Blended mobile-based interventions with integrated virtual reality exposure therapy for anxiety disorders: A thematic analysis of patient perspectives

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Abstract

Background: Guided mobile-based interventions may mitigate symptoms of anxiety disorders such as panic disorder (PD), agoraphobia (AG), or social anxiety disorder (SAD). With exposure therapy being efficacious in traditional treatments for these disorders, recent advancements have introduced 360° videos to deliver virtual reality exposure therapy (VRET) within mobile-based interventions.

Objective: Despite ongoing trials evaluating the treatment's efficacy, research examining patient perceptions of this innovative approach is still scarce. Therefore, this study aimed to explore patient opinions on specific treatment aspects of mobile-based interventions with mobile VRET and psychotherapeutic guidance for anxiety disorders.

Methods: Eleven patients diagnosed with PD, AG, or SAD who had previously taken part in the experimental condition of two randomized controlled trials for a mobile intervention including mobile VRET participated in cross-sectional, retrospective interviews. Employing a semi-structured interview format, patients were asked to reflect on their treatment experiences, personal changes, helpful and hindering aspects, motivation levels, and their encounters with the mobile-based intervention, manualized treatment sessions, and the mobile VRET.

Results: Thematic analysis led to the formation of 14 themes in four superordinate categories: (1) perceived treatment outcomes, (2) aspects of the mobile intervention, (3) experiences with mobile VRET, and (4) contextual considerations. Patients offered their insights into factors contributing to treatment success or failure, delineated perceived treatment outcomes, and highlighted favorable aspects of the treatment while pointing out shortcomings and suggesting potential enhancements. Most strikingly, while using a blended application-based intervention, patients highlighted the role of psychotherapeutic guidance as a central contributing factor to their symptom improvement.

Conclusions: The findings of the thematic analysis and its diverse patient perspectives hold the potential to guide future research directions to improve mobile-based treatment options for anxiety disorders. Insights from these patient experiences can contribute to refining mobile-based interventions and optimizing the integration of VRET in accordance with patients' preferences, needs, and expectations.

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ABSTRACT

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being efficacious in traditional treatments for these disorders, recent advancements have introduced 360° videos to deliver virtual reality exposure therapy (VRET) within mobile-based interventions. Despite ongoing trials evaluating the treatment's efficacy, research examining patient perceptions of this innovative approach is still scarce. Therefore, this study aimed to explore patient opinions on specific treatment aspects of mobile-based interventions with mobile VRET and psychotherapeutic guidance for anxiety disorders.

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Keywords: Virtual reality exposure therapy, anxiety disorders, internet- and mobile-based interventions, blended therapy, eHealth

Introduction

Anxiety disorders, such as social anxiety disorder (SAD), panic disorder (PD), or agoraphobia (AG), are a pervasive public health issue with 12-month prevalence rates between 0.9% and 1.2%, causing severe impairment for those affected [1–3]. SAD, PD, and AG are characterized by intense fear

reactions towards specific situations or bodily sensations that are normally perceived as harmless or non-threatening [4]. In SAD, typical anxiety-provoking situations include social interactions (e.g., being at the center of attention, meeting new people) [5]. In PD, panic attacks are triggered by an overinterpretation of occasional bodily arousal (e.g., elevated heartbeat) as life-threatening (e.g. suffering from a heart attack) [6]. In contrast, AG entails panic-like fear in situations where escape is difficult (shopping queues, subway, car rides) [7]. Affected individuals often describe anticipatory anxiety as especially troublesome, which may explain why all three disorders are often associated with avoidance and safety behavior [8, 9].

A highly evident approach to treating patients with SAD, PD, and AG is cognitive behavioral therapy (CBT) [10]. Typical methods utilized in CBT for these disorders are psychoeducation, exposure therapy, and behavioral experiments [11]. However, despite compelling evidence supporting the treatment's efficacy [12], most affected individuals fail to receive treatment (i.e., according to Stein et al. [13], less than a quarter of patients are admitted for treatment). One reason that keeps individuals in need from receiving treatment is the increasingly exhausted supply capacities in mental health care, leading to prolonged waiting periods and large pre-treatment attrition rates [14]. This is further aggravated by the fact that treatment recommendations such as exposure therapy often remain unfollowed due to time constraints, high costs, and resource demands [15, 16].

A recent approach to bridge the shortage of treatment capacities is utilizing internet- and mobile-based interventions (IMIs) [17], which include smartphone applications that are tailored for specific psychological disorders such as SAD, PD, and AG. Most of these applications incorporate psychoeducation, mindfulness, or basic CBT interventions and have been shown effective in reducing symptoms [18–20]. IMIs can follow a stand-alone approach or may also include varying degrees of psychotherapeutic guidance. Regarding the latter, guided treatment programs were shown to be superior in reducing clinical symptoms than stand-alone approaches [17, 20]. Possible advantages of IMIs include flexible use at almost any time and place as well as relieving the psychotherapist's time burden [21]. While the use of IMIs could display an option to bridge scarce treatment capacities, it remains an issue that exposure is difficult to deliver, while it is associated with high therapeutic efficacy for many anxiety disorders [22]. The question therefore arises of how exposure therapy can be integrated within IMIs.

One way to reduce barriers in the delivery of exposure therapy is the transfer of anxiety-eliciting situations to a virtual reality environment. Virtual reality exposure therapy (VRET) allows for the creation of specific scenarios that may be challenging or impractical to replicate in real life (in vivo)

and that are tailored to elicit fear responses [23–25]. These simulations can be adjusted according to each patient's unique needs (i.e., massive, or gradual approach) and specific concerns, while therapists maintain full control during such sessions [26]. The so-called immersion (i.e., the feeling of realism created in VR atmospheres) helps to uphold patients' apprehension without any actual risk involved [24, 27]. So far, VRET has been used in the treatment of multiple anxiety disorders such as SAD or AG to reduce symptoms and improve the quality of life successfully [27, 28]. Compared to exposure in vivo, increased acceptance and lower refusal rates have been reported in the past, making VRET a low-cost treatment option with a high success rate [24, 29].

While both approaches (IMIs and VRET) have so far been used separately, the combined use of both approaches can bring substantial benefits. Taken together, the use of an IMI might bridge waiting times, while VRET might help to implement exposure without high costs and resources [24]. To benefit from the advantages, new approaches most recently have tried to integrate mobile VRET into IMIs [30–32]. Instead of using expensive VR equipment, patients instead use a head-mounted construction in which they can insert their smartphone as a screen and display 360° videos. By doing so, it was demonstrated that treating acrophobia via self-guided VRET is possible [30, 33]. Currently, RCTs are ongoing to investigate the efficacy of improving symptoms of SAD, PD, and AG using this innovative treatment approach [31, 32, 34].

