Collaborative Management of PTSD Treatment through Smartphone Apps Validated through Patient-Centered Design

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1. Background

Post-traumatic stress disorder (PTSD) is a mental health disorder that an estimated 8% of Americans – 24.4 million people – experience at any given time.

Smartphone apps can complement PTSD treatment in a variety of ways. • e.g. Homework tools, psychoeducation

Recent research has shown that apps are a feasible method for enhancing standard treatment for PTSD. • 76% of Veterans receiving outpatient treatment for PTSD reported owning a smartphone • 85% reported interest in at least one potential use of an app as part of therapy • VA clinicians trained in evidence-based treatment for PTSD generally find treatment integration of smartphone apps to be favorable

Systematic review of more than 113 publicly-available PTSD smartphone apps showed: • Only 2 (CPT Coach and PE Coach) were designed explicitly for integration with standard treatment. • Most apps are standalone and do not have remote monitoring capabilities.

Critical Need: to determine how to best integrate information from these apps into ongoing treatment and validate the efficacy

2. Research Aims

Aim 1: Derive functional and information requirements to inform the design of a usable, efficient, and interactive PTSD information system that meets the needs of clinicians and patients.

Aim 2: Develop and verify the efficacy of a sensor-enabled smartwatch app in predicting stress state changes

3. Methods & Results

3.1 Systematic Review of Peer-Reviewed Literature

- Inclusion criteria: 1) The article reviewed or validated an existing PTSD app 2) The article detailed the development of a new app for the detection or treatment of PTSD 3) The article was a case study using PTSD apps

- A total of 28 papers met the inclusion criteria.

- Only SIX documented original studies evaluating the design or usage of a PTSD smartphone app.

- Only TWO PTSD apps were studied: PE Coach and PTSD Coach.

- None of the reviewed papers documented the design requirements for the PTSD smartphone app.

3.2 Systematic Review of Smartphone App Information

- Inclusion criteria: 1) Web search for relevant apps: Search Engines, Online Forums and Communities, App Rating Sites, Government Mobile App Sites

- 2) Search terms included either “App” or “Apps” and the following words related to PTSD (e.g., Trauma), Symptoms of PTSD (e.g., Anger), the patient’s mental state based on heart rate data and physical activity metrics from a wearable device under the high stress test conditions to validate the sensor data.

- 3) PTSD Coach (the most widely used PTSD mobile health application.)

- A total of 113 apps were found and reviewed.

- Only TWO apps (PE Coach and CPT Coach) were designed explicitly for integration with standard treatment.

4. Implications

While remote monitoring using sensor-based technologies offer many capabilities that can be implemented in mHealth apps, there are still many limitations and challenges that prevent the existing and future apps from reaching their full potential including treatment adherence, compliance, and convenience. A careful selection of human factors engineering (HFE) methods tailored to the information system will unveil user requirements focusing on usability, security and privacy, as well as safety and reliability.

5. Future Work

Subject Matter Expert (SME) Interviews
- Veterans with PTSD will be recruited to expand the descriptive model of care

Laboratory Study
- 40 veterans will participate in a user study to identify the optimal sensor configuration (e.g., reporting interval, sensitivity, etc.) required for heart rate data to prompt the user, (2) develop an analytical model that will predict the patient’s mental state based on heart rate data and automatically adjust for environmental factors, perspiration, and watch movements, and (3) determine human factors and usability issues that need to be considered in the enhanced design.

Iterative Formative Usability Testing
- The initial tests would include concurrent gathering of signals from EEG (i.e., electrical activity of the brain) and physiological and voice metrics from a wearable device under the high stress test conditions to validate the sensor data.

- This would be followed by tests with the wearable device(s) under various home conditions and conditions specific to the usability and reliability of the sensor data.

Summative Usability Testing
- PTSD patients will be recruited to use the device in a usability laboratory to collect subjective data on usability and overall experience, followed by in-home trials to gather additional data.

- For longitudinal user experience data collection, a diary study will be conducted where patients are asked to document thoughts, evaluate experiences, and provide other contextual information such as events that precipitated the hyperarousal.

For more information about this work, contact Dr. Farzam Sasangohar: sasangohar@tamu.edu; (979) 458-2337
### Sample Characteristics of Currently Available Apps

<table>
<thead>
<tr>
<th>App Theme</th>
<th>Treatment Integration</th>
<th>Education</th>
<th>Exercises</th>
<th>Symptom and Progress Tracking</th>
<th>Outside Professional Support</th>
<th>Outside Peer Support</th>
<th>Total Apps</th>
<th>iOS</th>
<th>Android</th>
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<td>3 VA PTSD Treatment</td>
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<tr>
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