Brief Peer-Supported webSTAIR for Trauma-Exposed Veterans in the Community: Randomized Controlled Trial

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Abstract

Background: Peer-supported mobile health (mhealth) programs hold the promise of providing a low-burden approach to increasing access to care and improving mental health. While peer support has been shown to improve engagement into care, there is limited investigation about the impact of peers on symptom outcome. Trauma-exposed populations frequently suffer from co-occurring posttraumatic stress and depressive symptoms as well as difficulties in day-to-day functioning. This study evaluated the potential benefits of a peer-supported transdiagnostic mhealth program on symptom outcomes and functioning.

Objective: This randomized controlled trial tested the effectiveness of Brief Peer-Supported (BPS) webSTAIR, an abbreviated transdiagnostic online program derived from Skills Training in Affective and Interpersonal Regulation (STAIR) compared to waitlist control in a community sample of Veterans who screened positive for either post-traumatic stress disorder (PTSD) and/or depression.

Methods: A total of 178 eligible Veterans were enrolled in the study using a 2:1 randomization scheme with 117 assigned to BPS webSTAIR and 61 assigned to the waitlist control. PTSD and depressive symptoms as well as emotion regulation, and psychosocial functioning were assessed via phone at pretreatment, posttreatment, and 8-week follow-up. Mixed-effects models were used to assess change in outcome measures across timepoints and evaluate the impact of module completion on outcomes. Exploratory analyses were conducted to determine whether number and type of peer interactions influenced outcomes.

Results: Participants randomized to BPS webSTAIR reported significantly greater improvement on all outcome measures at posttreatment compared to the waitlist control (d=-0.48 to -0.64), and gains were maintained at 8-week follow-up. Those who completed more modules reported greater improvement on all outcomes (d=-0.64 to -0.83). An initial cohort of participants who were required to chat with a peer coach to progress exchanged more messages per module but were less likely to complete the program, compared to a later cohort for whom chatting was optional.

Conclusions: BPS webSTAIR was effective in improving PTSD and depression symptoms, emotion regulation, and psychosocial functioning in Veterans. Peer-supported transdiagnostic mhealth programs may be a particularly efficient, effective, and low-burden approach to improving mental health among trauma-exposed populations. Future research should evaluate how best to deliver peer support, how much to deliver, and for whom the support benefits most. Clinical Trial: ClinicalTrials.gov NCT04286165

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Abstract

Background

Peer-supported mobile health (mhealth) programs hold the promise of providing a low-burden approach to increasing access to care and improving mental health. While peer support has been shown to improve engagement into care, there is limited investigation about the impact of peers on symptom outcome. Trauma-exposed populations frequently suffer from co-occurring posttraumatic stress and depressive symptoms as well as difficulties in day-to-day functioning. This study evaluated the potential benefits of a peer-supported transdiagnostic mhealth program on symptom outcomes and functioning.

Objective

This randomized controlled trial tested the effectiveness of Brief Peer-Supported (BPS) webSTAIR, a 6-module transdiagnostic online program derived from Skills Training in Affective and Interpersonal Regulation (STAIR) compared to waitlist control (WL) in a community sample of Veterans who screened positive for either post-traumatic stress disorder (PTSD) and/or depression.

Methods

A total of 178 eligible Veterans were enrolled in the study using a 2:1 randomization scheme with 117 assigned to BPS webSTAIR and 61 assigned to WL. PTSD and depressive symptoms as well as emotion regulation, and psychosocial functioning were assessed via phone at pretreatment, posttreatment, and 8-week follow-up. Mixed-effects models were used to assess change in outcome measures across timepoints and evaluate the impact of module completion on outcomes. Exploratory analyses were conducted to determine whether the type and number of peer interactions influenced outcomes.

Results

Significant interaction effects were observed for all outcomes such that participants randomized to BPS webSTAIR reported significantly greater improvement at posttreatment compared to WL with moderate effect sizes for PTSD (PCL-5 d = -0.48) depression (PHQ- 8 d = -0.64), emotion regulation (DERS-16 d = 0.61) and functional impairment (WSAS d = 0.61); gains were maintained at 8-week follow-up. Those who completed more modules reported greater improvement on all outcomes. An initial cohort of participants who were required to engage with a peer coach to progress through the modules interacted more frequently with peers but completed fewer modules compared to a later cohort for whom peer engagement was optional.

Conclusions

BPS webSTAIR was effective in improving PTSD and depression symptoms, emotion regulation, and psychosocial functioning in community Veterans. Peer-supported transdiagnostic mhealth programs may be a particularly efficient, effective, and low-burden approach to improving mental health among trauma-exposed populations. Investigation of peer-supported programs among other populations is necessary to evaluate the generalizability of the findings. Analyses comparing peer support that was required versus optional indicated that some veterans may not need or want peer support. Future research should evaluate how best to deliver peer support and for whom it is most beneficial. If successful, peer-supported tech programs may increase the VA workforce as well as improve veteran mental health services and outcomes.