The accumulation of robust quantitative data on how the treatment affects the symptomatology of anxiety disorders forms the foundation of any clinical use. However, to allow an unproblematic integration into practice, it is indispensable to understand the perspectives of patients who experienced the treatment first-hand, which could potentially be derived from qualitative data material [35]. Therefore, the goal of the present study was to systematically analyze patients’ perspectives concerning the integration of mobile VRET in guided IMIs for SAD, PD, and AG. By doing so, aspects can be identified that patients deem most relevant and which are related to their improvement or deterioration [36, 37]. Also, the present study investigated self-reported reasons why patients receiving the treatment do or do not experience change, how they navigate through the IMI and the mobile VRET, and which limitations and benefits they have faced. Given the fact that the blended treatment also featured in-person psychotherapeutic guidance, an additional topic of investigation included patients’ opinions on the combination of application-based treatment with psychotherapeutic guidance. On this basis, ideas can be formed on how to improve further similar approaches by facilitating patient adherence. To this aim, we interviewed 11 patients with SAD, PD, or AG, who took part in a treatment program consisting of a psychotherapist-guided IMI with mobile

VRET as part of two randomized controlled trials (RCT) [31, 32].

Methods

Participants

Patients were recruited from two randomized controlled trials. These compared a blended treatment approach comprising an IMI with in-app mobile VRET and appointments with a licensed psychotherapist to an active control condition with relaxation training (more details concerning the trials can be found in Planert et al. [31] and Hildebrand et al [32]). Inclusion criteria were (1) fulfilling the ICD-10 diagnostic criteria of one of the following psychological disorders: agoraphobia, unspecified (F40.00), agoraphobia with panic disorder (F40.01), agoraphobia without panic disorder (F40.02), social phobia (F40.1), or panic disorder (F41.0), and (2) completing the treatment in the randomized controlled trials (for a full list of inclusion and exclusion criteria see Planert et al. [31] and Hildebrand et al. [32]). Only participants from the treatment group in either of the two trials were invited upon completion of the RCT. A total of N = 11 patients (n = 5 patients with SAD; n = 6 patients with PD or AG) agreed to partake in the interview.

Procedure

The mobile phone-based application specifically developed for the treatment of SAD, PD, and AG (Invirto© [38]), constituted the blended treatment with IMI and mobile VRET. The application's content consisted of an introduction, goal setting, psychoeducation, tension regulation, cognitive techniques, and exposure. Throughout the blended treatment, five psychotherapeutic appointments were carried out (for details see Planert et al. [31] and Hildebrand et al. [32]). As the mobile-based application offers three different treatment programs depending on the respective anxiety disorder, participants were included who completed one of either of the three programs. For an overview of the treatment procedure and study schedule, see Figure 1.

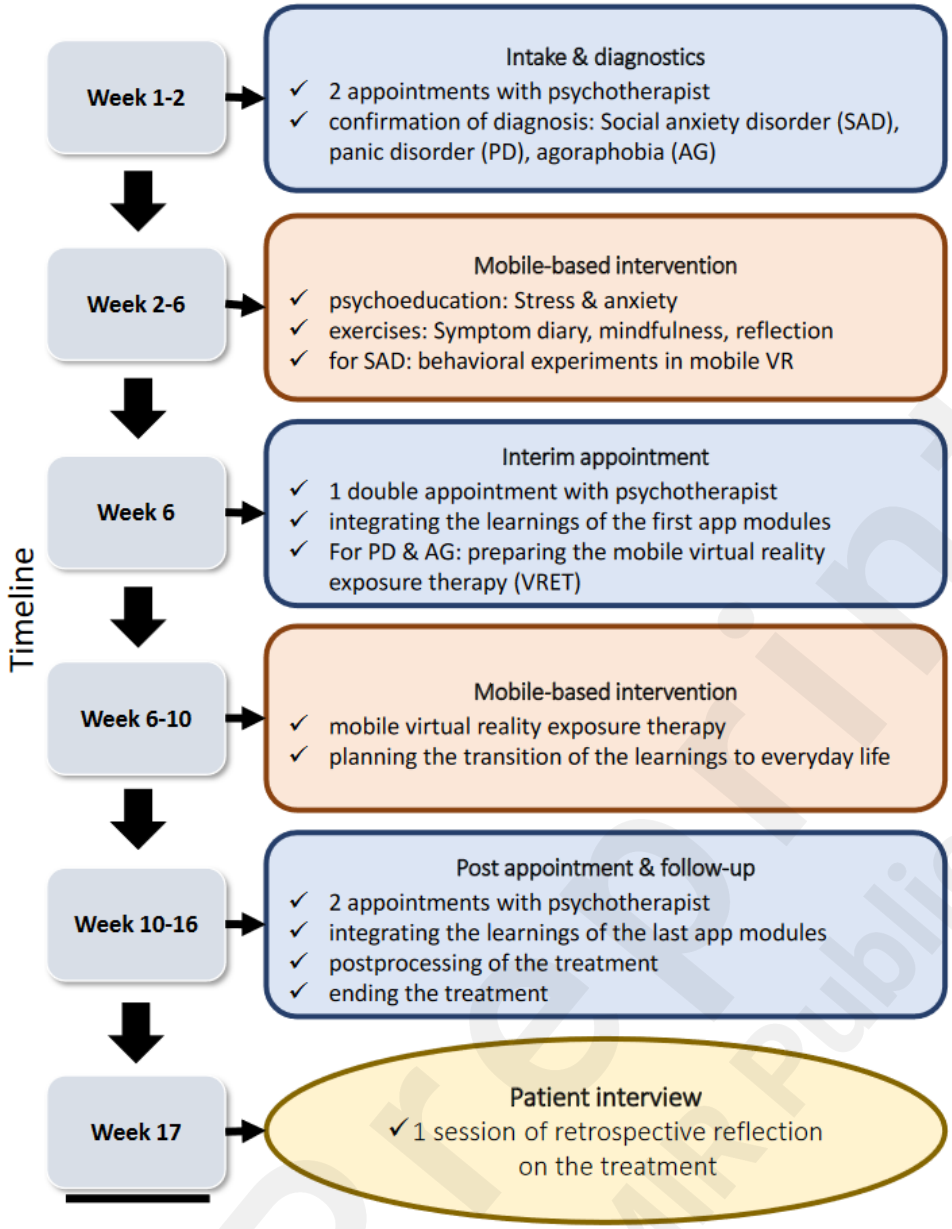
At study entry, patients received two diagnostic appointments, in which they were assessed for eligibility after which they received access to the application, which was available for 90 days after prescription. They were instructed to complete the first modules including psychoeducation and exercises (e.g., identifying and visualizing triggers of fear and visualization). Patients with SAD also completed exercises in VR (e.g., behavioral experiments) as 360° videos without the possibility of interacting with the environment. These included a job interview and a talk in front of a virtual audience. Patients with PD and AG did not complete exercises in VR before the next appointment.

