Bridging the Gap: Creating a Clinician-Facing Dashboard for PTSD

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Abstract. Post-traumatic stress disorder (PTSD) is a serious mental health condition. Prolonged Exposure (PE) therapy has been shown to have the greatest therapeutic efficacy in treating PTSD. However, clinicians face significant challenges in delivering PE therapy successfully. We conducted a two-part study with 17 clinicians where we (1) gathered requirements for a PE therapy dashboard and (2) had clinicians assess the relevance and usability of our dashboard prototypes. The first part of our study showed that clinicians wanted (1)improved workflow for their PE sessions (2)improved methods of monitoring their patients' self-report data and (3)a way to assess their patients' progress outside of sessions. The second part showed that our dashboard prototypes were highly usable. Our study provides preliminary steps in designing user-centered tools that assist clinicians in the delivery of PE therapy by improving data access and workflow efficiency.

Keywords: PTSD · Post traumatic stress disorder · PE Therapy · Prolonged exposure therapy · Clinician dashboard

1 Introduction

Post-traumatic stress disorder (PTSD) is a mental health disorder that can develop after a person experiences a traumatic incident [2]. PTSD is characterized by four symptom clusters: (1) trauma re-experiencing, (2) avoidance of trauma related situations, thoughts, and feelings (3) negative alterations in thought and mood and (4) hyperarousal [2]. Furthermore, PTSD has serious comorbidities including suicidal ideation [19], substance abuse [21], and domestic violence [23]. The lifetime prevalence of PTSD in the United States is around 9% [2].

In this research, we focus on the treatment of PTSD using Prolonged Exposure (PE) therapy, a manualized therapeutic approach which has been shown to have one of the greatest therapeutic efficacies [4,12]. PE therapy has its theoretical underpinnings in Emotional Processing Theory of PTSD; a theory that

Published by Springer Nature Switzerland AG 2019
D. Lamas et al. (Eds.): INTERACT 2019, LNCS 11746, pp. 224–233, 2019.
https://doi.org/10.1007/978-3-030-29381-9_14

emphasizes processing the traumatic memory in the reduction of PTSD symptoms [10]. The two main determinants of successful PE Therapy are repeated *in vivo* (real world) exposure to situations that the patient is avoiding due to trauma-related anxiety, and repeated, prolonged imaginal exposure where the patient revisits the trauma memory by visualizing and recounting the traumatic event aloud [10]. The fundamental takeaway of the in vivo and imaginal exposure components is for the patient to learn that the traumatic memory and the trauma itself are two distinct entities [10]. Successful PE therapy results in patients being able to reclaim control over their lives by reducing the excessive fear and anxiety [10].

PE therapy can be administered via traditional weekly sessions or daily in intensive outpatient programs. During sessions, clinicians discuss the patient's progress, review previous homework assignments, conduct imaginal exposure sessions, guide the patient through emotional and cognitive processing, and assign new homework. The therapist must keep track of the patients's self-report measures via instruments such as the PTSD Checklist (PCL) and Subjective Units of Discomfort scale (SUDs). The PCL is used to assess a patient's PTSD symptoms [15] while the SUDs scale measures how distressed the patient is feeling in the current moment. This scale ranges from 0, a state of no distress, to 100, a state of the most distressed the patient has ever experienced [10].

Our work explores opportunities for the development of technology to support clinicians in the delivery of PE therapy. While technology currently exists to support patients during their treatment [5,6,13,16,18], there is a lack of clinician-focused technology. We address this gap by first examining the challenges that PE clinicians face when delivering therapy through semi-structured interviews. Then we propose and evaluate two clinician-facing design solutions to improve clinicians' abilities to document and monitor patient progress and more effectively target treatment.

2 Related Work

Prior work on the treatment of PTSD using PE includes a variety of interfaces. Numerous mobile applications have been developed to diagnose and treat symptoms of PTSD [17]. One of the most popular mobile applications, PE Coach, was developed with the goal of facilitating PE therapy for the patient [13,16]. Functionality of this application includes the ability to record imaginal exposure sessions, enter SUDs, and schedule appointment reminders. Kuhn *et al.* found that clinicians generally have favorable perceptions of PE Coach [13], however, PE Coach does not currently have a clinician interface. Recent work in the computing field has explored the user requirements for the design of future technology which incorporates the perspectives of various stakeholders including both clinicians and patients [9].

Virtual reality (VR) based applications have also been used to improve PE therapy by enabling scenarios that are realistic yet safe for the patient [5,6,18]. VR has been used to simulate combat environments for veterans [18]. Furthermore, there is hope that the use of VR could increase the utilization of PE therapy [5]. As in the case of mobile applications, VR applications for PTSD have been primarily developed as a tool for patients [6].

