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## Pilot trial of a transdiagnostic computerized anxiety sensitivity intervention among VA primary care patients

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### ABSTRACT

People in need of mental health treatment do not access care at high rates or in a timely manner, inclusive of Veterans at Department of Veteran's Affairs (VA) medical centers. Barriers to care have been identified, and one potential solution is the use of technology-based interventions within primary care. This study evaluated the Cognitive Anxiety Sensitivity Treatment (CAST), a previously developed computerized treatment that has shown efficacy in community samples for mental health symptoms including: anxiety, depression, post-traumatic stress, and suicidal ideation. VA primary care patients with elevated anxiety sensitivity ( $N = 25$ ) were recruited to participate in a mixed-method open pilot to examine acceptability, usability, and preliminary effectiveness in a VA primary care setting. Participants completed an initial visit, that included the intervention, and a one-month follow-up. Veterans found CAST to be generally acceptable, with strong usability ratings. Qualitative analyses identified areas of strength and areas for improvement for use with VA primary care Veterans. Repeated measures ANCOVAs revealed significant effects for symptoms of anxiety, depression, traumatic-stress, and suicidal ideation. CAST could potentially have a large public health impact if deployed across VA medical centers as a first-step intervention for a range of mental health presenting concerns.

### 1. Introduction

People in need of mental health treatment typically do not access care at high rates or in a timely manner. Nationally representative, population-based research suggests that only 41% of those with mental health disorders access treatment the year prior and only 33% receive minimally adequate treatment, if any treatment at all (Wang et al., 2005). Delays from mental health disorder onset to treatment initiation can span years, with the average delay reaching a decade in the U.S. (Wang et al., 2004).

Problems accessing mental health care persist for some in the Department of Veterans Affairs (VA; Keller & Tuerk, 2016; Maguen et al., 2012). For example, thirty-five percent of Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans at the VA meet criteria for at least one mental health diagnosis. Even with improvements in access to treatments for some mental health disorders

(Karlín and Cross, 2014; Goldberg et al., 2019) many Veterans never access mental health care, or do not received adequate doses of mental health care, despite the presence of impairing mental health symptoms (Brown and Jones, 2016; Seal et al., 2010; Teich et al., 2016).

Veteran barriers to care have been specified (e.g., Bovin et al., 2019; Possemato et al., 2018; Tanielian and Jaycox, 2008), including concerns about stigma, medication side effects, confidentiality, and logistical barriers such as Veteran schedule and access. To address these issues, and consistent with national healthcare priorities (Institute of Medicine, 2014), VA has aggressively pursued the embedding of mental health specialists in primary care (Department of Veterans Affairs, 2015). Integrated mental health allows for the treatment of mild to moderate psychiatric disorders and behavioral health problems in primary care, with on-going symptom assessment and a stepped-care approach to referrals to additional mental health interventions. In stepped-care approaches, patients are started with the least intensive

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treatment and are offered more intensive treatments as needed (Bower and Gilbody, 2005). This approach is thought to have the potential to increase both treatment engagement and efficiency in providing mental health care. Indeed, embedding mental health specialists in primary care and employing a stepped-care approach has been shown to improve access to mental health services (Leung et al., 2019; Leung et al., 2018).

Technology-based interventions can play an important role in integrated mental health stepped-care approaches to treatment (e.g., Espie, 2009; Green and Iverson, 2009), as they address some barriers to care by drawing on convenience, the ability to reach individuals in remote locations and on the patient's schedule, and the elimination of face-to-face meetings with clinicians, thereby reducing stigma associated with seeing a mental health professional. One highly promising technology-based intervention for mental health symptoms is the Cognitive Anxiety Sensitivity Treatment (CAST; Schmidt et al., 2014). CAST specifically targets anxiety sensitivity, or a fear of anxiety and related sensations, which has been shown to be a transdiagnostic risk factor that contributes to the development and maintenance of a variety of mental health symptoms, including anxiety, depression, post-traumatic stress, and suicidal ideation (Capron et al., 2013; Marshall et al., 2010; Naragon-Gainey, 2010). CAST is a fully computerized, 45-minute intervention that comprises education about the nature of anxiety symptoms and a guided interoceptive exposure exercise (i.e., voluntary hyperventilation), which is a well-established, highly effective intervention for reducing fearful responding to anxiety sensations (Schmidt and Trakowski, 2004).