WORD COUNT = 441 (MAX is 450)

Trial Registration

ClinicalTrials.gov NCT04286165

Keywords: PTSD, Depression, Veterans, mhealth, Peer support, Transdiagnostic

Among U.S. Veterans, the prevalence of comorbid post-traumatic stress disorder (PTSD) and major depressive disorder (MDD) is estimated to be roughly twice the rate of PTSD alone [1], and the symptoms of each of these disorders have been associated with deficits in emotion regulation [2,3] and psychosocial functioning [4,5]. Meanwhile, Veterans experience numerous practical and cultural barriers to accessing evidence-based mental health treatment. These include the need to travel long distances to facilities, financial constraints, health conditions, inflexible work schedules, and caregiver responsibilities [6-8] as well as veterans' desire to be self-reliant and the perceived stigma of receiving mental health care [9,10]. There are, in addition, systemic barriers including a shortage of mental health providers in many parts of the U.S. [11]. Mobile health (mhealth) programs, including web-based and app programs, address these difficulties and have been found to be effective in the treatment of symptoms of PTSD and depression [12-15]. However, it has been shown that mhealth programs with human support consistently provide greater benefits than entirely self-guided programs [16,17]. Given the burdens on clinicians and other licensed professionals in effectively serving patient needs, the introduction of peer-supported mhealth programs holds the promise of reducing the burden to the health care system while maintaining and potentially increasing access to care and supporting patients in obtaining optimal outcomes.

Peer specialists are individuals with lived experience of recovery from mental health difficulties who are trained to support patients with similar problems in engaging in and completing mental health programs [21]. Peer specialists bring particular strengths to their roles, including their ability to develop strong rapport with participants and reduce stigma [19,20]. Literature reviews have indicated that the presence of peers increases engagement in treatment across individuals with a variety of mental health difficulties and disorders, treatment modalities and delivery strategies [21,22]. In particular, studies assessing the use of peer-supported mhealth among trauma-exposed Veterans have demonstrated increased engagement into treatment [23]. However, randomized controlled trials assessing the impact of peers on symptom change are relatively few in number [24]

including for mhealth interventions [25].

Studies integrating peer specialists into Veteran Affairs (VA) mhealth programs have strongly supported their acceptability and feasibility [26-30]. Randomized controlled trials have reported moderate to modest symptom change outcome, including studies assessing PTSD and depression when compared to waitlist [27], depression when compared to usual care [28], and anxiety and depression when compared to entirely self-guided work [29]. Additional trials are needed to assess mental health outcomes, particularly symptom change and psychosocial functioning to better understand the optimal contribution of peer-supported mhealth programs to mental health care. The current study evaluates a peer-supported transdiagnostic mhealth program for trauma-exposed Veterans. Given the frequency of co-morbid symptomatology among trauma-exposed populations [31,1], a transdiagnostic approach, if successful, provides the opportunity for broad use across various trauma-exposed populations with diverse needs. Moreover, different types of symptoms share issues with emotion regulation and psychosocial functioning, making these difficulties important treatment targets.

The program evaluated, webSTAIR, is a web-based program adapted from Skills Training in Affective and Interpersonal Regulation (STAIR), a manualized evidence-supported cognitive behavioral intervention for trauma-exposed individuals with symptoms of PTSD and/or depression that focuses on improving psychosocial functioning by building emotion regulation and interpersonal skills. Investigations of 10-12 session STAIR have reported large effect sizes in the reduction of PTSD and depression as well as in emotion regulation and psychosocial impairment [32,33]. Similar outcomes have been obtained in a briefer 6-session version, including in a randomized controlled trial in primary care [34] and in an open trial delivered by peers in a low-income primary care community service [35]. In parallel to the STAIR studies, investigations of webSTAIR assessed a 10-module version with weekly coaching sessions from licensed mental health providers. These studies have included two open trials [36, 37] and one comparison trial [38]. The open trials found

significant improvements with moderate to large effect sizes for PTSD, depression, emotion regulation difficulties and psychosocial impairment and the comparison study, with a noninferiority design, found that reducing coaching support to biweekly (5 coaching sessions) from weekly (10 coaching sessions) resulted in noninferior benefits on all outcomes.

Given the evidence supporting the success of brief, peer-supported STAIR in reducing a range of symptoms, along with growing support for the effectiveness of web-based mental health programs, a six-session peer-supported version of webSTAIR was developed. This abbreviated version of the webSTAIR protocol can be completed in a shorter time frame than the 10-session webSTAIR and integrates support from trained Veteran peers at the end of each module. The potential benefits of this program, if successful, is the availability of a low-burden, brief mhealth program that is effective in reducing PTSD and depression symptoms as well as improving emotion regulation and psychosocial functioning.

Objectives

The aim of this study was to assess the benefits of BPS peer-supported webSTAIR compared to a Waitlist control condition among U.S. Veterans with symptoms of PTSD, depression, or both. We hypothesized that participants assigned to the BPS webSTAIR condition would experience significantly greater improvement in PTSD symptoms and depressive symptoms (primary outcomes) as well as in emotion regulation and psychosocial functioning (secondary outcomes) compared to Waitlist, and that these gains would be maintained at an 8-week follow-up. Exploratory analyses were conducted to determine whether the number and type of peer interactions influenced outcomes. The study was funded by the National Center for PTSD Dissemination and Training Division within the VA Palo Alto Health Care System.

