Using a Mobile Application in the Management of Anger Problems Among Veterans: A Pilot Study

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ABSTRACT Objective: This feasibility pilot study evaluated the usability of a mobile application (app), Remote Exercises for Learning Anger and Excitation Management (RELAX), as an adjunct to an anger management treatment delivered to Veterans. Methods: Four Veterans completed pre- and post-treatment measures of anger, post-traumatic stress disorder, depression, interpersonal functioning, and app use. Results: Descriptive results of clinical outcomes are provided. Qualitative data included Veterans' and therapists' feedback regarding the acceptability of the technology, satisfaction with the RELAX app, homework facilitation, and suggestions for improvement. Large reductions in anger, post-traumatic stress disorder and depression symptoms, and improvements in social functioning were evidenced post-treatment. Veterans reported that the RELAX app was helpful and appreciated its functionality. Conclusions: Our findings support using an app as an adjunct to traditional anger management.

INTRODUCTION

Military service members and Veterans often experience high levels of anger,[1,2] as well as associated conditions such as post-traumatic stress disorder (PTSD).[3,4] Dysregulated anger may also be related to impaired family and social functioning, as increased rates of substance abuse, domestic violence, sexual violence, and child abuse have been seen in Veterans with PTSD.[5–9] Several treatments have been developed for dysregulated anger and stress[10–14]; however, barriers are often encountered when conducting mental health treatments with Veterans. Critical logistical barriers to care for many rural Veterans include limited access to specialty care because of large geographic distances that Veterans must travel to mental health facilities and monetary costs associated with transportation and child care.[15,16] Other obstacles to receiving care center on a Veteran's tendency to avoid perceived stigma associated with mental health treatment.[17] In addition, many Veterans who initiate psychotherapies drop out of treatment before attending an adequate number of sessions for the treatment to be effective.[18] High rates of dropout (i.e., up to 30%) have been evidenced among Veterans in effectiveness trials of mental health treatments for PTSD.[19,20]

Cognitive behavioral treatment (CBT) for anger management is an evidence-based treatment (EBT) that typically incorporates workbooks, homework assignments (e.g., self-monitoring work sheets, journaling), and audio-recording of treatment sessions as part of the treatment protocol. Additional barriers to care that patients receiving CBT for anger management experience include a limited ability for Veterans to practice anger management skills outside of the therapy session in more naturalistic settings and limited opportunity for therapist provision of feedback to clients. A potential solution to these difficulties is the use of mobile technologies (e.g., smartphones).[21] "Where" a patient can receive care using mobile technologies includes the home, at work, and on the go since mobile devices are almost always turned on and within reach, thus eliminating many potential obstacles for Veterans when receiving mental health care.

Mobile application (app) delivery allows materials to be downloaded to reside on the user's device, thus avoiding a dependency on Internet connectivity at the specific moment the user wants to access treatment materials. This is especially helpful for those requiring just-in-time tools to manage acute distress and rural and/or low-income users who may not have access to or be able to afford dependable high-speed Internet. Mobile-based monitoring tools can be quick, easy, and discreet during the recording and retrieval of self-tracking information and provide the additional benefit of almost always being with the user, thus facilitating more accurate in vivo recordings. Mobile devices can also be used to cue periodic self-assessment, provide timely reminders for treatment-related tasks and monitoring, and render tailored

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assessments and customize educational material or messages based on initial responses in real time to best fit the user's specific experiences. A few studies have shown clinical effects on outcomes of interventions delivered via mobile phones, texting, and apps conducted with Veterans with mental health disorders.[22–24] Despite promising preliminary findings, there is a lack of research on psychological interventions provided over apps,[25] particularly app delivery of anger treatment.

In this pilot study, we evaluated the usability of a mobile app, Remote Exercises for Learning Anger and Excitation Management (RELAX), as an adjunct to an EBT for anger management delivered to Veterans. Remote tools for EBTs exist to help identify and treat symptoms of depression (e.g., MoodGym[26]), anxiety (e.g., Virtual Reality[27]), and PTSD (e.g., PTSD Coach,[28] PE Coach[24]); however, no such system exists to address anger management among Veterans. The primary goal of this study was to explore Veteran and therapist usability and acceptability ratings of the RELAX app as an adjunct to anger treatment.