CAST has demonstrated efficacy in reducing symptoms of PTSD, anxiety, depression, and suicidal ideation in multiple randomized controlled trials (Schmidt et al., 2014, 2017; Short et al., 2017a), but limited research exists among Veterans. A secondary analysis (Short et al., 2017b) of CAST users from a previous randomized clinical trial (Schmidt et al., 2014) found that the sub-set 16 community-dwelling Veterans in the sample reported moderate or higher usability and applicability, and Veterans' acceptability ratings were modestly higher than non-Veteran participants. Another study evaluated CAST among 16 Veterans engaged in a VA intensive outpatient treatment for opioid use disorder. This study reported adequate acceptability/usability and a medium effect size for reductions in anxiety sensitivity. Small-to-medium effect size reductions were found for depression, anxiety, and stress. Notably, neither of these prior studies examined acceptability of CAST among Veterans engaged with primary care at VA, and neither included qualitative methods to determine areas for improvement for use with Veterans.

Veterans in primary care present with a broad range of needs, broad range of symptoms (Seal et al., 2007), and are arguably an ideal population and setting to deploy a first-step intervention, a single-session, transdiagnostic intervention (Bower and Gilbody, 2005) such as CAST due to the potential of eliminating the potential barriers associated with referral to specially mental health. Examining acceptability, usability, and preliminary efficacy of CAST, and gathering critical qualitative feedback to determine potential areas for improvement is an essential next step towards successfully deploying this intervention, and other similar interventions, within a large healthcare system like VA.

This study evaluated the use of the CAST program in VA primary care patients through an open, pilot trial. The primary outcomes were traumatic stress, anxiety, and depressive symptoms. Qualitative feedback was collected to assess acceptability and usability of the intervention as well as to determine potential areas of improvement for using CAST with Veterans within a primary care setting. Study aims were to: (1) collect user feedback from Veterans regarding the acceptability/usability of CAST and potential areas of improvement for use with Veterans, and; (2) investigate the preliminary efficacy of CAST in reducing mental health symptoms (anxiety, depression, and PTSD) among Veterans enrolled in VA primary care.

## 2. Method

### 2.1. Participants

US military Veterans ( $N = 25$ ) were recruited from a large VA medical center via referrals from healthcare providers, flyers/brochures, and staffed waiting area tables in the primary care clinic and outpatient mental health clinic. Veterans were invited to participate in a study examining a "computerized treatment for stress and anxiety." Veterans were eligible if they were (1) enrolled in primary care at the VA facility and (2) scored at least 1 SD above the community mean on the Anxiety Sensitivity Index-3 (ASI-3) cognitive subscale (score of  $\geq 7$ ; Taylor et al., 2007). Exclusionary criteria included: (1) age greater than 65, (2) women who are pregnant, (3) history of stroke, seizure, irregular heartbeat, or heart failure, (4) uncontrolled Chronic Obstructive Pulmonary Disease (COPD), emphysema, or asthma. Given the study team's inability to provide medical clearance for participation, exclusionary criteria were selected in consultation with a physician to ensure no negative side effects of the interoceptive exposure exercise (voluntary hyperventilation) among individuals with these characteristics. Participants were on average 51.44 years old ( $SD = 9.49$ ) and the majority identified as male (84%) and Caucasian (72%). Full sample demographics can be found in Table 1.

### 2.2. Measures

#### 2.2.1. Anxiety Sensitivity Index – 3 (ASI-3)

The ASI-3 is an 18-item questionnaire used to assess fear of anxiety-related sensations and has been validated in community and clinical samples (Taylor et al., 2007). Participants rate the degree to which they

