1. Background

Post-traumatic stress disorder (PTSD) is a mental health disorder that affects 3.44 million people in the United States – a 24.4 million people – experience it at any given time.

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.
- A total of 28 papers met the inclusion criteria.
- Only six reviewed 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 methodologies.

3.2 Systematic Review of Smartphone App Information

- Search terms included either “App” or “Apps” and the following keywords: PTSD, Treatment (e.g., Cognitive Processing Therapy), or Social support for PTSD.
- Mental health or treatment apps had to be relevant to PTSD.
- 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.

3.3 Patient-Centered Design for an Active Smartphone App

- A user-centered design approach was used to implement a PTSD smartphone application.
- The design was informed by hierarchical task analysis and a heuristic analysis.

Subject Matter Expert (SME) Interviews

10 interviews were conducted with the VA Psychiatrists & Psychologists.

SMES were asked to validate a descriptive model of the current PTSD treatment process.

SMES interviews were also used to derive functional and informational requirements for the PTSD smartphone app.

Intervention: The device alerts the patient when “hyper arousal” is detected by the heart rate sensor. Other activities are denounced using other sensors.

Therapy: The tool provides variety of interactive activities, facilitates connection to peers, and clinicians, and patient’s social networks.

Usability Testing

- 8 Texas A&M University graduate students were asked to explore PTSD Coach (the most widely used PTSD mobile health application).

Major interaction, technical and usability issues were identified and documented.

While subjects found the tool to be easy to use, the functionality did not meet their expectation.

On Demand Access: Patients can use the tool to use the interactive features of the tool whenever they feel stressed.

Self-Assessment: Patients can use the tool to complete periodical self-assessments, review their progress, and share the results with clinicians.

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 (1) identify the optimal sensor configuration (e.g., reporting interval, sensitivity, etc.) required for heart rate values 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 correlate specifications to test the usability and reliability of data provided.

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, please contact Dr. Farzan Sasangohar: sasangohar@tamu.edu; (979) 458-2337

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[Reference]

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