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ORIGINAL ARTICLE

Clinician Perceptions of Using a Smartphone App with Prolonged Exposure Therapy

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Abstract Clinician perceptions of clinical innovations affect their adoption and spread. This study investigated mental health clinicians' ($n = 163$) perceptions of a patient-facing smartphone application (app) for prolonged exposure (PE) therapy for posttraumatic stress disorder, before its public release. After reading a description of the app, participants rated perceptions of it based on diffusion of innovations theory constructs. Perceptions were generally favorable regarding the app's relative advantage over existing PE practices, compatibility with their values and needs, and complexity. Age (<40 years), smartphone ownership, and having used apps in care related to more favorable perceptions. Smartphone ownership, relative advantage, and complexity significantly predicted intention to use the app if it were available. These findings suggest that clinicians are receptive to using a PE app and that dissemination efforts should target sub-groups of PE clinicians to maximize adoption.

Keywords Posttraumatic stress disorder · Prolonged exposure therapy · Diffusion of innovations · Smartphone app · PE coach

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Introduction

Smartphones and their applications (apps) have only appeared within the past several years, yet they are increasingly being used in healthcare settings (Franko and Tirrell 2012). In fact, a recent review of the medical literature identified 83 apps that were designed to be used by healthcare professionals, medical or nursing students, and patients (Mosa et al. 2012). Patient apps include those for healthcare conditions such as diabetes, sleep apnea, and asthma. Use of smartphones in mental health settings, however, appears to be lagging (Ehrenreich et al. 2011). The reasons for this are unclear but it could be the result of mental health patients lacking access to technology (Borzekowski et al. 2009) or differences in the preferences of medical and mental health professionals.

Regardless of the causes, smartphones have a vast potential to improve mental healthcare (see Clough and Casey 2011) and emerging evidence suggests that using apps in care is acceptable to patients and may increase engagement in therapy and enhance outcomes. For example, Rizvi et al. (2011) reported that individuals with borderline personality disorder and substance use disorder who were undergoing dialectical behavior therapy (DBT) found DBT Coach, a companion app for the therapy, highly satisfying and helpful to use. The app was also found to increase participants' use of the specific DBT skill (i.e., opposite action) it supports, reduced acute distress and urges to use substances, and decreased symptoms of depression and other psychopathology.

Adoption of smartphone apps in mental healthcare settings will largely depend on clinician perceptions of what apps can offer. Diffusion of innovations theory (Rogers 2003) proposes that the perceived attributes of the innovation held by potential adopters are especially important

in this process. In particular, the theory highlights the importance of the innovation's perceived relative advantage compared to current practices; compatibility with clinicians' values, needs and settings; ease of use or lack of complexity; trialability or ability to be tried or experimented with before fully implementing; and observability, which is the capacity to observe results of the innovation. In short, innovations that are perceived as being better than those currently being used, that are consistent with clinicians' values, needs, and settings, are easy to use, are observable to others, and are able to be experimented with before being fully adopted will spread more quickly than will those lacking these perceived characteristics.

Clinician perceptions about innovative practices have been shown to be important in the adoption decisions and the rate at which new practices become part of routine health care (Greenhalgh et al. 2004). Recently, mental health clinician perceptions of computer-based psychological treatments have received research attention (Carper et al. 2013); however, research is lacking on therapists' perceptions of using mobile phone interventions, such as smartphone apps, in the provision of psychotherapy. This novel area of study is worthy to pursue because findings could have implication for dissemination efforts (e.g., targeted educational campaigns) and implementation programs (e.g., providing ongoing support for integration of apps into care) that may be needed to bring these promising innovations into broader use. Efforts to influence potential adopters' perceptions of innovations have shown promise in increasing their assimilation (Greenhalgh et al. 2004).

Existing, well-characterized provider communities that use specific types of evidence-based psychotherapies are ideally suited for understanding factors related to adoption of apps designed for use with specific protocols. Since 2007, the US Department of Veterans Affairs (VA) has been training their mental health clinicians who treat veterans with posttraumatic stress disorder (PTSD) in prolonged exposure (PE) therapy (Foa et al. 2007; Karlin et al. 2010), a cognitive behavior therapy (CBT) for PTSD that has well-established efficacy (Institute of Medicine 2008). To date, over 1500 VA clinicians have been trained to competently deliver PE (for details of this training program, see Karlin et al. 2010), as demonstrated by patient outcomes comparable to those found in published randomized controlled trials of PE (Eftekhari, Ruzek, Crowley, Rosen, Greenbaum, and Karlin 2013).