Methods

Procedures

Candidates for study participation were recruited via social media advertisements and

directed to complete a short set of online screening questions. Following the screening, study candidates were contacted via phone and scheduled for a 30-60-minute phone assessment with the study coordinator to assess inclusion and exclusion criteria, receive an explanation of the program and complete (verbal) informed consent. If eligible for the study, the participants were provided access to the program. Randomization was allocated at a 2:1 ratio (webSTAIR to Waitlist) in blocks of 12 and was computer-generated via an algorithm developed by staff otherwise not involved in the study. Participant randomization assignment was indicated upon opening the program URL. Participants in the BPS webSTAIR condition received instructions to start the program within 2 weeks following the assessment and to complete the 6-module program within 10 weeks. Assessments for posttreatment (10-week mark) and an eight-week follow-up were conducted via phone by study staff who were unaware of the condition and assessment period. Participants in the Waitlist condition were given the information that they would have access to the webSTAIR program in 10 weeks and completed assessments at the pretreatment and posttreatment (10-week mark). Waitlist participants were then given access to webSTAIR. Participants were paid 40 dollars for the pretreatment assessment and 60 dollars for the posttreatment and follow-up assessments. Recruitment began on 10/16/2020 and follow-up ended on 9/28/2022. The study was approved by the IRB of the university affiliated with the VA. The study is registered at www.clinicaltrials.gov (). Data were collected online and stored in a secure VA-approved environment.

Participants

Individuals were eligible if they were a Veteran or military personnel, over twenty-one years of age, endorsed experiencing at least one traumatic event, reported symptoms of PTSD or depression, or both, as indicated by a score of ≥3 on the Primary Care PTSD screen for DSM-5 (PC-PTSD-5) [39] and/or ≥2 the Patient Health Questionnaire-2 items (PHQ-2) [40], were able to read and write in English and had a PC computer and stable internet connection, and resided in the U.S. Exclusion criteria were determined during the phone assessment and were (1) the presence of

significant suicidality as indicated by the presence of a plan and means, (2) the presence of cognitive difficulties or active psychosis that would indicate a low likelihood of benefiting from treatment, and (3) current participation in trauma-focused treatment.

Measures

The pretreatment assessment included a series of sociodemographic questions and the Life Events Checklist (LEC) [41], which in this study was used to measure only those potentially traumatic events that directly happened to the individual, in addition to the measures below. The posttreatment assessment was scheduled for week 10 of the study and follow-up at 8 weeks post-treatment.

PTSD Symptoms. Posttraumatic stress disorder symptoms were measured using the PTSD Checklist for DSM-5 (PCL-5) [42]. This 20-item self-report measure asks participants to indicate how much they have been bothered by each symptom in the past month, on a scale from 0 (‘Not at all’) to 4 (‘Extremely’). A total score is calculated by summing all items, where higher scores correspond to greater PTSD symptom severity. A cutoff score of 31-33 points or more has been established as indicating probable PTSD [43]. The PCL-5 has demonstrated excellent internal consistency, good test-retest reliability, and excellent convergent validity among Veterans [43]. The baseline Cronbach’s alpha of the PCL-5 in the current sample was 0.92.

Depressive Symptoms. Depressive symptoms were measured using the Patient Health Questionnaire-8 Item (PHQ-8) [44]. The PHQ-8 is a self-report measure that comprises the first eight items of the PHQ-9. It asks participants to rate how often they have been bothered by each problem over the past month, on a scale from 0 (‘Not at all’) to 3 (‘Nearly every day’). A total score is calculated by summing all items, where higher scores correspond to greater depressive symptom severity. The PHQ-8 has demonstrated good internal consistency and convergent validity among both psychiatric outpatients and the general population [44,45]. The baseline Cronbach’s alpha of the PHQ-8 in the current sample was 0.83.

Emotion Regulation. Emotion regulation was measured using the Difficulties in Emotion Regulation Scale-16 Item (DERS-16) [46]. This 16-item self-report measure asks participants to rate how often each of a series of statements applies to them on a scale from 1 (‘Almost Never’) to 5 (‘Almost Always’). A total score is calculated by summing all items, where higher scores correspond to greater difficulties with emotion regulation. The DERS-16 has demonstrated excellent internal consistency, good test-retest reliability, and good convergent and discriminant validity [47]. The baseline Cronbach’s alpha of the DERS-16 in the current sample was 0.93.

Psychosocial Functioning. Psychosocial functioning was measured using the Work and Social Adjustment Scale (WSAS) [48]. This 5-item self-report measure asks participants to rate their degree of impairment in carrying out each of a series of activities on a scale from 0 (‘Not at all’) to 8 (‘Very Severely’). A total score is calculated by summing all items, where higher scores correspond to greater functional impairment. The WSAS has demonstrated strong psychometric properties among psychiatric samples [48,49]. The baseline Cronbach’s alpha of the WSAS in the current sample was 0.82.

Engagement and completion data

Metadata on chat sessions, including the number of messages exchanged with a peer coach, was collected at the participant level. Measures of program engagement within the BPS webSTAIR condition included the number of modules completed, the total number of messages exchanged, and the average number of messages exchanged per module.

Treatment

The BPS webSTAIR intervention is a shortened, six-module version of webSTAIR adapted from brief STAIR [34]. The six modules of BPS webSTAIR focus on emotional awareness, emotion management through the body, thought, and behavior channels, distress tolerance, and self-compassion. The program integrates text, audio, and video delivery of psychoeducation with interactive exercises and worksheets to help patients understand and internalize the concepts

introduced.