After six weeks, there was a third appointment to evaluate what patients learned in the last modules and to prepare for the next phase. Before this appointment, patients were called to check up on their

progress and whether they were ready for the next appointment. For patients with SAD, this included evaluating the prior behavioral experiments in mobile VR and preparing the transfer of those experiments into everyday life. For patients with PD or AG, evaluation included the prior psychoeducation and exercises without VR. They were prepared for behavioral exercises (e.g., running upstairs) and exposure to mobile VR (e.g., sitting in a car or train), by 360° videos without the possibility of interacting with the environment. After the third appointment, patients diagnosed with all three anxiety disorders had four weeks to complete the remaining modules including exposure in VR in multiple scenarios (e.g., a car/plane ride, or a supermarket), emotion regulation, and relapse prevention. Afterward, patients and psychotherapists evaluated the complete intervention in a fourth appointment. After six weeks, patients had a follow-up appointment to assess long-term changes in symptoms and were asked to participate in a half-standardized interview. The obtained data were retrospective insights from patients who completed the whole treatment and were able to extensively use the application in their daily routine.

Figure 1.

Procedure of the treatment process and study schedule.



Note. Flowchart of the study schedule. On the left, boxes indicate the respective week of the trial. Blue boxes indicate psychotherapeutic sessions while the red boxes stand for periods in which the patients worked independently with the treatment application. The yellow box marks the time point at which the patient interviews took place.

Half-standardized interview procedure

All interviews were held in German language and took on average 30 minutes and 40 seconds, with a standard deviation of 6 minutes. After describing the interview's purpose and how data protection was ensured, the interviews were started with an open impulse, giving the interviewee the chance to address what they found most striking about the treatment they participated in. This was done by asking "How did you experience the treatment you were taking part in?". Afterward, the interviewer

followed a semi-structured manual based on the Client Change Interview (CCI) [39]. The CCI establishes aspects that are potentially associated with a client's change in psychotherapy, such as helpful and hindering aspects, personal or psychological changes they made, or attributions for these changes. In the present study, the interview manual was expanded by specific questions about the app included in the study, along with the mobile VRET, the study design of the RCT, and the expected role of the specific treatment in mental health care. The interview was semi-structured, and for every point the interviewee brought up, the interviewer was instructed to ask follow-up questions to ensure an in-depth understanding. All interviews were semantically transcribed by student assistants. The interview procedure after the follow-up appointment was approved by an amendment of the respective ethics statement (ER_48_2021, amendment AZ_56/2023).

Data analysis

To analyze the interview data, a thematic content analysis was conducted according to Braun and Clarke [36, 37]. The analysis was carried out by two independent researchers utilizing the text analysis program MAXQDA (VERBI, MAXQDA). As a first step, both coders intuitively went over a part of the interviews in a summarizing manner. This was done to establish codes, representing the content of the interviews. At this point, codes were not structured. Afterwards, the coders reviewed each other's codes to check on errors, or parts and messages the other coder might have missed. The generated codes were then interpreted and grouped into overarching categories (e.g., VR-related content, IMI-related content) by one coder. The second coder then checked the categories and the assigned codes. Afterward, the codes in one overarching category were grouped into multiple themes by the second coder and checked by the first coder. Then, both coders reflected and interpreted the categories and themes with their corresponding codes and depicted them in a thematic map (see Figure 2).

Results

As the interviews were conducted in German, extracted quotes were translated from German to English word for word. The extracted codes appear indented and in italic letters below the respective themes. For demographic characteristics of the eleven interviewees, see Table 1.

Table 1. Demographic information of the interviewed patients.

Patient code	Age range	Gender	Primary diagnosis (ICD-10)
P01	20-25	female	social anxiety disorder
P02	20-25	female	panic disorder

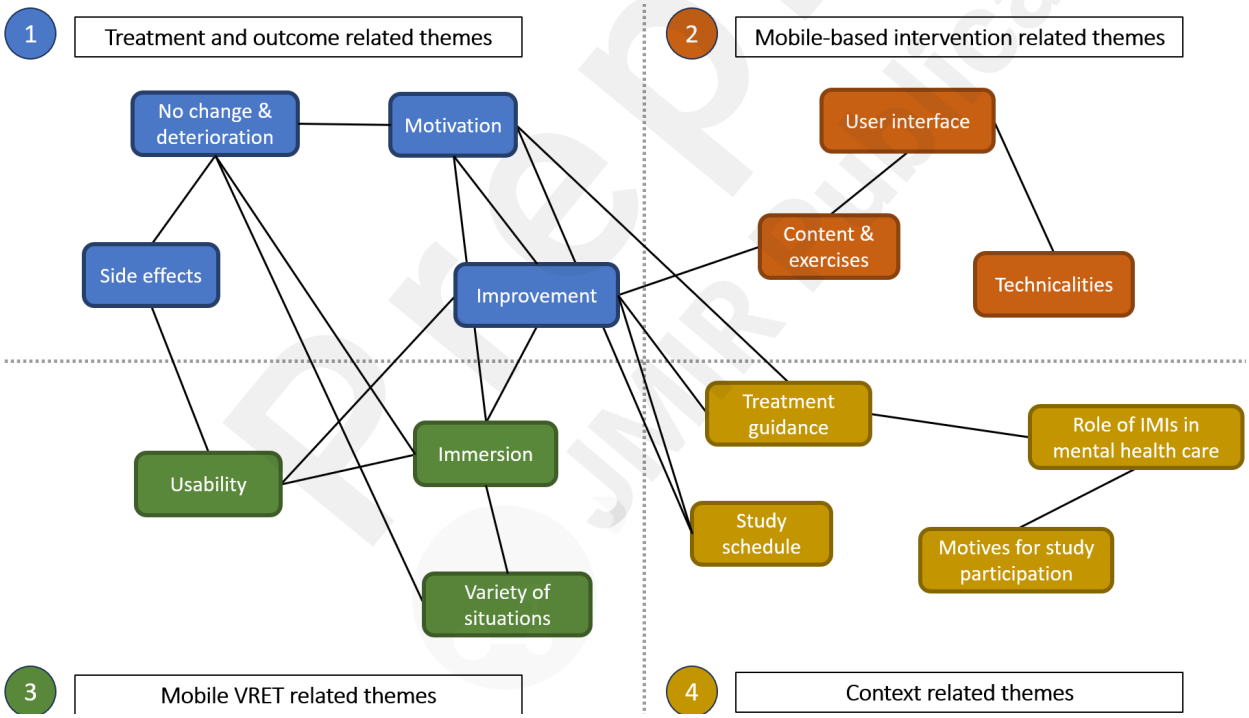
P03	20-25	female	social anxiety disorder
P04	45-50	female	agoraphobia
P05	25-30	female	social anxiety disorder
P06	25-30	female	panic disorder
P07	40-45	female	panic disorder
P08	30-35	female	agoraphobia
P09	60-65	male	agoraphobia with panic disorder
P10	25-30	female	social anxiety disorder
P11	20-25	male	social anxiety disorder