PE is a manualized psychotherapy (Foa et al. 2007) that is typically delivered in weekly, 90-minute sessions over the course of 10 weeks (fewer or more if indicated). It includes psycho-education about PTSD, highlighting the role of avoidance and negative thoughts in maintaining the condition. Patients are taught a breathing retraining technique for anxiety management and, most importantly, two forms of exposure to overcome avoidance and facilitate emotional processing of the trauma memory. During in vivo exposure, patients systematically and gradually confront avoided trauma-related or distressing situations that are objectively safe or relatively low risk. In vivo exposure helps patients break avoidance habits by confronting trauma-related anxiety-producing stimuli, tolerating elevated anxiety in the moment without escaping, and ultimately learning that these situations are manageable and not as dangerous as they had seemed. During imaginal exposure patients confront the trauma memory through repeated, prolonged retellings of the event. Imaginal exposure helps patients organize the trauma memory, better differentiate that the memory reflects a past rather than a current event, habituate to the anxiety, reduce overgeneralization of the trauma memory, and regain their sense of self-control and competence.

PE involves common CBT practices, such as homework assignments with self-monitoring and practicing skills outside of session. But unlike other CBTs, PE involves audio-recording of sessions for patients to listen to as homework. This is an essential part of the therapy, as it serves to reinforce psycho-educational materials and facilitate emotional processing of the trauma memory through repeatedly listening to the trauma recounting. The requirement to audio record sessions can present logistical challenges for clinicians who must attend to recording procedures and their patients who might have to obtain a tape or digital audio recorder and manage multiple recordings. Smartphones have the potential to address these unique logistical challenges of PE as well as support more common CBT practices.

In 2011, the DoD and VA partnered to build "PE Coach", a patient-facing smartphone app designed to support the provision of PE (Reger et al. 2013). PE Coach offers several key features and functions designed to improve upon existing PE practices and replace paper-based assessments, handouts, and homework tracking forms. For example, the app provides psychoeducation about PTSD (e.g., common reactions to trauma) and PE (e.g., the treatment rationale) with audio-visual presentations. The app also presents instruction on breathing retraining, including an audio-visual demonstration on how to breathe in ways that reduce anxiety and a coaching tool to practice the skill. For the in vivo exposure treatment component of PE, the app allows patients to construct a fear hierarchy and then select and rate in vivo exposure items for homework. Likewise, imaginal exposure homework assignments can also be rated and saved for review in session. Finally, as PTSD symptoms are assessed weekly or biweekly during PE, the app administers the PTSD Checklist (PCL; Weathers et al. 1993), a validated, widely used self-report measure of PTSD. This feature allows

clinicians and patients to track changes in symptom severity scores over the course of PE treatment.

In addition to the clinical utility of the app, it also offers several logistical conveniences that take advantage of existing smartphone features. These include the ability to audio record sessions, including making multiple recordings within a session (e.g., one of the full session content and one of just the imaginal exposure portion of the session), setting homework calendar reminders, entering contact information for their clinician and appointments, and scheduling appointment and assessment reminders.

PE Coach became available at no cost in the Google Play (for Android devices) and Apple (for iOS devices) app marketplaces in February and March 2012, respectively. As of October 2013, it has been downloaded over 16,000 times in 55 countries. Prior to its public release, the present study was conducted. Based on diffusion of innovations theory (Rogers 2003), we examined PE Coach's perceived relative advantage, compatibility, and complexity, but not its trialability and observability, as the app had not yet been available and in use. Likewise, we assessed clinicians' behavioral intention (Ajzen 1991) to use the app if it were available as a proxy for actual use because behavioral intentions are well-established determinants of behavior (Armitage and Conner 2001), including clinician behavior (Perkins et al. 2007).

Thus, the current study is the first of its kind to our awareness that seeks to understand clinician views of integrating a mobile phone app with psychotherapy. We specifically sought to examine PE-trained VA clinicians' perceptions about using a smartphone app designed to support the provision of PE with their patients with PTSD. We hypothesized that participants would believe that the app would provide a relative advantage to existing PE procedures, offering conveniences and other advantages to existing practices that would improve both the process and outcome of the therapy. We also expected that participants would perceive the app as being compatible with their own and their patients' values and needs, and as not being too complicated to use in care for themselves and their patients. Next, we examined if clinician characteristics (i.e., age, smartphone ownership, prior/current use of apps in care) related to their perceptions of the app. Lastly, we examined if clinician characteristics and perceptions of the app predicted behavioral intention to use the app in the future.