At the end of each module, participants were prompted to complete a chat session with a Veteran peer coach to help clarify program content and answer any questions they might have about how to implement the skills presented in the module. Interaction with the peer occurred via secure instant messaging on the program platform. Participants could message peers as often as they liked while they were on the platform. It was not expected that the participant would receive a response from the same peer. The peer program was committed to responding to text messages within 24 hours. Due to changes in the availability of Veteran peer coaches over the study period, three distinct cohorts were identified based on participant start date. In Cohort 1 (10/16/2020 – 7/9/2021) coaches were available for 24/7 support, and participants were required to complete a chat session with a coach at the end of each module in order to move forward to the next module. In Cohort 2 (7/10/2021 – 11/22/2021) coach availability was reduced to 8 hours a week, with 4 hours at the beginning of the day) (8:30am-12:30pm) and 4 hours at the end of the day and into the evening (4:30pm). In Cohort 3 (11/23/2021 – 7/20/2022) coach availability remained reduced, but participants were able to independently skip any chat sessions they chose. For all three cohorts, the research coordinator was available as back-up for logistical and content support Monday through Friday by phone call or secure text message during an 8-hour workday (8am to 4:00pm Pacific) with response completed within 24 hours or less.

Veteran peer coaches

All Veteran peer coaches were VA certified peer counselors, which includes a working knowledge of VA guidelines for assessing suicidal risk and referral to the Veteran suicide hotline. In addition, for this project, the peers received training by the developers of the online platform about navigation of the system (Vets Prevail) and received a manual and a workshop consisting of two 2-hour meetings taught by webSTAIR staff (MC and SS) which described the interventions and provided suggestions about how to connect the program material to ongoing stressors in the life of

the Veteran client and to recommend practice of skills between sessions.

Statistical analysis plan

Analyses were conducted using R (Version 4.2.2). All participants who met eligibility requirements and completed the pretreatment assessment were included in the final data set, regardless of whether they completed the program or participated in subsequent assessments. Consequently, all analyses were conducted using the intention-to-treat sample of randomized participants. Categorical pretreatment demographic variables and responses to individual LEC items were compared between the treatment and control groups using chi-squared tests of independence. The mean LEC scores for the two groups were compared using independent samples two-tailed *t* tests. Rates of missingness were 0% at baseline, 38% at posttreatment (47% webSTAIR, 21% waitlist), and 42% at follow-up (webSTAIR condition only). Missing data was addressed using multiple imputation. Joint multiple imputation of missing values at posttreatment and follow-up assessments was carried out using the panImpute function in package *mitml*. Due to (1) some of the presently reported analyses being specific to webSTAIR participants, while other analyses were relevant to the full sample, (2) differences in the assessment schedule between the treatment and control conditions (i.e., only webSTAIR participants were assessed at follow-up), (3) the unbalanced randomization design, and (4) differences in rates of missingness between conditions, multiple imputation procedures were carried out separately for the data that would be used to examine within-group change for webSTAIR participants across the three timepoints and between-group differences in change from pre to posttreatment. In other words, the between-group imputed datasets consisted of baseline and posttreatment data for all participants, whereas the within-group imputed datasets included baseline, posttreatment, and follow-up data for only the participants randomized to webSTAIR. In each case, 100 data sets were generated with missing values imputed. Prior to imputing the data, chi square tests and *t* tests were used to identify predictors of missingness and baseline characteristics related to non-missing values on outcome variables. The missing data

correlates identified from these preliminary analyses (employment status, education level, service era, and gender) were included as auxiliary variables in the imputation models. To ensure that any interactions between time and condition were appropriately preserved in the between-group imputed datasets, this interaction term was included as a predictor in the between-group imputation model. Results were pooled across imputed data sets using the test Estimates function in the *mitml* package.

For the main analyses of our primary and secondary outcomes, linear mixed-effects models were fitted using restricted maximum likelihood (REML) estimation with the lmer function in the package *lme4*. These models included main effects for time and condition, a time by condition interaction, as well as fixed effects to adjust for potential differences between the cohorts that may have resulted from changes in peer accessibility and chat requirements during the study. To control for potential cohort effects, two dummy variables were created to identify the participants in Cohorts 2 and 3, with Cohort 1 as the reference group. A random intercept was included in all models to account for repeated measurements within participants. The time by condition interaction term provided a test of the difference in change from pre to post treatment between the webSTAIR and waitlist conditions. Cohen's *d* between-group effect sizes for each measure were calculated by dividing the estimated interaction term by the standard deviation of pretreatment scores in the total sample. Similar models were constructed to measure within-group change among webSTAIR participants across all three time points. The time predictor in these models was specified so that posttreatment was the reference category, which enabled us to evaluate the magnitude and statistical significance of changes that occurred from pre- to posttreatment, as well as whether any improvements during treatment were retained during the follow-up period (i.e., as indicated by a non-significant estimate for change between the posttreatment and follow-up assessments). In the within-group analyses, Cohen's *d* effect sizes for change from pre- to posttreatment and from posttreatment to follow-up in the BPS webSTAIR group were calculated by dividing the estimated coefficients for time by the standard deviation of pretreatment scores for the BPS webSTAIR

condition.

To evaluate the impact of program completion on outcomes, module completion was categorized as ‘None’ (did not complete any online content, including the Welcome Module), ‘Some’ (completed the Welcome Module and no more than Module 2), or ‘Moderate to Complete’ (completed Module 3 or higher). Within each completion group, linear mixed-effects models were constructed for each outcome measure to evaluate within-group change across time. Time predictor dummies were specified such that posttreatment was the reference category, and a random intercept was included in each model. Cohen’s *d* effect sizes for pre- to posttreatment change within each completion group were calculated by dividing the estimated coefficient for time by the standard deviation of pretreatment scores for BPS webSTAIR participants in the respective completion group (e.g., the standard deviation of pretreatment PCL-5 scores among BPS webSTAIR participants in the ‘Moderate to Complete’ group).