**Table 1**  
Demographic information.

|   |       |        |
|---|-------|--------|
| Characteristic  |       |        |
| Age, <i>M (SD)</i>  | 51.44 | (9.49) |
| Gender, <i>n (%)</i> , Female                             | 4     | (16.0) |
| Race, <i>n (%)</i>  |       |        |
| American Indian   | 0     | (0.0)  |
| Asian   | 0     | (0.0)  |
| Black or African American                                 | 7     | (28.0) |
| Native hawaiian/pacific islander                          | 0     | (0.0)  |
| White   | 18    | (72.0) |
| Other/mixed race  | 0     | (0.0)  |
| Ethnicity, <i>n (%)</i> , hispanic or latino <sup>a</sup> | 2     | (8.0)  |
| Highest degree obtained, <i>n (%)</i>                     |       |        |
| High school diploma/GED                                   | 10    | (40.0) |
| Associate's degree  | 5     | (20.0) |
| Bachelor's degree   | 7     | (28.0) |
| Master's degree   | 0     | (0.0)  |
| Doctoral degree   | 1     | (4.0)  |
| Other   | 2     | (8.0)  |
| Marital status  |       |        |
| Never married   | 3     | (12.0) |
| Married   | 10    | (40.0) |
| Legally separated/divorced                                | 12    | (48.0) |
| War era during service                                    |       |        |
| Vietnam   | 2     | (8.0)  |
| Gulf war  | 12    | (48.0) |
| OEF   | 2     | (8.0)  |
| OIF   | 1     | (4.0)  |
| Other   | 8     | (32.0) |
| Deployed to combat zone, <i>n (%)</i> , yes               | 11    | (44.0) |
| Psychotherapy for emotional problems <sup>a</sup>         |       |        |
| No  | 0     | (0.0)  |
| Yes, in the past  | 10    | (40.0) |
| Yes, currently  | 14    | (56.0) |
| Medication for emotional problems <sup>a</sup>            |       |        |
| No  | 2     | (8.0)  |
| Yes, in the past  | 10    | (40.0) |
| Yes, currently  | 12    | (48.0) |

Note. <sup>a</sup> one participant had missing data.

agree with each item on a 5-point scale ranging from “Very Little” to “Very Much”. Higher scores indicate a greater fear of anxiety-related sensations. The ASI-3 was administered at baseline, post-intervention, and at 1-month follow-up. In the current sample the ASI-3 demonstrated excellent internal consistency at baseline ( $\alpha = .93$ ).

### 2.2.2. Generalized Anxiety Disorder 7 (GAD-7)

The GAD-7 (Spitzer et al., 2006) is a 7-item questionnaire designed to assess anxiety symptoms. The GAD-7 has been widely validated and is commonly used clinically in the VA to assess for symptoms of anxiety. Participants rate how often they have been bothered by specific symptoms on a 4-point scale ranging from “Not at all” to “Nearly every day”. The GAD-7 was administered at baseline and at the 1-month follow-up. In the current sample the GAD-7 demonstrated good internal consistency at baseline ( $\alpha = .87$ ).

### 2.2.3. Patient Health Questionnaire 9 (PHQ-9)

The PHQ-9 (Spitzer et al., 1999) is a 9-item questionnaire designed to assess symptoms of depression. The PHQ-9 has been widely validated and is used in routine practice in the VA to assess for symptoms of depression. Participants rate how often they have been bothered by specific symptoms on a 4-point scale ranging from “Not at all” to “Nearly every day”. The PHQ-9 was administered at baseline and at the 1-month follow-up. Consistent with many previous studies (e.g., Louzon et al., 2016; Norr et al., 2018), Item 9 (“Thoughts that you would be better off dead, or of hurting yourself”) was used as an efficient means to examine suicidal ideation. In the current sample the PHQ-9 demonstrated excellent internal consistency at baseline ( $\alpha = .91$ ).

### 2.2.4. PTSD checklist for DSM-5 (PCL-5)

The PCL-5 (Weathers et al., 2013) is a 20-item questionnaire designed to assess the symptoms of PTSD. The PCL-5 has been widely validated and is commonly used clinically in the VA to assess for symptoms of PTSD. Participants rate how much they have been bothered by specific symptoms on a 5-point scale ranging from “Not at all” to “Extremely”. The PCL-5 was administered at baseline and at the 1-month follow-up. In the current sample the PCL-5 demonstrated excellent internal consistency at baseline ( $\alpha = .93$ ).

### 2.2.5. Systems usability scale (SUS)

The SUS is a widely used, 10-item self-report questionnaire that assesses the usability of technology systems (Brooke, 1996). Participants rate their experience with the usability of the computer program on a 5-point scale ranging from “Strongly disagree” to “Strongly agree”. The SUS was administered post-intervention and demonstrated good internal consistency ( $\alpha = .83$ ).

### 2.2.6. Acceptability questionnaire (AQ)

The AQ is an 8-item questionnaire designed to assesses the subjects’ perceived acceptability of, and engagement with, the CAST program across various domains and the items have been used in previous studies examining the CAST program (Norr et al., 2017a; Raines et al., 2020; Short et al., 2017b). The AQ was administered post-intervention.