Note. Information revealing the age is given as ranges to protect the anonymity of the interviewed patients.

Themes of the various interview segments were divided into four overarching categories: “Treatment and outcome-related themes”, “mobile-based intervention-related themes”, “VRET-related themes”, and “context-related themes”, see Figure 2.

Figure 2

Thematic map of the established themes in their respective category.



Note. Themes are divided by category. Links between the themes indicate thematic relatedness depending on the statements of the interviewed patients.

Category 1: Treatment and outcome-related themes

The first category covered themes that were related to patient-perceived aspects of the blended

treatment or its outcomes. In total, this category consisted of four themes: symptom improvement, no change, symptom deterioration, side effects, and motivation throughout treatment.

Theme 1: symptom improvement

Throughout the treatment, many of the interviewed patients experienced symptom improvement. Indications as to how and why their symptoms might have improved are covered by this category's first theme. While some patients reported a perceived symptom remission, others indicated that while the treatment helped, they felt not fully recovered:

> *I was able to learn a lot and made big advancements. By now, I oftentimes go by car alone and I feel like I make progress every day, I also stopped thinking about my anxiety. (P04, Pos. 8)*

> *Well, I still have anxiety. Partly, it got better. (P03, Pos. 18)*

Various reasons were given for the perceived improvement: While some patients stressed the superior role of one component of the therapy (e.g., therapeutic appointments, VRET, psychoeducation), some pointed out that the comprehensive approach with a treatment-app, mobile VRET, and psychotherapeutic appointments was helpful:

> *Yea, I'd say the therapist rather helped me, coming from an interpersonal understanding. (P02, Pos. 29)*

> *It was an interplay. There was the app, in which I learned about anxiety and its causes. And then I had a person that accompanied or led me. The appointments helped me to keep going and push through. (P06, Pos. 50)*

While sometimes the mobile VRET was highlighted as an especially helpful ingredient, others claimed that everything but the mobile VRET was beneficial:

> *And these experiments with the VR-headset. They really helped me, because in these situations, I really had anxiety, but I knew it was not real and it doesn't matter how I behave. (P03, Pos. 51)*

> *I think the video took an hour, I was on the highway and I was in the passenger seat. But being the passenger was no problem for me. That's the same as if I was in somebody's car, that doesn't bother me either. (P09, Pos. 54)*

Besides the treatment components, symptom insight, learning to reflect on these symptoms, and getting access to treatment after a long search were mentioned as crucial factors. Reflecting on their treatment progress, participants illuminated different factors that facilitated their symptom improvement and acted as protective factors, like engaging modules, social support, hope, optimism, and motivation to use the application.

Theme 2: no change and (short-term) symptom deterioration

Some patients reported retrospectively no change or even deterioration of their initial symptomatology. They brought up that the treatment was not able to address all aspects of their anxiety due to the manualization and the one-fits-all approach. Also, they reported a lack of individualization and personalization.

> *It's not possible as it is a pretty general format. For example, symptoms I don't have are described or you are put in a state that does not cause anxiety. That is something I suspected to happen in the beginning. (P11, Pos. 108)*

One patient brought up that through psychoeducation, symptoms worsened by shifting the focus toward them:

> *I always watched the first few modules at night. This was usually the time when I got my panic attacks and listening to the modules was kind of a trigger for me. For example, it's about what happens in your brain and what symptoms it can have. After hearing about the symptoms, I started to notice them and that is how my panic was caused. Very unpleasant, nausea and shortness of breath. When the person in the app talked about it, it sometimes made it even worse for me. (P02, Pos. 48-49)*

Theme 3: Side effects

The theme side effects covered codes addressing unwanted changes associated with the treatment, but not related to the patient's anxiety disorders. Side effects included simulation sickness (e.g., "*I got a little headache"; P02, Pos. 36)*, and the surfacing of other problems (e.g., trauma), which were not addressed by the application.

> *I think there still is something. For now, I'd use the app, but through the treatment, other areas arose that were problematic, which were kind of hidden before. In that sense, you could say that it had a negative effect. (P10, Pos. 44)*

Theme 4: Motivation throughout the treatment

Motivation was oftentimes addressed by the interviewed patients, depicting it as a dynamic process throughout the treatment. Many linked it as a crucial factor to the success or failure of their treatment. Different factors were given as reasons for an increase or decrease in motivation. Patients described the motivation to reduce symptoms to be able to master feared situations and to increase well-being.

> *I was totally motivated, I wanted it, no matter what. For me it was so important, as from day to day, my life completely shifted and I couldn't deal with it. Before, I was a happy and funny person and suddenly, I was afraid of everything. (P07, Pos. 64)*

During the interviews, patients emphasized the necessity of being motivated for the, in large part, self-reliant treatment. Therefore, a lack of motivation was brought up as a potential risk factor for treatment success:

> *In the beginning [I was] very motivated, but at some point, that faded a little. And then I had a few weeks doing nothing. Then I realized I should do something and did a few exercises. But sometimes, I lack the motivation to sit down at home and engage [with the app]. I think it lacks the person that in some way 'kicks your butt'. (P03, Pos. 74)*

However, a high initial motivation was no guarantee for long-term engagement with the treatment application. For example, a patient reported a reduction in motivation to engage with the application due to a quick initial symptom reduction and overall improvement. Eventually, this made it harder to find the required time for the treatment or difficulties in facing their anxiety in the frame of the treatment and a lack of translation into their everyday life.