Exploratory analyses were conducted in order to better understand the impact of the type (required versus optional) and number of peer chat sessions in the different cohorts. For each participant, we calculated the total number of chat messages exchanged with a peer support coach and the average number of chat messages exchanged per module of the program completed. Descriptive statistics for chat messages were examined by cohort. Comparisons were drawn between Cohort 1, in which chat sessions were required to advance to the next module, and Cohort 3, in which chat sessions were not required for module advancement, to assess whether chat engagement and completion rates differed in these two contexts. We did not include Cohort 2 in these analyses, given that this was a transitional phase when participants’ experiences with the chat feature may have varied in ways that are not quantifiable (e.g., experienced highly variable wait times in connecting with a peer).

Finally, the relationship of chat messages with treatment outcomes was explored by fitting linear regression models that included average messages exchanged per module and pretreatment

scores for the outcome as predictors of pre- to posttreatment change in the outcome. Due to differences between cohorts in the availability of peer coaches and program instructions for module completion, the relationships between messages exchanged per module and change in outcomes could not be interpreted in the same way across cohorts. Given these differences in context, separate models were estimated for each cohort so that relationships between chat engagement and outcomes could be interpreted according to the specific circumstances of each cohort. Additionally, differences in the number of modules completed by participants were taken into account by examining the relationships between messages exchanged *per module* (vs. total messages exchanged) and change in outcomes.

Results

A total of 178 eligible Veterans were enrolled in the study using a 2:1 randomization scheme with 117 assigned to BPS webSTAIR and 61 assigned to the waitlist control. As indicated in the CONSORT chart (Figure 1), 201 participants were initially enrolled but 23 participants (16 in webSTAIR and 7 in waitlist) were excluded from the study predominantly due to low credibility regarding their veteran status (e.g., did not know their rank, were uncertain about which branch of the armed forces they served in). Sample sociodemographic characteristics are shown in Table 1. Similar to other Veteran samples, most participants were male. Roughly two-thirds were White or Caucasian, and the average age was 48.08 (SD = 9.04). Nearly 58% were approved for VA service connection status for PTSD (at any disability rating), 27.0% had never applied, 8.4% had applied or had an application under review, and 6.7% had an application denied. A total of 32.0% were currently engaged in other (non-trauma focused) counseling, and 6.7% had received evidence-based treatment for PTSD or related conditions within the past year. No significant differences by condition were found for any sociodemographic item. At pretreatment, the two conditions did not significantly differ on any outcome measures except for the PHQ-8.

Table 2 presents the imputed means and standard deviations of scores on outcome measures

by condition across time points, along with the model-implied Cohen's *d* effect size measures for between-group differences in change and overall change within the webSTAIR group, derived from the linear mixed-effects model results. Significant Condition x Treatment interaction effects were observed for the PCL-5, PHQ-8, DERS-16, and WSAS indicating that webSTAIR participants experienced significantly greater improvements from pre- to posttreatment than Waitlist participants. Results of the mixed-effects models examining change in outcomes across the three timepoints at which webSTAIR participants were assessed similarly indicated that webSTAIR participants experienced significant improvements on all measures between pre- and posttreatment treatment: PCL-5, PHQ-8, DERS-16, and WSAS. Improvements experienced during treatment on all outcome measures were maintained through follow-up with no significant changes observed from posttreatment to follow-up for any of the outcome measures. Male veterans did not differ from veterans who identified as other genders on any of the outcome measures at posttreatment or follow-up.

Table 3 shows the estimated coefficients and effect sizes for pre- to posttreatment change in the outcome measures by module completion group in the BPS webSTAIR condition. Participants who completed no modules (n = 25; coded as 'None') did not experience a significant change in PCL-5 score from pretreatment to posttreatment (Est. = -1.88; SE = 4.72; P = .69; d = -0.13). Those who completed at least the Welcome Module but did not move beyond the second full module of BPS webSTAIR (n= 48; coded as 'Some') experienced a mean PCL-5 total score reduction of 6.77 (SE = 3.16; P = .03; d = -0.50). Participants who completed three or more (out of six total) modules of BPS webSTAIR (n= 44; coded as 'Moderate to Complete'), experienced an estimated PCL-5 total score reduction of 10.13 points from pretreatment to posttreatment (SE = 2.49; P < .001; d = -0.64). The PHQ-8, DERS-16, and WSAS followed a similar pattern, wherein significant pre- to posttreatment improvements were observed for the 'Some' and 'Moderate to Complete' groups, but not the 'None' group.

Chat usage data is displayed for all participants in the BPS webSTAIR condition and by cohort in Table 4. Cohort 1 participants completed a significantly higher number of chat sessions compared with participants in Cohort 3 (P = .004). The average number of messages exchanged per module was 11.92 in Cohort 1 and 4.44 in Cohort 3 (P = .004), and participants in Cohort 3 were significantly more likely to exchange no messages at all, χ^2 (1, N = 71) = 10.00, P = .002. However, participants in Cohort 3 completed moremodules, an average of 4.05 modules (including the Welcome Module) compared to an average of 2.45 modules completed in Cohort 1, t(69) = -2.46; P = .02. Additionally, 40.0% of participants in Cohort 3 compared with only 19.4% of participants in Cohort 1, χ^2 (1, N = 71) = 3.48, P = .06. Regarding the relationships of chat usage with outcomes, the number of messages exchanged per module in Cohort 1 was not significantly associated with pre- to posttreatment change in any of the study outcomes (Ps > .37). Results were similar for Cohort 3 in that the number of messages exchanged per module was not significantly associated with pre- to posttreatment change in any outcome (Ps > .66).