METHODS

Participants

Five Veterans from the Trauma Stress Recovery Program of the VA Pacific Islands Health Care System and community sites participated in group anger management. Two Veterans served in the Army, two in the Air Force, and one in the Marines. Two Veterans served during the Vietnam War era, one served in Desert Storm/Desert Shield, one served in the Post-Cold war era (1991–2001), and one served in the Operation Iraqi Freedom/Operation Enduring Freedom/Operation New Dawn war era. The Veterans' average age was 54.2 years (standard deviation = 13.4, range = 36–66 years). Four Veterans were married and one was separated. The sample was comprised of two Pacific Islander Veterans, two White Veterans, and one Latino/Hispanic Veteran. Ethnicity was determined by the Veterans' self-report of primary race/ethnicity. Two Veterans graduated college, two Veterans attended some college, and one Veteran was a student. One Veteran was working full time, one was working part time, one was unemployed, one was unable to work as a result of disability, and one was retired. Four Veterans were service connected for an injury sustained during military service and one was service connected for PTSD.

Measures

Technology Feedback Questionnaire

Usability ratings for the RELAX app were collected throughout treatment, immediately post-treatment, and at the 3-month follow-up interview. Single items were used to assess: (1) ease of app use, (2) frustration with app use, and (3) helpfulness of the app in dealing with anger. Each item was measured on a 6-point scale, with a rating of 1 corresponding to "very easy" and a rating of 6 corresponding to "very difficult." For ease of interpretation, responses have been recoded so that lower scores represent more negative ratings ("difficult to use," "frustrating to use," "not helpful") and higher scores represent more favorable ratings ("easy to use," "not frustrating to use," "helpful").

State-Trait Anger Expression Inventory-2

The State-Trait Anger Expression Inventory-2 (STAXI-2)[29] consists of 57 items assessing the intensity of anger as an emotional state (state anger), the tendency of an individual to experience state anger or anger proneness (trait anger), anger expression, and anger regulation. The STAXI-2 has demonstrated strong reliability and validity.[29,30] The 10-item STAXI-Trait Anger scale (STAXI-Trait) and 32-item STAXI-Anger Expression Index (STAXI-AEI) were both administered.

Dimensions of Anger Reactions-5

The Dimensions of Anger Reactions-5 (DAR-5)[31] is a brief, reliable, and valid screening measure of common anger reactions. Items on the DAR-5 assess anger frequency, intensity, duration, interpersonal aggressiveness, and the extent to which anger interferes with interpersonal relationships.

Inventory of Psychosocial Functioning-Brief

The Inventory of Psychosocial Functioning-Brief[32] is a 7-item self-report instrument developed and validated for use with active duty service members and Veterans to assess functional impairment across a spectrum of domains of functioning over the previous 30 days: (1) romantic relationships, (2) family relationships, (3) work, (4) friendships and socializing, (5) parenting, (6) education, and (7) self-care.

Patient Health Questionnaire—Depression Subscale

The Patient Health Questionnaire (PHQ-9)[33,34] is a 9-item, brief, self-report screening tool that assesses the presence and severity of depressive symptoms in the previous month. The items are based directly on the diagnostic criteria for major depressive disorder in the *Diagnostic and Statistical Manual of Mental Disorders- Fourth Edition* (DSM-IV).[35] The measure is reliable, valid, and sensitive to changes in depressive symptoms.[33,36,37]

PTSD Checklist for DSM-5 (PCL-5)

The PCL-5[38] is a modified version of the PCL, which is one of the most widely used PTSD self-report measures and consistently displays excellent psychometric properties.[39] The PCL-5 reflects the new DSM-5[40] criteria for PTSD. Recent research has found the PCL-5 to have psychometric properties commensurate to its predecessor.[41]

Procedures

Qualitative Data Analysis

Results focus on qualitative descriptions of implementation issues and modifications made to the RELAX protocol. Veterans were asked questions throughout the treatment regarding their prior experience with mobile app interventions, comfort levels regarding technology, and perceptions of the RELAX app, iPod Touch, and heart rate monitor. Veterans' statements regarding the ease of use, frustration with, and perceived helpfulness of the RELAX app and associated technology are presented. The Veterans' satisfaction with the functionality of the RELAX protocol, including the portability and ability to individualize the app, was also examined.