## 2.3. Qualitative interviews

Two qualitative interviews were conducted (at post-intervention and 1-month follow-up) to assess participants’ user experiences with the CAST program. The questions were designed by study investigators to identify areas for improvement in future iterations of the program. Responses were summarized, transcribing word for word when possible, by a study research coordinator during the interview. For this analysis, only data from the interview administered post-intervention was included. The specific questions were: “What did you like about the program?”, “What did you not like about the program?”, and “What are

three ways this program can be improved for use specifically with Veterans?”.

## 2.4. Procedure

A pre-enrollment study screen to determine eligibility was conducted in person or over the phone by a study research coordinator and lasted approximately 2-5 minutes including completion (written or verbal) of the ASI-3 cognitive subscale. Volunteers deemed initially eligible were then scheduled for the first study visit. At the initial study visit, participants were provided with an overview of the study and completed written informed consent. After informed consent, participants completed baseline self-report measures that assessed demographics, current and past mental health treatment, as well as symptoms of anxiety, depression, and PTSD. Once baseline measures were completed, participants were instructed on how to navigate the CAST program on a laptop computer. After completing CAST (45 minutes), participants completed post-treatment questionnaires to assess changes in anxiety sensitivity levels from baseline, along with rating the acceptability/usability of the CAST program in a VA setting. Following all questionnaires, participants completed a qualitative interview with a study coordinator trained in rapid qualitative inquiry (e.g., Regeer et al., 2017) by an experienced doctoral-level qualitative researcher. The entire in-person visit lasted approximately 2 hours.

At the one-month follow-up visit, participants completed a questionnaire packet to measure symptom change and another qualitative interview to give participants the opportunity to provide additional feedback about the CAST intervention. This entire in-person visit lasted approximately 30-45 minutes.

### 2.4.1. Cognitive Anxiety Sensitivity Treatment (CAST; Schmidt et al., 2014)

The CAST program consists of 50 slides that contain video animation and audio narration throughout, as well as interactive features, such as brief-intermittent quizzes to promote comprehension. Participants start with psychoeducation on anxiety-related sensations (e.g., elevated heart rate, difficulty concentrating) and are provided corrective information aimed at dispelling myths commonly held by individuals with high anxiety sensitivity. Participants are then shown how to complete interoceptive exposures through a guided video and are told that these exposures can help correct their conditioned fear to anxiety-related sensations. Participants then complete ten, 60-second guided hyperventilation trials and are asked to rate after each trial the intensity of the sensations experienced and their subjective distress. After completing the hyperventilation trials, the participant’s responses are graphed by the program to demonstrate any changes over the course of the trials.

## 2.5. Data analytic plan

### 2.5.1. Quantitative analyses

To examine changes in AS from baseline to post ( $N = 25$ ) paired samples t-tests were utilized. Changes in AS and symptoms over the period from baseline to follow-up ( $n = 21$ ), were examined with repeated measures ANCOVAs (baseline and 1-month follow-up time points). The number of individual and group mental health appointments (assessed via medical record review) during the study period (baseline to 1-month follow-up) were included as covariates to control for the effect of mental health appointment attendance over the course of the study. Only participants who completed both measurement points for the test of interest were included.

### 2.5.2. Qualitative analyses

Matrix analysis was used to evaluate the qualitative interview data, which provides a visual template of the systematic coding and categorization process of the pattern of responses collected from

**Table 2**  
Acceptability .

| Item  | n (%)   |
|---|---------|
| Presentation easy to understand                 |         |
| No  | 0 (0)   |
| Somewhat  | 3 (12)  |
| Moderately                                      | 3 (12)  |
| Yes   | 19 (76) |
| Presentation easy to follow                     |         |
| No  | 1 (4)   |
| Somewhat  | 2 (8)   |
| Moderately                                      | 3 (12)  |
| Yes   | 19 (76) |
| Information in presentation was helpful         |         |
| No  | 2 (8)   |
| Somewhat  | 1 (4)   |
| Moderately                                      | 4 (16)  |
| Yes   | 18 (72) |
| Will use information/techniques learned         |         |
| Unlikely  | 2 (8)   |
| A little likely                                 | 1 (4)   |
| Somewhat likely                                 | 6 (24)  |
| Very likely                                     | 16 (64) |
| Information applicable to daily life            |         |
| Not applicable                                  | 0 (0)   |
| A little applicable                             | 4 (16)  |
| Somewhat applicable                             | 8 (32)  |
| Very applicable                                 | 13 (52) |
| Applicable to stressors during military service |         |
| Not applicable                                  | 3 (12)  |
| A little applicable                             | 4 (16)  |
| Somewhat applicable                             | 7 (28)  |
| Very applicable                                 | 11 (44) |
| Engagement during the presentation              |         |
| Not engaged                                     | 0 (0)   |
| A little  | 3 (12)  |
| Somewhat engaged                                | 6 (24)  |
| Very engaged                                    | 16 (64) |
| Interested throughout the presentation          |         |
| Not interested                                  | 0 (0)   |
| A little interested                             | 1 (4)   |
| Somewhat interested                             | 10 (40) |
| Very Interested                                 | 14 (56) |