Discussion

Principal results

The results of the study indicated that as compared to Waitlist, peer-supported webSTAIR is effective in improving symptoms of PTSD and depression, as well as emotion regulation and psychosocial functioning, with gains maintained at 8-week follow-up. The within-group pre to post effect sizes for the webSTAIR participants ranged from 0.48 to 0.64, somewhat larger than those found for other peer-supported mhealth programs [21, 22]. Brief Peer-Supported (BPS) webSTAIR offers a convenient and potentially more scalable option for Veterans who have limited time available, lack access to a mental health provider, or prefer to work through the content in a self-guided manner.

Outcome varied depending on the number of modules completed. Among those who

completed three or more modules, the mean reduction in PCL-5 score was over 10 points and for the PHQ-8 was nearly 5 points, reductions that are typically considered clinically meaningful [50, 51]. Furthermore, our findings suggest that even partial completion of BPS webSTAIR (completing at least the Welcome Module but not past the second module) is associated with improved PTSD and depressive symptoms, emotion regulation, and psychosocial functioning relative to Waitlist. Therefore, the program may be of some benefit to patients who are unable to fully complete it due to low functional status or other demands on their time.

Overall, only about half of the veterans engaged with peers, with the highest level of non-engagment (70%) occurring in Cohort 3. Analyses of chat data provide may provide insights about the role of peer engagement in mhealth. Based on our analyses of chat data from Cohort 1, requiring a peer chat to move to the next module of the program was associated with a greater number of chat sessions and more messages exchanged, per module and in total. However, it did not contribute to program completion. In fact, the average number of modules completed in Cohort 1 and the proportion of program completers was significantly lower than that in Cohort 3. The introduction of a required engagement with the peer was intended to prompt the participants into peer engagement that otherwise might not have happened and provide an experience of contact that would lead to more engagement with the program and greater completion rates; however, this did not happen. Rather, the higher module completion rate within Cohort 3 suggests that participants were motivated to work through the content even without support. Similar to this study, Possemato and colleagues [34] reported that 55% of Veterans provided with the option to engage with a peer chose not to and suggested that some Veterans might not need or want peer support. We speculate that a flexible, personalized approach to peer utilization leads to better program use and potentially better outcomes. The analyses indicated that while greater module completion was associated with the cohort with flexible peer contact, and increasing module completion was associated with a better outcome, the number of contacts (peer chats) was not associated with better outcome in either cohort. This may be

due to the potential moderating effects of patient preference regarding the use of peer support. For example, only patients who need and want peer support may benefit from it while others might do equally well or better without it. It would be valuable to identify the baseline characteristics of clients who might substantially benefit from peer support versus those who will not. In addition, it may be that clients who will be helped by peer support will experience greater benefit if the peer was proactive in reaching out to the client. In qualitative interviews, mental health coaches have pointed to the value of building in proactive contact initiated by coaches rather than placing the onus on participants to engage [52]. In this study the peers were available to the veterans to chat, but the veterans initiated the contact. Future efforts to enhance the impact of peers may involve modification regarding how proactive they are.

Limitations

The present study has limitations. First, we relied fully on self-report measures administered by phone. Second, for ethical reasons, we did not maintain the waitlist group during the follow-up period and so were unable to conduct between-group analyses of change from pretreatment to follow-up. Third, the study design did not intentionally include an implementation variation regarding required versus optional engagement peers. As a result, the cohort analyses are post-hoc and we have limited information about the veterans' experience. We do not know, for example, the average wait time for a chat, the range of wait time nor the frequency of contact with the research coordinator. Differences in these factors across the cohorts could have contributed to the observed differences in retention rates. Furthermore, chat transcripts were not accessible and thus we were limited in our ability to explain why more chat messages were not associated with better outcomes. It could be that the conversations were routine and pragmatic (e.g., resolving technical issues) versus meaningful guidance about the content of webSTAIR. Lastly, participants were veterans recruited via social media advertisements which may limit generalization of findings beyond veterans or individuals who do not interact with social media.

Conclusions

This study adds to existing literature on mhealth by demonstrating that a brief, transdiagnostic peer-supported web-based program can provide moderate to large improvements in PTSD and depression symptoms as well as in emotion regulation and psychosocial functioning. Given the potential of peer-supported mHealth programs to expand access to evidence-based care for symptoms of PTSD and depression, future research should evaluate how best to deliver peer support, how much to deliver, and for whom the support benefits most. Future studies may also explore alternative formats for the delivery of peer support; for instance, proactive outreach from peer coaches and/or supplementary channels of communication (e.g., phone contacts) to increase flexibility in ways in which a peer relationship can be built. The particular strengths of peer support for specific and varied aspects of mental health care such as treatment engagement, program completion and symptom reduction need to be determined in order to develop maximally efficient and effective mental health services.

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Conflicts of Interest
There are no conflicts of interest.

