.009	0.02	0.05	0.05	0.03	0.03	0.62	0.45	0.45

Note: For acronym definitions, please see the Note under Table 2.