Currently technology for PE therapy is geared toward the patient, however, there is also ample opportunity to help clinicians. For example, these professionals have specific challenges based on their level of experience administering PE therapy [24]. Novice clinicians are often overwhelmed by the manualized nature of PE therapy; they often focus on the implementation of in vivo and imaginal therapy and forego key clinical skills such as listening. Successful PE therapy depends on patients fully engaging with their traumatic memories, and novice clinicians often fear that patients may over engage. Thus, even though PE therapy has high efficacy, its delivery can be improved.

PE is known to be one of the most effective and highly used therapies for PTSD. We presented examples that highlight the range of low-tech (app) and high-tech (VR) options geared toward improving PE practice for patients. We have also shown that clinicians have pressing needs that have gone unmet. In our work we opt to target a practical solution to aid clinicians. Specifically, we see the opportunity for development of a clinician-facing dashboard that could, in combination with PE Coach, improve the ability of clinicians to target treatment and monitor patient progress.

3 Methods and Results

The university's ethics review board authorized the study protocol and all participants signed informed consent forms before participating. We conducted a two-part study where we gathered (1) requirements for a clinician-facing PE Therapy system and (2) feedback about two PE Therapy systems that we designed.

3.1 Interviews

In the first part of our study, 12 clinicians (10 females, 2 males, age range 30 to 58 years) that practice PE therapy participated in semi-structured interviews that lasted about 45-min. The goals were: (1) to understand the challenges clinicians face when delivering PE therapy, (2) to better comprehend how clinicians assess patient progress and (3) to determine what data clinicians are missing from their existing processes. Audio from the interviews were both recorded and transcribed. Two of the researchers used thematic analysis [7] to analyze these interviews. The researchers met to analyze, iterate, and develop 28 themes from 120 transcript excerpts. From these discussions, three main themes emerged.

The first theme highlighted the need for improved workflow during the therapeutic sessions. The current process for collecting and reviewing patient data is inefficient; clinicians want a system that enables them to quickly digest relevant information. PE clinicians have to balance time spent collecting and analyzing data and engaging in therapeutic tasks. The compromise is typically to either not collect some (or all) data or to briefly review subjectively reported data by asking the patient questions. This theme is exemplified in the following quotes:

> *"[Any data] needs to be easily accessible, not time intensive, and immediate because if those are not readily available, or I got to figure it out, then I'm not going to do it." -Clinician 07*

> *"One thing that is a challenge for me as a clinician is that there are so many things to be, you know, um, be aware and assess in a short amount of time [...] you want to focus on the therapeutic tasks." -Clinician 05*

Another theme was that self-reports are an important part of monitoring patient progress, but clinicians struggle to effectively monitor all of the self-report scores. This is due to the large amount of self report homework and data that needed to be processed and analyzed by the clinicians before therapy sessions. Past research has emphasized the utility of visualizing such time-oriented patient variables [1,14]. Research on therapeutic processes within PE suggest several indicators, including decreases in SUDs between exposures and completion of homework tasks [8,20], that are predictive of treatment outcome. Clinicians expressed this sentiment and stated:

> *"I put a lot of faith in [self-reports]. I definitely use them to drive treatment, to know when to terminate, when to change." -Clinician 04*

> *"Your desk starts to explode with paperwork and of course the writing the notes, and inputting their scores each week and trying to mention their SUDS." -Clinician 04*

The third major theme was that clinicians would like a better way to asses their patients' symptoms and behaviors outside of therapy and expressed a desire for more frequent assessments of symptoms in the patient's home, and information about the patient's daily life. Clinicians stated:

> *"More frequent assessment of symptoms or anything like that in their home environments." - Clinician 08*

> *"Information about what they're actually doing in their real life. So if there's a way to observe them and see if they're doing... engaging in safety behaviors [...] just a little bit more information not based on their self-report." -Clinician 02*

Based on these themes, we developed prototypes for two different design alternatives. To address the third theme, we designed a "social sensing system" that would enable clinicians to gather collateral information from people that the patient trusts, or "trusted others." Trusted others are people close to the patient, such as a spouse or sibling, who can provide another prospective on the patient's treatment progress. Other research has incorporated the perspectives of trusted others with success. Foong *et al.* explored the value of volunteer knowledge in the care of dementia patients and found that these individuals provided effective, reliable information [11]. The second design addresses the first and second themes. It is a clinician-facing information dashboard aimed at automating the collection and visualization of patient self-report and homework data.