participants (Averill, 2002). First, two subject matter experts (AMN and GMR) reviewed all interview responses and independently created proposed categories for the matrix. These proposed categories were then reconciled with one another, and the final coding categories were placed along the top of the matrix. Next, two research team members (ACK & JLN) independently coded responses vertically under the corresponding category to display trends and frequency of the responses per category splitting by strengths and weaknesses. All disagreements were reconciled through discussion between the coders.

### 3. Results

#### 3.1. Acceptability and usability

Item-level results from the AQ can be seen in Table 2. The majority of participants rated CAST as at least “moderately easy” to understand (88%), “moderately easy” or “easy” to follow (88%), at least “moderately helpful” (88%), at least “somewhat engaging” (88%), “somewhat interesting” or “very interesting” (96%), and at least “somewhat applicable” to daily life (84%). The majority of participants also found CAST to be “somewhat applicable” or “very applicable” to stressors during military service (72%). Eighty-eight percent of participants reported that they were “somewhat likely” or “very likely” to use the information and techniques learned. SUS scores ( $M = 83.00$ ,  $SD = 13.75$ ) demonstrated good-to-excellent usability and were higher than average SUS scores found through meta-analytic work ( $M = 70$ ; Bangor et al., 2008).

Qualitative data indicated that user reactions to the CAST

**Table 3**  
Characteristic program strengths and weaknesses within each theme.

| Thematic categories |   |
|---------------------|---|
| Valence             | Program usability   |
| Strength            | “I felt very engaged in the program. I’m very audio, so hearing all the information was helpful. The way the information was broken down was helpful/wonderful. Straight forward, straight to the point, short and simple.”<br>“Spoke at a good pace/good learning pace.”   |
| Weakness            | “Break up the information, not all in one session. Allow for discussion with others, put it into a group session.”<br>“Dark theme should change to a lighter theme”   |
|                     | Content quality   |
|                     | “Information and education about myths surrounding stress or anxiety, makes people feel that stress is normal and can be healthy.”<br>“breathing exercises were fun/interesting”  |
|                     | Impact/outcomes   |
|                     | “Noticed stress levels went down”<br>“I liked the myth busting part because several of those myths I believed. My brother-in-law had a heart attack and all this time I believed it was due to stress. The myth education debunked that belief”<br>“did not improve stress symptoms”  |
|                     | Military/Veteran Relevance  |
|                     | “Good examples relevant to veterans already”<br>“More readily available . . . to more people not just in MH treatment . . . Reduces stigma. Let other veterans know in the program that other veterans experience stress and concealing their stress. . . more recruitment to reach others that could benefit.”<br>“More examples that relate to veterans specifically rather than civilians (different types of stress).”<br>“Adding more material related to combat, questions and examples. . . More female veterans. Female specific program would be helpful.” |

intervention largely fell into four domains: usability of the program, quality of content presented, impact of the intervention on the participant, and its applicability to military and Veteran populations. Participants generally highlighted both strengths and weaknesses within each of these domains (see Table 3). When discussing the program's usability and design, participants appreciated that the CAST program was straightforward, easy to use, and easy to understand. Others appreciated the auditory component of the program, commenting on the narrator's voice, tone, and pace while delivering the information. Veterans also noted CAST's overall structure helped with usability—that the layout, order, visual aids, and quizzes solidified their learning. Veterans highlighted three areas of weakness in CAST's usability. First, they suggested that breaks be built into the intervention so that information is easier to absorb. Second, others took issue with the computer-only format and voiced a desire to discuss the ideas presented in a larger group setting. Finally, Veterans noted some technical difficulties that interfered with the program, such as long buffering time slowing the intervention down, distracting flashing between slides, and difficulty viewing the information against a dark background.