Abbreviations
BPS: Brief Peer-Supported
STAIR: Skills Training in Affective and Interpersonal Regulation
PTSD: post-traumatic stress disorder
webSTAIR: web-based Skills Training in Affective and Interpersonal Regulation
MDD: major depressive disorder
Mhealth: mobile health

VA: Veteran Affairs
PC-PTSD-5: Primary Care PTSD screen for DSM-5
PHQ-2: Patient Health Questionnaire-2 items
LEC: Life Event Checklist
PCL-5: PTSD Checklist for DSM-5
PHQ-8: Patient Health Qustionnaire-8 Item
DERS-16: Difficulties in Emotion Regulation Scale-16 Item
WSAS: Work and Social Adjustment Scale
REML: restricted maximum likelihood
SE: standard error

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Table 1: *Sociodemographic and Clinical Characteristics of Participants at Baseline*

Baseline characteristic	BPS webSTAIR (*n* = 117)	Waitlist (*n* = 61)
Age[a]	47.66 (9.31)	48.90 (8.49)
Race or ethnic background		
White or Caucasian	80 (68.4%)	40 (65.6%)
Black or African American	17 (14.5%)	9 (14.8%)
Hispanic, Latino(a) or Mexican	9 (7.7%)	7 (11.5%)
American Indian or Alaskan Native	4 (3.4%)	3 (4.9%)
Other	5 (4.3%)	0 (0.0%)
Self-identified gender		
Male	81 (69.2%)	44 (72.1%)
Female	36 (30.8%)	16 (26.2%)
Transgender	0 (0.0%)	1 (1.6%)
Lifetime Trauma (LEC)	10.92 (2.68)	10.84 (2.62)
Baseline Outcomes		
PCL-5	48.41 (14.55)	43.93 (16.84)
PHQ-8	15.41 (5.23)	13.48 (5.66)
DERS-16	52.44 (13.95)	48.18 (15.26)
WSAS	27.05 (8.70)	25.25 (9.14)

Table 2: *Imputed Means, Standard Deviations, and Cohen's d Effect Sizes of Outcomes*

		Time point						Cohen's *d* (95% CI)		
Measure	Condition	Pretreatment		Posttreatment		Follow Up		Time (Pre to Post) x Condition Interaction	Pre to Post Change for BPS webSTAIR	Post to FU Change for BPS webSTAIR
		M	*SD*	*M*	*SD*	*M*	*SD*			
PCL-5	BPS webSTAIR	48.41	14.55	41.28	17.56	42.09	18.28		-0.48** (-0.76, -0.21)	0.05 (-0.23, 0.32)
	Waitlist	43.93	16.84	43.39	17.86					
								-0.43* (-0.78, -0.07)		
PHQ-8	BPS webSTAIR	15.41	5.23	12.05	5.77	12.71	6.13		-0.64*** (-0.87, -0.40)	0.12 (-0.15, 0.39)
	Waitlist	13.48	5.66	12.88	5.77					
								0.51* (-0.90, -0.12)		
DERS-16	BPS webSTAIR	52.44	13.95	43.04	15.10	44.95	15.97		-0.61*** (-0.85, -0.36)	0.07 (-0.19, 0.34)
	Waitlist	48.18	15.26	47.50	14.82					
								-0.60** (-0.99, -0.21		
WSAS	BPS webSTAIR	27.05	8.70	21.74	10.44	22.83	10.72		-0.61*** (-0.87, -0.35)	0.13 (-0.12, 0.38)
	Waitlist	25.25	9.14	23.27	10.40					
								-0.38* (-0.74, -0.01)		

Note. All models controlled for potential cohort effects. BPS = Brief Peer-Supported; FU = Follow Up; PCL-5 = PTSD Checklist for DSM-5; PHQ-8 = Patient Health Questionnaire – 8; DERS-16 = Difficulties in Emotion Regulation Scale – 16. WSAS = Work and Social Adjustment Scale$P < .05$. ** $P < .01$. *** $P < .001$.

Table 3: *Results from Mixed Models Examining Pre to Post Changes in Outcome by Completion Group*

Measure	Module Completion Category											
	None (n=25)[a]				Some (n=48)[b]				Moderate to Complete (n=44)[c]			
	Estimate	SE	*d*	95 % CI	Estimate	SE	*d*	95 % CI	Estimate	SE	*d*	95 % CI
PCL-5	-1.88	4.72	-0.13	(-0.79, 0.53)	-6.77*	3.16	-0.50	(-0.95, -0.04)	-10.13***	2.49	-0.64	(-0.95, -0.33)
PHQ-8	-1.15	1.46	-0.23	(-0.82, 0.35)	-3.09**	0.96	-0.68	(-1.09, -0.27)	-4.82***	0.82	-0.81	(-1.08, -0.54)
DERS-16	-2.18	4.26	-0.13	(-0.65, 0.38)	-8.44**	2.69	-0.70	(-1.13, -0.26)	-12.16***	2.07	-0.83	(-1.11, -0.56)
WSAS	-2.33	2.62	-0.25	(-0.79, 0.30)	-5.04**	1.74	-0.64	(-1.07, -0.20)	-7.31***	1.32	-0.81	(-1.10, -0.52)

Note. CI = Confidence interval; PCL-5 = PTSD Checklist for DSM-5; PHQ-8 = Patient Health Questionnaire – 8; DERS-16 = Difficulties in Emotion Regulation Scale – 16. WSAS = Work and Social Adjustment Scale.

[a] Completed no modules.

[b] Completed through the Welcome Module, Module 1, or Module 2.