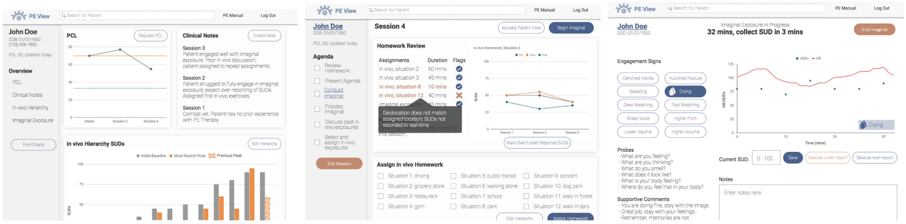
3.2 Design Solutions

The social sensing prototype has three main sections: (1) a social sensing overview section that would enable a clinician to view a trusted other's assessment of a patient's progress (Fig. 1A), (2) an in vivo section that displays a trusted other's assessment of a patient's in vivo session (Fig. 1B), and (3) a messaging section that would enable a clinician to message a trusted other with pre-formulated questions pertaining to a patient's state and progress (Fig. 1C).

A. Social Sensing Overview B. In Vivo C. Messaging

Fig. 1. Clinician facing feedback from trusted others

The information dashboard prototype focuses on the digitization of the PE manual's paper forms to allow for automated visualization of self-report data throughout the therapy. Variables were selected for the dashboard based on interviews with clinicians, the therapy manual, and research into the predictive power of various self-report measures [8,10,20]. The dashboard design consists of three screens. The first provides a patient overview which graphically displays the patient's PCL score, in vivo hierarchy progress, in-session imaginal exposure SUDS and the clinician's notes (Fig. 2A). The second screen provides a session agenda, homework review graphics, homework assignment capabilities and in-session notes (Fig. 2B). The third screen provides an overview of the imaginal exposure sessions. It allows for real-time graphing of SUDS and physiological measures, such as heart rate, one-click capture of patient engagement signs, such as crying or clenching fists, and clinician note entry (Fig. 2C).



A. Patient Overview B. In Session C. Imaginal Exposure

Fig. 2. PE therapy information dashboard

3.3 Feedback Sessions

In the second part of the study, we conducted feedback sessions with five clinicians (4 females, 1 male, age range 31 to 39 years). They had been practicing PE therapy for an average of 4.4 years (±2.4 years).

Feedback sessions for the social sensing interface had six components (1) a device usage survey, (2) think-aloud tasks for each of the three sub-components: the general social sensing feature (*see* Fig. 1A), the in vivo feature (*see* Fig. 1B) and the messaging feature (*see* Fig. 1C), (3) a task interview for each of the three sub-components, (4) a post-task interview, and lastly (5) a System Usability Scale (SUS) questionnaire for the social sensing interface as a whole ([3]).

The purpose of the device usage survey was to gain insight into the clinicians' technology usage habits. These habits were uniform, as they all used laptops/PCs for their clinical work, though some expressed a desire to use a tablet when interacting with a patient. Think-aloud tasks were performed to both assess whether the clinicians could complete specific tasks using the interface and to gather feedback on features as they were using them. Task-specific questions allowed for further explication of the system features. The post-task interview and the SUS were performed to obtain the clinician's assessment of the system as a whole.

As part of the feedback process, clinicians were asked to rank the three social sensing sections in order of importance, all five agreed unanimously on the order: (1) the in vivo section (most important), (2) the general social sensing section, and (3) the messaging section (least important). This consistency in ranking indicates the specific use cases for which clinicians want collateral data. Overall, clinicians had positive feedback regarding the fact the social sensing system as whole could provide them with important, missing data. Clinicians stated:

> *"I had an outpatient before; it would've been useful to have feedback from his wife about how he was, she was a huge part of his treatment." -User 01*

> *"I always want to hear more about what other people think is going on. I get a skewed picture talking to one person." -User 05*

The results of the System Usability Scale were positive as well, with an average score of 89.5 which corresponds to an "excellent" usability rating [22].

Clinicians voiced concerns that the social sensing system as a whole might lead to privacy and confidentiality issues that would need to be discussed with the patient prior to inclusion of the trusted other. Clinicians also noted that the social sensing section could better emphasize the problematic behavior notice and visualization of what the emoticons meant. Regarding the in vivo section, clinicians mentioned that it did not clearly indicate that the SUDs assessment was that of the trusted other and not that of the patient, but found this section the most important in assessing the patient. However, they liked that the messaging section had a pre-populated question form that allowed them to quickly send desired queries.