> *In the beginning, it was fairly easy [to work with the app] because I knew it had to happen. The weeks before that weren't really worth living. Once I got a grip on my anxiety, also because of the app and the therapy, it got harder, as it is quite time-consuming and I couldn't estimate how long the next module would take. (P02, Pos. 62)*

Category 2: mobile-based intervention related themes

The second category covered three themes, regarding the mobile-based application used in the intervention of the study: app content and exercises (theme 1), user interface (theme 2), and technicalities (theme 3). The displayed codes do not concern the mobile VRET, which is treated in another category (Category 3: VRET-related themes).

Theme 1: Content and exercises

The first theme covered patients' opinions concerning the content and exercises of the application. Patients viewed the modules covering psychoeducation, the in-app push notifications, and the option to repeat contents as especially helpful.

> *I was surprised, how well the content was specialized to my panic disorder. I guess there is different content available that is shown to you, depending on what you have. (P02, Pos. 62).*

> *Also, it was nice that I received notifications. (P04, Pos. 33)*

Patients had mixed opinions on relaxation exercises. As some described them as *"extremely helpful" (P08, Pos. 16-17),* others perceived it as rather misleading and distressing:

> *[…] These breathing or mindfulness exercises partly worsened my panic. Well, definitely the breathing exercises, as I tried it a lot in the beginning. As soon as I gave room to my panic and tried to breathe against it, it became worse and made it take longer. (P02, Pos. 34)*

Some patients expressed a desire for in-app contact with other patients or their psychotherapist to share progress or solve issues with peers:

> *It could be that for social anxiety, this isn't realizable, but I could well imagine that it works like group therapy. So you could talk about it. 'How was the situation for you?' 'What was your take-home message?' (P11, Pos. 144)*

Theme 2: User interface

Overall, the application was received as well-built, regarding quality and user interface.

> *[...] and I found [the app] qualitatively well-made. And it was good to listen to it and to read through it. (P11, Pos. 96)*

The option to choose the in-app psychotherapist was brought up as an advantage. However, the importance of an option to speed up videos in the modules was highlighted. To further facilitate usability, a function to consume the content while being absent from the screen was desired.

> *Not being able to lock the screen, not being able to close the app. These are mechanisms that in some way make sense, but most of the time I used the app while cleaning, doing my laundry, or doing my homework. And then your cellphone is in another room and you have to click to proceed. That wasn't severe, but also not comfortable. (P10, Pos. 86)*

Theme 3: Technicalities

The sign-up process was marked as a problem source and a transparent guide on how to acquire access to the treatment application and a function to download content was deemed helpful. However, it was also pointed out that technical difficulties, if they occurred, were quickly solved by the app support.

> *One time a situation didn't load, so I contacted the support and they solved it fairly quickly, on the same day. It worked directly. (P11, Pos. 88)*

Category 3: VRET-related themes

The third category consisted of three themes, covering opinions that were related to the mobile VRET modules of the treatment application. Participants discussed their experiences in the VRET, incorporating the degree of immersion, the usability, and the variety of situations displayed in the treatment app.

Theme 1: Immersion

The first theme covered the perceived degree of immersion. Here, several patients emphasized the feeling of immersion as helpful for their improvement and the ability of the application to create immersion and elicit fear.

> *And then I had anxiety, even though it was not real. It was quite surprising that I was able to do that. It was quite interesting and for some part even fun. Overall, I think it was mostly interesting to get to know more about [the anxiety]. (P03, Pos. 34)*

> *I think that is especially because I am conscious about being in a virtual situation. Other aspects, such as noises from the outside felt different. It is so advanced that you can*

> *completely exchange certain things, which somehow felt very real, without the real consequences, however. (P11, Pos. 79)*

On the other hand, other patients found the pre-recorded situations unrealistic, which could have negatively affected the degree of immersion. In that sense, it was addressed as a shortcoming that the mobile VRET consisted of 360° videos without possible interaction. This was perceived as especially problematic by patients with SAD, as the pre-recorded audience did not react to them.

> *You wear the VR-headset and you are sat in front of an audience, which is obviously filmed and the VR doesn't really matter, because no matter what I do, they will always react the same. And that is not what causes my fear, it rather is the direct contact with others. (P01, Pos. 26)*

> *So sometimes, when I misspoke, I had the feeling that it usually would've been a situation that would have caused a reaction. That took a bit of the immersion away. But I cannot estimate how much. (P11, Pos. 82)*

In addition, some patients with PD or AG described a lack of anxiety when confronted with situations in mobile VR.

> *What I didn't like, was the virtual [reality], yes, that didn't match. I have to be honest, I sat on an airplane with weird people that did not look real and made repetitive movements. The airplane didn't even shake or do anything that would have caused something in me. Or being alone in the basement. You would imagine this being creepy, yes? But nothing happened, not even a mouse hushed by or anything. I tried a lot, but that wasn't for me. Or a shopping queue, nothing happened. Unrealistic. But for the rest, the app was great. (P07, Pos. 28)*

Theme 2: Usability

The second theme was the usability of the VRET. While some patients did like facing feared situations at home, others felt discomfort when using mobile VRET.

> *My parents were home for the whole day so I could only train in situations when no one was at home. At some time in the evening, when I was sure that no one could hear me. (P05, Pos. 66)*

Some patients described problems with the compatibility of the VR application and their smartphone,

despite fulfilling the requirements. For example, they mentioned lags in the 360° videos.

> *It should have worked with my phone, but it lagged so much, for five seconds it worked and then it stood still for another five. (P09, Pos. 52)*

Regarding the VR headset, patients had problems with adequate fit and the glasses fogging up on the inside.

> *The VR headset did not really fit well and I got a bit of a headache because I wasn't able to correctly adjust the resolution. (P02, Pos. 36)*

Another patient brought up that the weight of the head-mounted construction with the smartphone inside made it difficult to wear the equipment for an extended time period:

> *I found the headset very heavy. At some point, I had to put my elbows on my knees and by that point, it did not feel like not being at home on the couch. (P10, Pos. 107-108)*

Finally, it was suggested that, since the app was only available for 90 days, the VR equipment should be only distributed temporarily, as when the license ends, the patient has no further use for the equipment that is tailored to the treatment app.

Theme 3: Variety of VR-content

A third theme covered the situations available in VR within the treatment app. Patients described the situations presented in the app as aligning well with the fear-evoking situations in real life. They also liked the variety of agoraphobic situations they were able to attend without having to face these situations in real life.

> *So first of all, being able to identify the anxiety and then being able to directly test it. It was nice to directly go into the specific situations. So, thinking back, I would have never gone into the situation [in reality]. It was practical, I did not need to go somewhere to go through the fear. (P06, Pos. 100)*

However, the situations were criticized for the lack of eventfulness. Patients did expect options to further increase fear and to adjust situations.