Quantitative Data Analysis

Because of the small sample size and high variability among scores on continuous measures, Wilcoxon signed rank tests were used to examine changes in median scores across time. Secondary analyses using paired *t* tests are presented comparing changes in mean scores over time; however, results based on means should be interpreted with caution because of the small sample size and poor distributional properties. All quantitative analyses were conducted using SPSS 19 (IBM Corporation, Armonk, New York).

Anger Management Treatment

This study utilized a manualized group anger management treatment protocol[42,43] based on a cognitive behavioral treatment approach that provides psychoeducation and teaches self-monitoring, relaxation, cognitive restructuring, assertiveness training, and communication skills. Sessions are typically 90 minutes long; however, some sessions were extended up to 110 minutes to allow additional time for technology coaching.

Anger Management Mobile App

The RELAX system was developed in collaboration with the staff of Charles River Analytics, Inc. This system was funded by the U.S. Army Medical Research and Material Command. The RELAX program is free for U.S. Government use, but is not publically available at this time. The RELAX system is composed of a mobile app, a heart rate monitor, a remote server, and a web-based therapist interface. This system allows for out-of-session practice of skills taught in the anger management protocol, self-monitoring and recording of biofeedback (i.e., heart rate), and collection of certain user data on the remote server, which can then be shared with the therapist through the therapist interface. The app design allows users to monitor their anger, including anger frequency, intensity, and anger cues (or warning signs). The RELAX app also contains exercises to help the user manage anger, such as time-out plans, progressive muscle relaxation, diaphragmatic breathing, and cognitive restructuring and it allows users to personalize these techniques to their individual anger profiles. These exercises are meant to enable users to create an individually tailored anger control plan within the app.

Treatment Modifications

In addition to adding more time to certain sessions, a few other modifications were made to the treatment protocol. Specifically, an Apple TV was used during treatment sessions to orient participants to the RELAX app and demonstrate new app functions (corresponding to new skills taught in group). Fidelity sheets, checklists, and scripts for organizing technology information were utilized and a manual for the app was created. Thus, Veterans were provided with both the anger management and RELAX app manuals. Veterans were asked to complete all their assignments in the app instead of the anger management manual.

RESULTS

Table I provides descriptive statistics for all scaled outcome measures. Only 4 of 5 participants completed treatment and the 2 post-treatment assessments. Because of the very small sample size, descriptive results should be the primary means for evaluating outcomes of the RELAX intervention.

User Ratings of RELAX App

Veteran perceptions of the RELAX app, the iPod Touch, and the heart rate monitor were assessed throughout treatment, midtreatment, immediately post-treatment, and at 3 months post-treatment. Figure 1 depicts median ratings of

TABLE I. Descriptive Statistics for Continuous Outcome Measures at Baseline, Post-Treatment, and 3-Month Follow-Up Interviews

	Baseline		Post-Treatment		3-Month Follow-Up	
Outcome Measure	Mean (SD)[a]	Median	Mean (SD)[a]	Median	Mean (SD)[a]	Median
STAXI-Trait	26.0 (6.7)	23.0	15.3 (3.8)*	15.0***	19.5 (11.2)	16.5
STAXI-AEI[b]	54.0 (18.2)	55.5	20.0 (15.1)***	20.5	31.5 (25.0)	25.0
PCL-5	66.3 (7.7)	64.5	35.8 (30.9)***	35.5***	35.3 (32.4)***	31.5
PHQ-9	20.3 (10.0)	16.0	15.3 (13.6)	13.0	7.3 (10.0)*	3.5
B-IPF[c]	2.9 (1.4)	3.4	2.2 (1.9)	2.9	1.6 (1.6)*	1.3
DAR-5	18.3 (4.2)	20.0	10.0 (3.9)**	10.5***	14.0 (6.8)	12.5

[a]SD, standard deviation. [b]STAXI-AEI, STAXI-Anger Expression Index. [c]Inventory of Psychosocial Functioning-Brief. *$p < 0.05$, **$p < 0.01$, ***$p < 0.10$.