In order to evaluate the information dashboard, clinicians were first asked to complete a background survey about their experience with PE therapy and rate their current satisfaction with the process of delivering PE therapy on a seven-point Likert scale. Clinicians then completed the following four think-aloud tasks on the information dashboard: (1) prepare for an upcoming appointment with patient John Doe, (2) review John Doe's homework, (3) conduct an imaginal exposure session with John Doe and (4) assign John Doe his next set of homework. After each task, clinicians were asked to rate their satisfaction with the process using the dashboard, and were asked follow-up questions about their experience using the system. After completing all tasks, clinicians were asked to provide three words to describe the system and were interviewed about their overall impressions of the system as a whole. The goal of the information dashboard feedback session was to understand whether a clinician-facing dashboard centered on visualizing self-report data would be useful to clinicians.

Overall the information dashboard received positive feedback with clinicians describing it as comprehensive (n = 2), intuitive (n = 2) and helpful (n = 2). Clinicians thought the system would improve accountability, both for the patient and the clinician, saying:

> *"This seems much more organized and much easier to notice any discrepancies." -User 04*

> *"I like that it's more holistic, and it could be more accurate." -User 02*

Clinicians often described the system as a tool their patient's could use directly or collaboratively with the clinician. One clinician stressed the importance of allowing the patient to remain in control of the treatment saying:

> *"Usually now, you bring your form, and you tell me how those things went, and it's in the patient's ballpark in terms of how they want to talk about it [...] they take ownership of their work." -User 05*

Clinicians were skeptical of two features: (1) clinician notes and (2) the ability to mark suspected SUDs as over or under reported by the patient. Since all clinicians in this study already took notes in a separate system, they did not see the need to record or transfer notes to another system. Clinicians thought that the ability to mark SUDs as over or under reported made their judgment seem too official. Instead, one clinician purposed a companion metric, such as a perceived unit of distress, that would allow the clinician to rate their perception of the patient's distress without placing official judgment on the reported SUDs.

The in vivo hierarchy and homework review sections of the dashboard had the most usability issues, and several design changes were identified to improve these features. Clinicians were most excited about the imaginal exposure feature, with many saying that it would increase the likelihood of them visualizing the session and that it would save them time by allowing them to graph SUDs and engagement signs in real-time.

The results of the Likert questions were positive with all dimensions showing improvement using the dashboard compared to the current process (3). The biggest improvement was in the process of tracking a patient's mental health status, which was one of the main goals of the system (Fig. 3).

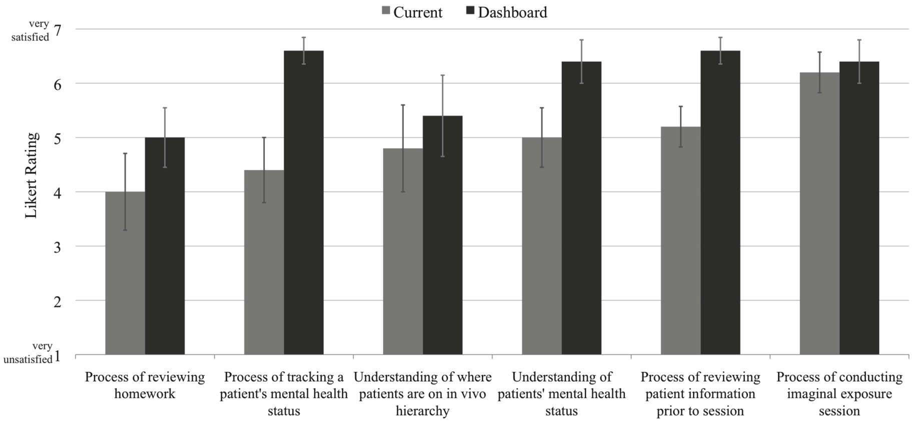


Fig. 3. Mean clinician satisfaction with current process versus mean dashboard-assisted process (bars represent standard error)

4 Conclusion

To our knowledge, no clinician-facing dashboards have been developed for PE or other PTSD psychotherapies. Our research bridges a gap in PTSD therapy, the design of an interface to streamline the clinician's workflow during PE therapy. In the first part of our study we found that clinicians wanted (1)improved workflow for their PE sessions (2)improved methods of monitoring their patients' self-report data and (3)a way to assess their patients' behavior in the "real world." We prototyped and evaluated two systems to meet these needs. On the positive side, both of the systems were well received and clinicians believe that we are on the right track. Thus, a next step is to combine the best features of both interfaces to develop a single system that allows clinicians to access self-report and social sensing data seamlessly. On the negative side, clinicians noted that there were practical privacy matters that needed to be addressed. These will require meeting with patients (and their trusted others) to understand under what conditions social sensing would be acceptable to them. It is also important to identify features that will encourage patients to maintain ownership of their treatment, such as the ability for patients to indicate specific homework or self-report data that they would like to discuss in sessions. Our study provides preliminary steps in designing user-centered tools that assist clinicians in the delivery of PE therapy by improving data access and workflow efficiency.

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