> *I thought that the situations would increase in intensity. I thought that eventually, I would stand on a huge stage and give a speech. And I thought that something VR-related would*

happen with the people. Not being in a prerecorded situation, but something like a chat. (P11, Pos. 100)

While the application did implement situations for SAD (e.g., giving a talk in front of an audience) and AG (e.g., a bus ride), one patient criticized the lack of available situations for eliciting bodily aroused panic disorder-related symptoms.

In the end, some modules did not fit my panic disorder anymore but fitted more to other anxiety disorders. […] But I think that also was because I wasn't able to pick a location that would cause my panic. For me, it is rather a personal, bodily thing. I tried one exercise on the airplane but after two minutes it was boring as it did not elicit panic. (P02, Pos. 34-36; Pos 62.)

Category 4: Context-related themes

The fourth category comprised themes that addressed the framework in which the patients received the treatment.

Theme 1: Significance of treatment guidance

The current treatment consisted of an application with mandatory psychotherapeutic sessions for the preparation and post-processing of certain modules. Many of the patients addressed this guidance in their interviews. For the majority, this was a crucial ingredient for symptom improvement or a protective factor against deterioration. Also, patients who did not particularly like the treatment application or the mobile VRET components, still regarded the psychotherapeutic sessions as helpful.

The therapist definitely helped. Just being able to talk and also for my understanding. So, the empathy and to accept it as normal and not be upset about it. (P02, Pos. 27-28)

Despite the guidance, it was criticized that patients could not share the completed modules with their psychotherapist. However, the combination of the treatment application and the psychotherapeutic sessions was brought up as a well-rounded mix by most patients. One of the given reasons was that the appointments facilitated the integration of the content learned in the application.

After I held the speech [in VR] I had an appointment and the therapist was able to improve

> *my anxiety a little, which I would have never achieved on my own. That's why it was very good that I still had the appointments. Completely on my own, it wouldn't have been possible. (P03, Pos. 38)*

Some patients addressed the desire for more appointments accompanying the application-based treatment.

> *I would've appreciated it if the time between the appointments was shorter and that we would've met more often and spoken more. (P07, Pos. 82)*

Theme 2: Study schedule

Patients attended psychotherapeutic appointments in prearranged intervals as part of the randomized controlled trials. Most patients indicated not feeling like *"being part of a research scenario" (P01, Pos. 54),* but being glad to contribute to research findings. However, to enable the manualized appointments in the experimental condition, the patients were asked to engage with the treatment application between the scheduled sessions. While this was perceived as helpful for staying motivated by most patients, some patients perceived it as stressful. The schedule was linked to treatment outcomes and limited the flexibility of the treatment.

> *First I felt relieved because usually, you have to wait a long time for a therapy spot. I was happy about any help, after all. It went quickly and I felt relieved, but also obligated to do this and that module between the appointments. […] A downside was that time-wise, you are independent, but also in this study combination. If you have this time frame in which you have to finish certain modules before coming to the next appointment, it is a downside for me, as it limits my flexibility. (P02, Pos. 13-14; 56-57)*

Theme 3: Motives for study participation

In their interviews, patients expressed their motives for participating in the present study context. For example, one patient was motivated to improve the supply situation for women in mental health care:

> *It is super important to generate new findings, therefore I find [participating in research] always positive. Especially, I think for many diseases, women are underrepresented, and when I can contribute to improving this and technology. (P02, Pos. 69-70)*

Another motive was getting access to therapy, as this is often constrained by long waiting times. Patients hoped to be prioritized by contributing to research.

> *I find the first step very hard and also exhausting when you are looking for a therapist. And when through [the study], you can quickly talk to someone, I consider this helpful, as you are rewarded for your first step and you don't need to call another 20 [psychotherapists] and receive 19 rejections. (P01, Pos. 62)*

Theme 4: Role of mobile-based interventions in mental health care

The fourth theme consisted of different opinions regarding the role of app treatment in mental health care. As such, IMIs were considered as an add-on to conventional therapy, e.g., as an alternative to traditional homework or to bridge waiting times.

> *Sometimes I think [waiting times] take way too long. The anxiety or the problems get more severe the longer it takes until they finally receive treatment. With this, you can at least work a bit on your own. (P07, Pos. 198)*

Also, IMIs were considered as having fewer barriers. This way, they could be a well-suited first step for patients searching for help.

> *I think many people are afraid to attend therapy in the first place or to completely trust another person. So I think it is easier to start the treatment with an app. For example, writing down things in the app without the therapist noticing. So I can imagine that this could lessen the barrier to starting a treatment. (P11, Pos. 67)*

However, while IMIs were perceived as suitable for complementing therapy or bridging waiting times, some patients also described limitations in their applicability. They thought that IMIs might only be suited for certain aspects of treatment or patients. For example, some people might prefer books over using their smartphones to inform themselves about their disorders. Patient 05 issued that she perceived the app treatment as helpful, as she already knew what her problem was:

> *If you have problems in many areas of your life and the app asks you to name your problems and then you type down an eternally long text, in that case, a real conversation is more practical. However, if you know your problem and just want to work on it… For me, that was very helpful and I think that could also be helpful for others. (P05, Pos. 82)*

Patients consistently made clear that from their experience, IMIs could be a complementary tool, but should not replace psychotherapy:

> *Difficult. I think that depends on the person. But I cannot imagine [IMIs replacing therapy]. Not in the current state. (P03, Pos. 96)*

Discussion

The goal of the present study was to systematically analyze patients' perspectives concerning the integration of mobile VRET into guided IMIs for treating anxiety disorders. This was done to inform how patients perceive this innovative treatment approach and where chances and challenges might lie. That way, in four overarching categories, 14 themes were identified: Symptom improvement, no change and deterioration, side effects, motivation, content and structure, user interface, technicalities, immersion, usability, variety of situations, treatment guidance, study schedule, motives for study participation, and role of IMIs in mental health care.

Perspectives on treatment outcomes

The first category of themes captures patients' experiences with symptom alleviation throughout the treatment. Most striking about the themes in this category was that patients articulated a variety of reasons for their respective change or no change and linked these to different entities of the treatment. Improvement was explained by oftentimes highlighting the helpful interactions with the guiding psychotherapist, but also by pointing out especially helpful treatment compartments such as psychoeducation, which was easy to follow as well as informational. Also, the mobile VRET was frequently brought up allowing for barrier-free encountering of otherwise feared and therefore avoided situations [24], highlighting the potential that mobile VRET yields in mental health care [28]. No change was explained by treatment compartments not meeting the individual symptomatology, yielding that the superficial treatment modality of an application-based treatment might not fit every patient. After all, the results give rise to the argument that treatment applications alone may not provide the depth of therapeutic interaction needed for comprehensive mental health care. Regarding the theme of side effects, it needs to be reflected on how to deal with adverse events related to the treatment [17] as it happened to one patient who learned through the treatment that there are other issues they need to deal with, for which there was no room left in the manualized short-term treatment. Without the frame of the study context, this occurrence could have gone unnoticed, and the patient would most likely not have received further treatment.