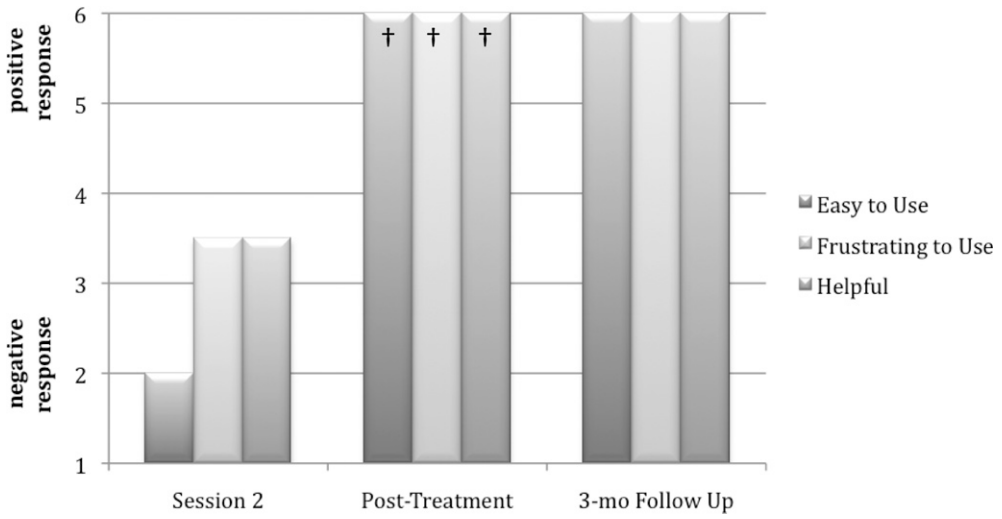

FIGURE 1. Median ratings for mobile app based on ease of use, frustration with app use, and helpfulness of app.

(1) ease of app use, (2) frustration related to app use (reverse scored), and (3) helpfulness of the app. Helpfulness of the app was rated with regard to learning the treatment content, practicing the skills, tailoring treatment to their personal experiences and needs, and helping them recognize symptom change over time. Early in treatment (Session 2) Veterans reported difficulty with using the app. However, at the end of treatment ($n = 4$) and 3 months after treatment ($n = 3$), participants unanimously rated the app as very easy to use, not at all frustrating, and very helpful.

Acceptability of Technologies

None of the Veterans reported prior experience with a mobile app intervention and only 2 reported having ever heard of a mobile app intervention. Comfort levels regarding technology use before participation varied greatly among group members. Notable Veteran quotes related to acceptability and satisfaction included

"The technology is absolutely outstanding."

"For me personally this is wonderful . . . it's helped me tremendously."

"It's like having two doctors, one on your wrist [referring to the heart-rate monitor] and one in your pocket [referring to the app which was loaded on the iPod Touch]."

Satisfaction With Functionality

Veterans appreciated the portability ("handy and convenient way to log anger reports") of the app and its discreteness ("nobody knows what I am doing"). Veterans liked the history function, which helped them to review and reflect on gains made during treatment. Some commented that looking back on anger reports helped them realize how reactive they were to the "little things." Veterans also appreciated that the app was customizable to incorporate their own personal anger triggers, cues, and preferred strategies. The app's ability to be tailored increased motivation for using the app and justified their time and effort. Veterans reported enjoying the biofeedback information, which helped them increase their awareness of escalating anger intensity and the impact on their various health conditions (e.g., heart problems, hypertension). The heart rate monitor also served as a reminder to stay mindful of their anger and to consciously attempt to control it.

Therapist Feedback

Generally, therapists viewed the main benefit of the RELAX system as its portability and discreteness as Veterans were able to practice the skills conveniently and in the moment instead of waiting to get home to their manuals or work sheets. Since these devices were constantly with the Veterans, they served as a consistent reminder to use their skills and manage their anger and aggressive impulses. Therapists provided suggestions to improve the usefulness of the therapist interface, many of which were implemented. The interface's current design allows for a quick overview of app use since the last session (number of anger reports completed, number of exercises completed, time spent with the app) and gives detailed information regarding anger reports (anger meter ratings, triggering events). Participants knew that these reports were printed and reviewed at the beginning of each session, which may have added to a sense of accountability and increased homework compliance.