[c] Completed through Module 3 or beyond.

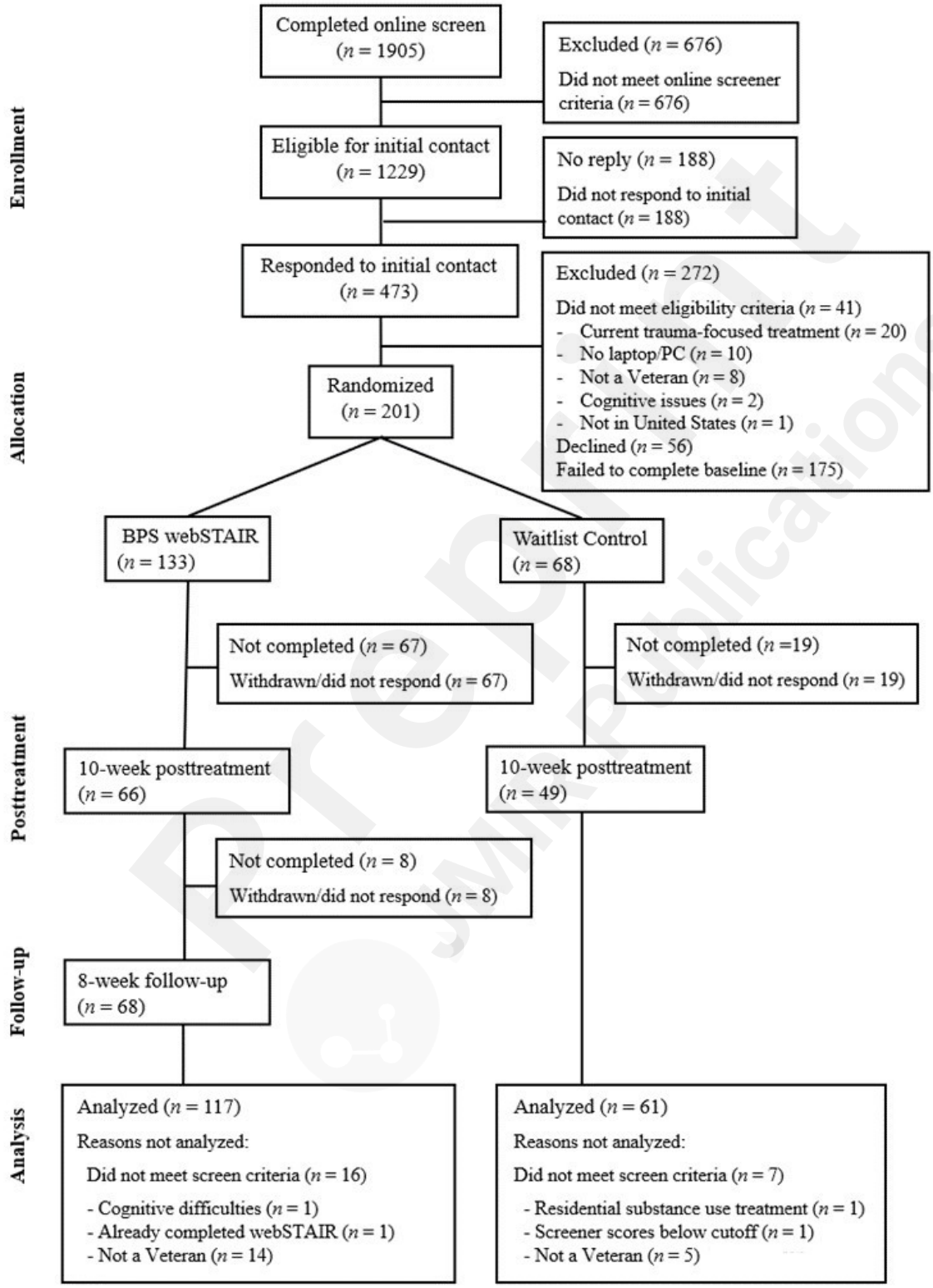
*P < .05. ** P < .01. *** P < .001.

Table 4: *Peer Chat Usage Metrics by Cohort*

	Cohort 1 (*n* = 31)	Cohort 2 (*n* = 46)	Cohort 3 (*n* = 40)	All Cohorts (*N* = 117)
No messages exchanged (%)	10 (32.3%)	17 (37.0%)	28 (70.0%)	55 (47.0%)
Total messages exchanged (SD)	48.87 (62.24)	21.46 (36.09)	23.58 (53.04)	29.44 (50.90)
Messages exchanged per module [a](SD)	11.92 (11.35)	5.97 (7.79)	4.44 (9.24)	7.02 (9.73)
No modules completed (%)	11 (35.5%)	13 (28.3%)	1 (2.5%)	25 (21.4%)
Modules completed (SD)[a]	2.45 (2.68)	2.43 (2.53)	4.05 (2.75)	2.99 (2.73)
Completed program (%)	6 (19.4%)	8 (17.4%)	16 (40.0%)	30 (25.6%)

[a] BPS webSTAIR includes a Welcome Module and 6 intervention modules. Module completion is presented on a scale of 0 to 7, where 7 indicates completion of the Welcome Module and six intervention modules.

***Figure 1**: CONSORT Diagram*



Supplementary Files

CONSORT (or other) checklists

Updated CONSORT Chart.
URL: http://asset.jmir.pub/assets/33ebf8e9251c60fbf116c6fcb41ab37c.pdf