As a central construct when addressing treatment outcomes, patients marked down motivation. While motivation has also been found to be a key factor in traditional psychotherapy [40] it appears to even play a bigger role when the patient is self-reliant in working through the majority of the treatment content [41]. In particular, motivation was described as a dynamic process that is highest in the beginning, when the psychological strain is highest and decreases throughout the treatment. After its decrease, it is then associated with no change or even deterioration, resembling previous findings on motivation in traditional psychotherapy [42]. For the present treatment approach, this finding highlights the need for additional motivators as the treatment progresses to protect the patient from demotivation and losing benefits from the treatment.

Perspectives on the treatment application

The second category of themes covered patient opinions targeting the treatment application. Most strikingly, psychoeducation was brought up as an overwhelmingly positive treatment component that can be delivered well via an application, which is in line with previous research on patient perspectives in digital treatment modalities [43]. Also, a high degree of individualization (e.g., choosing the voice of the in-app psychotherapist) and an adjustable user interface were stressed as preferable. An aspect that faced repeated criticism was the in-app relaxation. While mindfulness interventions have been found efficacious in mental health care [44], the present sample encompassed patients with anxiety disorders. In particular with PD, it might be that for such disorders, relaxation is better delivered via psychotherapeutic interaction than an app, regarding the possibility of relaxation-induced panic attacks [45]. This, together with patients who spoke about increases in anxiety while receiving in-app psychoeducation, further intensifies the risk of unwanted events from treatment aspects that were originally intended to be beneficial but possibly caused issues when delivered self-guided. For patients, it was also important to have quick access to the treatment application and to be able to use it without barriers. One of such barriers was long informational sections which patients could not speed up or listen to while being active (e.g., walking, cleaning), as the app would require the user to click to move along. The findings are comparable to other qualitative studies on opinions on app treatment, as in general, a desire for a high degree of personalization stood out here as well [43]. However, while implementing the patients' suggestions might lead to more treatment acceptance, it has to be carefully considered for each suggestion on their own, whether they could raise other issues. For example, allowing the locking of the screen or opening of other apps while using the treatment application could lead to less focus on the treatment and eventually a decline in motivation or less treatment success.

Perspectives on mobile virtual reality exposure therapy

In the third category, themes were listed that were related to the mobile VRET of the treatment application. The most discussed aspect was the degree to which the head-mounted construction with the patient's smartphone serving as a display was able to create an immersive experience for the VRET [46]. While it was welcomed by some patients, who described being pleased with the high immersion, others criticized a lack of interaction, given the fact that the mobile VRET consisted of prerecorded 360° videos. As the hardware was targeted as a problem source in the theme of usability, these findings suggest that mobile VRET still needs time to overcome these particular challenges. Results indicated that the required degree of immersive interaction varied depending on the kind of the respective disorder, as in the current study, especially patients with SAD addressed this shortcoming. This criticism fits well with the clinical picture of the disorder, as patients with SAD are oftentimes afraid of how they behave in interpersonal interactions [4]. Notably, however, VRET with 360° videos has still been found efficacious in previous literature [47] pointing towards a potential gap between what is perceived as helpful and what is found efficacious. As numerous studies have drawn out the possibilities of VRET in mental health care [28], it is yet to be seen how the intriguing treatment approach of using mobile VRET can be further improved to be well received by patients. One way could be to integrate desired elements such as the possibility to choose from a large pool of fear-evoking situations with optional adjustments such as the crowdedness of certain places or the pace of car/bus/tram rides, as brought up by the interviewed patients.

Perspectives on the study’s context

Themes of the fourth category, which were context-related, yielded that for the patients, the psychotherapeutic supervision was very important, the study schedule may have had an influence on the symptom change, and most patients could well imagine using (guided) treatment applications, but that they could not imagine them as a substitute for psychotherapy. Overall, the interviewed patients highly valued the psychotherapeutic sessions as part of the guided treatment approach. Despite the application being the main ingredient of their treatment, the psychotherapeutic guidance was recurring in all interviews and was always brought up positively or with the request to have more psychotherapeutic sessions. This finding is in line with previous literature that found guided IMIs to be superior to unguided ones [20], indicating that alliance as a mechanism of change also holds up for digitally delivered interventions [48]. While the general modality of using IMIs is partly aimed at reducing psychotherapeutic involvement [17], it should carefully be considered for each treatment approach as to how far this reduction is taken. In the present study, many interviewed

patients distinguished the psychotherapeutic appointment as the most remarkable factor in their treatment, while conceptually one could argue that it was only intended as a supporting element with the main focus laying on the treatment application with mobile VRET [31, 32].

The thematic connection between the theme of study schedule and the theme of symptom improvement originated in patients giving aspects of the study schedule as reasons for their improvement. For example, it was mentioned that the psychotherapeutic appointments and calls from the study team served as deadlines and a reminder to finish the modules in the treatment application, which then led to a more holistic understanding of etiological and maintaining factors underlying their anxiety disorder. Here, it is important to note that these check-ups would not have occurred in a real clinical setting. Despite making sure that the RCTs, from which the interviewed patients were recruited, accurately display real-world clinical settings, it is essential to acknowledge that they still engaged in a structured intervention within a controlled environment [31, 32]. These minimal, but necessary alterations could therefore have influenced the quantitative results. Beyond trials investigating the treatment efficacy, it is important to also further identify characteristics in patients (e.g., demographic and clinical variables, personality traits, coping mechanisms), as well as process variables (e.g. fear reduction during exposure) and context variables that may predict treatment outcomes of these interventions and to develop clear indications as to who should gain access to these treatment options [49–51]. Also, for this reason, future interventions could increasingly incorporate deadlines and check-ups to increase the patients' commitment to engage with the otherwise self-reliant treatment contents.

While treatment acceptance is a crucial factor in mostly self-delivered treatments, in their interviews, patients also reflected on the role of IMIs in the mental health care system. Due to the scarcity of treatment capacities, they could imagine IMIs as a way to bridge waiting times. However, they could not imagine the tested treatment to substitute for psychotherapy as a whole, which is comparable to other qualitative research on patient attitudes toward IMIs [52]. This finding also is in line with research on the perspective of psychotherapists on IMIs, who welcomed the digital treatment option as an aid for certain aspects but also could not imagine it as a substitute for psychotherapy [53].