Anger and Anger-Related Impairment

Results indicated large reductions on all anger measures at post-treatment and 3-month follow-up. At post-treatment, 3 of the 4 cases dropped below the STAXI cutoff of 20 points that is used to indicate clinically significant anger, with the remaining case having a score of 20. At 3-month follow-up, 2 cases were below the cutoff, 1 case had a score of 20, and

the remaining case reported an elevated anger score. Immediately post-treatment, all participants had STAXI-Anger Expression Index and STAXI-Trait scores at or below a STAXI-T score of 56, suggesting a return to a functional state. At 3-month follow-up, 3 of the 4 Veterans remained in this range. However, 1 Veteran had a STAXI-Trait score above 75, indicating clinically significant issues with anger. All Veterans demonstrated large reductions on the DAR-5. Using the clinical cutoff on the DAR-5 (12 points), although all 4 Veterans started in the clinically impaired range at the baseline assessment, only 2 remained in that range at both post-treatment and 3-month follow-up.

Mental Health

PTSD symptom scores showed large reductions at post-treatment and 3-month follow-up. Although all 4 Veterans' PCL-5 scores indicated a likely diagnosis of PTSD at pretreatment, only 2 scores remained in this range at post-treatment and only 1 at 3-month follow-up. Similar results were found for depressive symptoms. 1 Veteran had missing data on the PHQ-9 at baseline. The remaining 3 Veterans reported significant levels of depression at baseline (1 mild, 1 moderate, and 1 severe). However, at post-treatment, 2 cases no longer reached the clinical cutoff for depression on the PHQ-9 and the Veteran previously reporting severe depressive symptoms at baseline reported symptoms in the mild range.

Interpersonal Functioning

1 Veteran was missing baseline data on the Inventory of Psychosocial Functioning-Brief. The 3 remaining Veterans reported improvements in social role functioning following the intervention, including reductions in impairment scores of 7%, 17%, and 100% at post-treatment and 65%, 67%, and 89% at 3-month follow-up, respectively.

DISCUSSION

Research on the development, optimization, and implementation of mobile apps for PTSD and related symptoms such as anger is still in its infancy. Pilot studies suggest the potential value of using mobile devices to support or enhance PTSD treatment,[23,24] although no efficacy studies have yet been completed. The Veterans found the RELAX app and heart monitor to be helpful components of the treatment. Veterans and therapists provided suggestions for improvements to increase the ease of learning and usability of the app. Relative to their baseline scores, the 4 Veterans in this pilot study displayed large reductions on both anger and PTSD outcome measures after anger treatment with the adjunct RELAX app.

These findings support and extend prior work showing that apps provide Veterans with a way to safely and discreetly access self-support tools between therapy appointments. This is the first study to evaluate an app that specifically targets anger symptoms. Because of the small sample size and lack of a control group, we are unable to draw generalizable conclusions about whether the app resulted in more homework completion or bolstered clinical outcomes. The Veterans' positive responses and clinically meaningful improvements in anger symptoms are evidence that this app is a promising tool for managing anger symptoms.

We can expect the acceptability and convenience of mobile delivery to increase as app-enabled devices become more widely used across social classes and age groups. Veterans in our sample represented an array of war eras and branches of the military. However, more research is needed to assess whether inclusion of apps as a component of psychological treatment can improve patient outcomes and through which mechanisms and under what conditions such apps are most helpful to aiding patients' recovery. Further research is also needed to understand what modalities are best suited to specific care processes and how design factors and process variables (e.g., therapeutic alliance, protocol adherence) impact engagement with and clinical outcomes of technology-based tools. Future research must focus on how to best integrate successful tools into clinical care and enable more automatic, remote transmission of treatment through technology. Findings from future studies should feed back into the design and dissemination of the products themselves and provide an evidence base for new treatments. The successful incorporation of apps into mental health treatments could dramatically change future treatment models.

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