When commenting about the content of CAST, many study participants appreciated the education on myths and facts about stress and anxiety and the physiological components of stress, noting they learned something new. When considering the weaknesses of the content, several Veterans highlighted their desire for more information, such as about how stress manifests in different psychiatric diagnoses, specific information about post-traumatic stress disorder, and how to apply these skills to stress in the moment. In addition, some Veterans objected to the myths and facts element of the education, as the “facts” presented did not fit their worldviews. Participants had mixed views on the breathing exercises. Though many highlighted the practical exercises as strengths of the intervention which allowed them to solidify their learning and practice a useful skill, others had difficulty with them and found them distressing.

The fewest responses fell into the impact and outcome domain. Regarding strengths within this domain, several participants were pleased with the observed improvements in their stress levels after completing CAST, and others commented on the lasting knowledge they gained through participation. One Veteran voiced disappointment that their stress symptoms did not improve during the intervention.

Finally, when considering CAST's relevance to military and Veteran populations, many participants found the program quite relatable to Veterans' issues. However, others thought that the inclusion of more combat- and military-specific examples, more visuals of women Veterans (including the option for a female narrator), and information about PTSD specifically would help the program be more relevant. Veterans also noted how useful this program might be among Veterans, as many comments included a call for additional outreach to make it more widely available, including delivery in a remote format that would not require presenting to the medical center.

### 3.2. Changes in AS and mental health symptoms

Paired samples t-test revealed medium effects for baseline to post CAST change in ASI-3 total ( $\Delta M = 7.60$ ,  $\Delta SD = 11.25$ ;  $t_{(24)} = 3.38$ ,  $p = .002$ ;  $d = .68$ ), ASI-3 physical ( $\Delta M = 2.44$ ,  $\Delta SD = 3.98$ ;  $t_{(24)} = 3.07$ ,  $p = .005$ ;  $d = .61$ ), ASI-3 cognitive ( $\Delta M = 2.88$ ,  $\Delta SD = 4.89$ ;  $t_{(24)} = 2.94$ ,  $p = .007$ ;  $d = .59$ ), and ASI-3 social scores ( $\Delta M = 2.28$ ,  $\Delta SD = 4.10$ ;  $t_{(24)} = 2.78$ ,  $p = .01$ ;  $d = .56$ ). Repeated measures ANCOVAs, controlling for mental health appointment attendance between study visits, revealed medium-to-large effects on ASI-3, GAD-7, PHQ-5, PCL-5 and suicidal ideation (PHQ-9 item 9) from baseline to 1-month follow-up (see Table 4 for full results).

**Table 4**

Changes in clinical variables from baseline to 1-month follow-up.

|                   | Baseline |       | Follow-Up |       | $F_{(1,18)}$ | $p$    | $\eta_p^2$ |
|-------------------|----------|-------|-----------|-------|--------------|--------|------------|
|                   | $M$      | $SD$  | $M$       | $SD$  |              |        |            |
| ASI-3 Total       | 38.90    | 16.44 | 29.19     | 17.90 | 26.85        | <0.001 | 0.60       |
| ASI-3 Cognitive   | 13.76    | 6.76  | 9.24      | 6.97  | 27.27        | <0.001 | 0.60       |
| ASI-3 Physical    | 11.19    | 5.74  | 7.90      | 6.38  | 28.68        | <0.001 | 0.61       |
| ASI-3 Social      | 13.95    | 6.05  | 12.05     | 6.22  | 10.54        | 0.004  | 0.37       |
| GAD-7             | 13.24    | 5.38  | 10.52     | 6.28  | 19.20        | <0.001 | 0.52       |
| PHQ-9             | 14.76    | 7.55  | 10.05     | 6.00  | 21.03        | <0.001 | 0.54       |
| PCL-5             | 44.90    | 16.42 | 34.29     | 18.87 | 13.52        | 0.002  | 0.43       |
| Suicidal ideation | 0.90     | 1.18  | 0.00      | 0.00  | 5.14         | 0.036  | 0.22       |

Note. ASI-3 = Anxiety Sensitivity Index - 3; GAD-7 = Generalized Anxiety Disorder - 7; PHQ-9 = Patient Health Questionnaire - 9; PCL-5 = PTSD Checklist for DSM-5.

## 4. Discussion

The purpose of the current study was to examine the acceptability, usability, and preliminary effectiveness of a transdiagnostic computerized intervention for anxiety sensitivity focused on VA primary care patients. Results from the acceptability questionnaire revealed the majority of participants found the intervention acceptable across eight different domains, and usability scores (SUS) were higher than meta-analytic averages (Bangor et al., 2008). These results are consistent with prior work examining acceptability of CAST among Veterans in an academic setting (Short et al., 2017b) and among Veterans in a VA opioid use disorder intensive outpatient program (Raines et al., 2020).