Limitations & future research:

While the study was capable of drawing a multifaceted picture of patients' opinions, some limitations need to be addressed when interpreting the findings. Firstly, the findings of the current

study are derived from a therapist-guided IMI with integrated mobile VRET. This being said, findings may not be readily translated to either the broader concept of VRET in mental health care, IMIs in general, or other psychotherapeutic modalities. Instead, future research could gather additional data from different treatment settings and draw insightful comparisons on the isolated matters. Also, a qualitative data analysis method was used to interpret the obtained interview transcripts. While this approach offers a comprehensive understanding of how patients perceive partaking in the novel treatment approach, it requires caution in generalizing the findings. As such, no implications should be made about the treatment's efficacy, as this would require comparative research methods and data analysis. Future trials of a confirmatory nature are needed to further investigate the exploratory findings of the present study. Another point worth mentioning is that, from the patient's perspective, it was interpreted that the study schedule, despite mimicking real outpatient clinical settings, might be linked to the obtained results. For future research, it could therefore be beneficial to conduct studies in a more naturalistic setting, mirroring the real-world psychiatric supply situation.

Conclusions

The present study explored patients' perspectives on IMIs embedding mobile VRET for SAD, PD, and AG. As such, various components such as the psychoeducative content were listed as beneficial in the intervention, and motivation was continuously perceived as a crucial factor for treatment engagement. The mobile VRET was welcomed as an innovative add-on to overcome anxiety, but, for some patients, lacked immersion and personal fit due to the reliance on pre-recorded 360° videos without interaction. Finally, the psychotherapeutic guidance of the intervention was appreciated as especially beneficial and stood out as a central aspect in most of the interviews as it helped the patients to integrate their learning from the IMI and served as a deadline to engage with the IMI before the next treatment session. The current study has shown that in the further development of IMIs and other associated interventions such as VRET, it is important not only to empirically test the efficacy of such procedures or their acceptance among psychotherapists but also not to ignore the perspectives of patients and those affected, as these are highly valuable to further improve existing procedures as well as to ensure their applicability. For future research, it is suggested to explore patients' perspectives in other treatment modalities or to investigate the findings of the present study in confirmatory research designs.

Declarations

Conflict of interest

The authors declare no conflict of interest.

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Abbreviations
SAD: Social anxiety disorder
PD: Panic disorder
AG: Agoraphobia
IMI: Internet- and mobile-based intervention
VRET: Virtual reality exposure therapy
RCT: Randomized controlled trial

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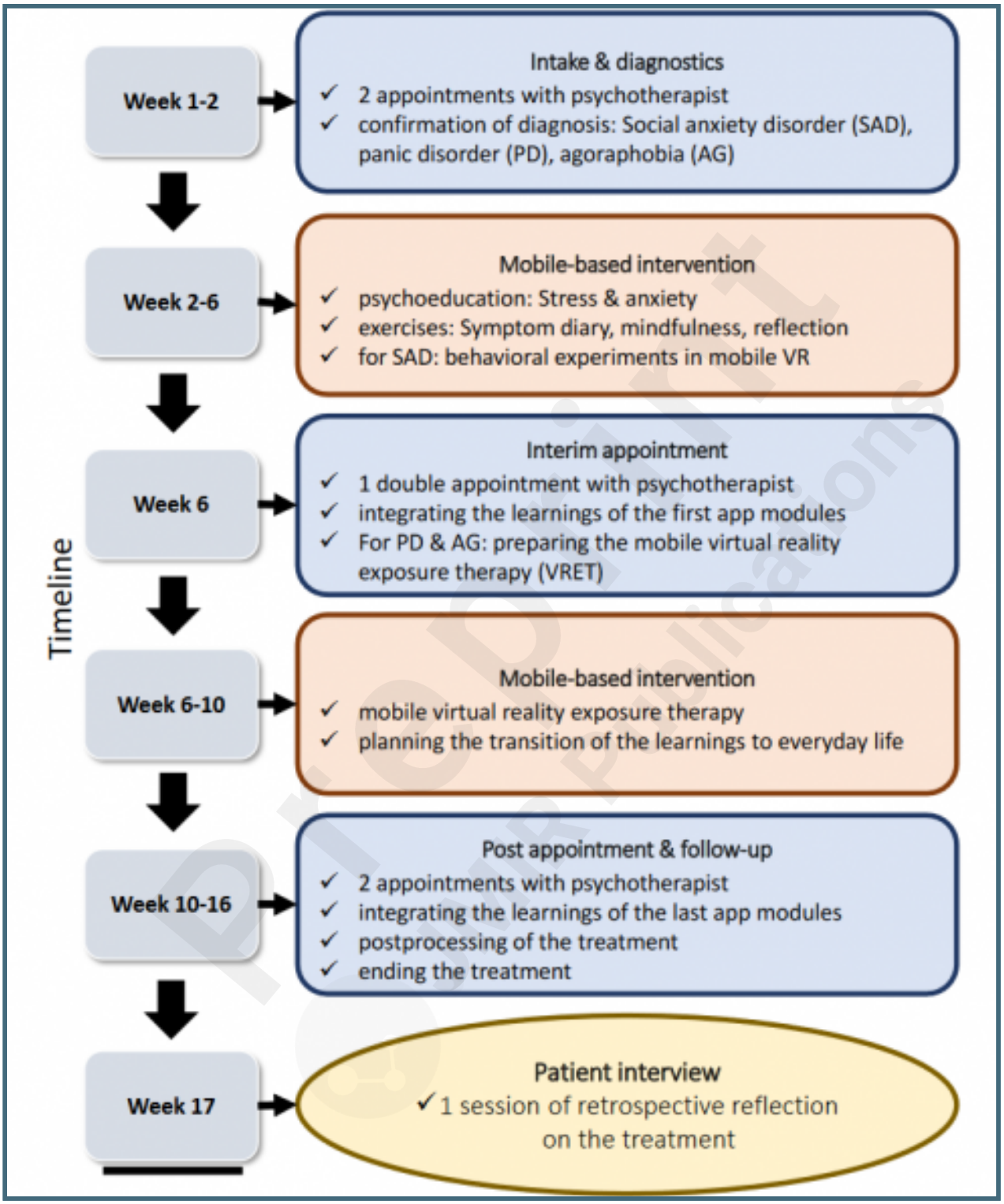
Supplementary Files

Figures

Procedure of the treatment process and study schedule.



Thematic map of the established themes in their respective category.