Results from the qualitative analysis fleshed out these results and provided rich data on several areas of strength as well as areas for potential improvement. Veterans appreciated the information being presented both visually and auditorily, citing this bimodal presentation as helpful for engagement and for understanding the content. Further, they appreciated that the information was presented in a straightforward manner while focusing on specific knowledge they can carry forward with them to better understand their experience of anxiety and stress symptoms. Some Veterans even requested more information on anxiety and stress symptoms, highlighting the importance of the educational component. As psychoeducation has been shown to be effective across many different treatment settings and outcomes (e.g., Norr et al., 2017b; Perry et al., 2017; Powell et al., 2019), finding ways to increase accessibility to psychoeducational content could be one method to further engage Veterans in primary care in mental health treatment.

Veterans expressed interest in having more CAST content examples that are specific to Veterans/military service and requested opportunities to discuss the content with other Veterans. These responses highlight the importance of military culture and of peers in providing competent care to Veterans and service members (Meyer and Wynn, 2018). Veterans also expressed optimism with employing an outreach program to get this intervention into the hands of Veterans who may be more apprehensive about engaging with traditional mental health services. This feedback encourages continued efforts by the VA and the Department of Defense to create and disseminate non-traditional treatment options including Internet-based and mobile health applications (Gould et al., 2019). While the current study examined completion of CAST at an in-person, research appointment at a VA medical center, prior work has suggested effectiveness of CAST when delivered remotely via the Internet (Norr et al., 2017a). Such an approach could be a useful way to engage Veterans who are not willing to attend in-person appointments, and could be particularly advantageous when in-person care is not possible, for example during a pandemic as seen with COVID-19.

Regarding the intervention's efficacy, the current study saw significant, medium-sized decreases in AS between baseline and posttest

( $d = .68$ ) and baseline to 1-month follow-up ( $d = .61$ ). These effect sizes are commensurate with studies examining CAST among undergraduate (Norr et al., 2017b; RCT;  $d = .81$ ) and community participants (Schmidt et al., 2014; RCT;  $d = .57$ ) in an academic setting as well as among Veterans in a VA opioid use disorder intensive outpatient program (Raines et al., 2020; open pilot; Glass's  $\Delta$  of 0.61). Results also revealed significant reductions, with large effects, for anxiety symptoms, depressive symptoms, PTSD symptoms, and suicidal ideation. The demonstrated reductions across a range of psychological symptoms is consistent with prior randomized controlled trials of CAST among community participants (Schmidt et al., 2014; Schmidt et al., 2017). These results suggest CAST program could be efficacious among VA primary care patients, and therefore has the potential to be a highly efficient and scalable treatment in a VA primary care setting with regard to both time investment from patients and resource investment from the VA system.

As a healthcare system, the VA faces unique challenges associated with enacting mental healthcare among a population that can be challenging to engage (Seal et al., 2010). Results from the current study suggest that the single-session CAST program could be an acceptable, effective, and efficient way to provide evidence-based mental health care to VA primary care patients. The results from the current study are promising given many Veterans express negative beliefs about mental health treatment generally (Fox et al., 2015) and identify barriers to receiving mental healthcare within a VA setting (Cheney et al., 2018), demonstrating the need for novel treatment delivery methods. Thus, CAST would help address these national priorities to integrate mental health care into medical settings (Institute of Medicine, 2014) to overcome some of these barriers to care as it can be deployed without trained mental health providers. Similarly, CAST could be offered as a first step within a stepped-care model (Bower and Gilbody, 2005) with Veterans graduated to higher levels of care as indicated. Indeed some Veterans in the current study commented they wanted follow-up in a group or individual setting, while others did not. Thus, having a non-traditional treatment option, such as CAST, be offered in a primary care setting could help engage Veterans who would otherwise not engage in mental health care, or who might further delay accessing care due to stigma about mental health treatment.

The current study is not without limitations. First, all Veterans who participated in the current study were either currently (56%) or previously engaged in psychotherapy (40%). Thus, though all participants were VA primary care patients, it is possible that the results would be different for a sample of VA primary care patients who were naive to mental health treatment. However, these patients likely offer an important perspective as they are aware of other mental health treatment experiences. Similarly, the results of the current study suggest that the CAST intervention can confer benefit even for those who have already received more traditional mental health care. Second, the single group design of the current study limits the ability to draw conclusions about the causal nature of the observed reductions in symptoms. Importantly, we controlled for the number of mental health (individual and group) appointments attended over the course of the study to ensure results were not simply associated with mental health appointment attendance. Third, the current study utilized a single item measure of suicidal ideation. Though a more comprehensive measure of suicide risk may provide a more nuanced perspective, research in a large sample (Louzon et al., 2016;  $N = 447,245$ ) of Veterans found that a single item measure of SI significantly predicted suicide mortality ( $HR = 1.47$ ), supporting the utility of measuring SI in this fashion. Fourth, for the qualitative portion of the study we relied on interviewer notes to capture response themes. It is possible this method could have resulted in missing information that would have been captured with audio recorded transcripts. Finally, though CAST was completed on the computer, all sessions were completed at the VA facility in the presence of a research coordinator. It is possible that completing this intervention remotely would yield a different treatment experience and results. Prior

work suggests that completing CAST remotely confers benefit (Norr et al., 2017a), however, future research should investigate this among a VA population. Important areas of future research include examining the efficacy of CAST for mental health treatment naïve Veterans, utility of employing CAST within a stepped care model embedded in primary care, and efficacy of CAST when delivered remotely to VA primary care patients to determine whether an in-office visit is needed.

Despite these limitations, the strong evidence of efficacy among community participants from prior randomized controlled trials coupled with the results from the current study further promote potential of CAST, and similar treatments, to reach Veterans who otherwise would not receive care. Veterans found this treatment experience to be highly acceptable and reported benefit with regard to symptoms of anxiety, depression, PTSD, and suicidal ideation. Involving Veterans in the collaborative development of these types of interventions is consistent with best practices in human centered design and is critical to achieving products Veterans find to be culturally competent. The results for the current study point to potential areas of improvement for CAST such as including more military relevant example and having the option for further engagement with this material via a group setting following the completion of CAST. Additional research is needed to explore feedback from mental health treatment naïve Veterans to examine the effects of CAST on future engagement in mental health care, and to evaluate the program delivered via a remote format. However, given the low cost of scaling and disseminating CAST (Norr et al., 2017a), the results of the current study suggest the possibility of CAST having a large public health impact across VA medical centers nationwide as a first-step intervention for a range of mental health presenting concerns.

## Author statement

### Contributions

Aaron Norr designed the study/analyses and contributed to writing all parts of the, methods, results, and discussion sections. Andrea Katz contributed to the qualitative analyses and contributed to writing the results section. Janelle Nguyen collected data, contributed to the qualitative analyses, and contributed to the writing of the methods section. Keren Lehavot contributed to the design of the study and provided feedback and edits to the manuscript. Norman Schmidt created the CAST intervention and provided feedback and edits to the manuscript. Greg Reger provided crucial feedback and edits throughout study design, analysis, and writing of the manuscript. All of the authors have agreed to the author order and to submission of the manuscript in this form.

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## Declaration of Competing Interest

None.





2007. Robust dimensions of anxiety sensitivity: development and initial validation of the Anxiety Sensitivity Index-3. *Psychol. Assess.* 19, 176–188. <https://doi.org/10.1037/1040-3590.19.2.176>.
- Teich, J., Ali, M.M., Lynch, S., Mutter, R., 2016. Utilization of mental health service by veterans living in rural areas. *J. Rural Health* 33, 297–304 <https://doi.org/10.1111/jrh.12221>.
- Wang, P.S., Berglund, P.A., Olfson, M., Kessler, R.C., 2004. Delays in initial treatment contact after first onset of a mental disorder. *Health Serv. Res.* 39, 393–416. <https://doi.org/10.1111/j.1475-6773.2004.00234.x>.
- Wang, P.S., Lane, M., Olfson, M., Pincus, H.A., Wells, K.B., Kessler, R.C., 2005. Twelve-month use of mental health services in the United States. *Arch. Gen. Psychiatry* 62, 629–640. <https://doi.org/10.1001/archpsyc.62.6.629>.
- Weathers, F.W., Litz, B.T., Keane, T.M., Palmieri, P.A., Marx, B.P., & Schnurr, P.P., 2013. The PTSD checklist for dsm-5 (pcl-5). Scale available from the National Center for PTSD at [www.ptsd.va.gov](http://www.ptsd.va.gov), 10.