Methods

Participants

Participants included 163 VA mental health clinicians who completed PE training as part of the national implementation of evidence-based treatments for PTSD (see Karlin et al. 2010). A requirement for that training included that clinicians treat patients with PTSD for a minimum of 50 % of their work time. Table 1 provides demographic information on the sample. Most participants were practicing in specialty PTSD outpatient clinics ($n = 64$, 40 %) or general mental health outpatient clinics ($n = 48$, 30 %). Participants indicated that they treated 21 patients with PTSD per week on average ($SD = 15$). Eighty-seven percent ($n = 138$) indicated that they used PE with patients on a weekly basis and, of these, the average number of PE patients was 3-4 per week ($M = 3.3$, $SD = 3.2$). Of the nearly three quarters of participants ($n = 120$, 74 %) who owned a smartphone, 58 % ($n = 70$) were iPhone and 35 % ($n = 42$) were Android users, while the remaining 7 % ($n = 8$) endorsed Blackberry, Windows, or other type of smartphone.

Table 1 Participant Demographic Characteristics

	n	%
Gender (female)	106	65 %
Age (years)		
20–29	3	2 %
30–39	55	34 %
40–49	50	31 %
50–59	42	26 %
60 and over	12	7 %
Profession		
Psychologist	91	56 %
Social worker	65	40 %
Other	6	4 %
Smartphone owner	120	74 %
Early adopter[a]	53	33 %

[a] Participants who indicated that they had used or are currently using a smartphone app with patients as an adjunct to treatment

Measures

A web-based survey was developed for this study. Initial items assessed participant demographic and professional characteristics (e.g., profession, clinic type, PE use, and caseload) as well as smartphone ownership and app usage. Participants were then asked to read a brief objective description of the features and functions of the PE app (see Appendix). Based on Rogers (2003) recommendation that "measures of the five perceived attributes should be developed in each diffusion study, rather than utilizing existing scales borrowed from previous investigations (page 265)," a study-specific measure was created by the authors, who include experts in PE, implementation science, psychometrics, and the PE app creators and leaders of

Table 2 Perceptions, future use intention, and endorsement of PE App

Subscales and items	*M* (*SD*)	Disagree (1–3) *n* (%)	Neutral (4) *n* (%)	Agree (5–7) *n* (%)
Relative advantage (α = .94)				
The PE app will make it easier for my patients to listen to session recordings	5.59 (1.42)	11 (6.8)	14 (8.7)	136 (84.5)
The PE app will make it easier for Veterans to complete PE homework	5.48 (1.32)	10 (6.2)	13 (8.1)	138 (85.7)
The PE app will make it easier to record sessions	5.34 (1.53)	16 (10)	22 (13.8)	122 (76.3)
The PE app will improve homework compliance	5.32 (1.31)	11 (6.8)	21 (13.0)	129 (80.1)
The PE app will make it easier for me to provide homework forms and psycho-educational materials	5.22 (1.49)	14 (8.7)	27 (16.8)	120 (74.5)
The benefits of using the PE app will outweigh any potential drawbacks	4.96 (1.37)	16 (9.9)	42 (25.9)	104 (64.2)
The PE app will make it easier for me to administer the PCL to my patients	4.85 (1.51)	23 (14.2)	46 (28.4)	93 (57.4)
Using the PE app will add to my overall workload[a]	3.17 (1.42)	83 (51.6)	52 (32.3)	26 (16.1)
The PE app will help my patients stay engaged in treatment	4.80 (1.18)	10 (6.2)	55 (34.2)	96 (59.6)
Use of the PE app will improve patient outcomes	4.75 (1.23)	11 (6.8)	59 (36.7)	91 (56.5)
The PE app will reduce no-shows and canceled PE appointments	4.43 (1.40)	29 (17.9)	56 (34.6)	77 (47.5)
The PE app will make it easier for me to adhere to the PE protocol	4.26 (1.46)	33 (20.4)	62 (38.3)	67 (41.3)
The PE app will improve my relationship with my patients	4.09 (1.33)	31 (19.5)	82 (51.6)	46 (28.9)
Compatibility (α = .75)				
Patients will recognize the value of the PE app	5.10 (1.17)	8 (5.1)	31 (19.6)	119 (75.3)
My local clinical leadership will support my use of the PE app.	4.94 (1.48)	20 (12.5)	44 (27.5)	96 (60.0)
My patients will not want to use the PE app[a]	3.44 (1.21)	77 (47.5)	61 (37.7)	24 (14.8)
Privacy concerns will be an issue for my patients using the PE app[a]	3.71 (1.47)	67 (42.4)	46 (29.1)	45 (28.5)
Privacy concerns will be an issue for me using the PE app[a]	3.75 (1.57)	67 (41.6)	41 (25.5)	53 (32.9)
Veterans of all ages will be able to use the PE app	4.19 (1.68)	59 (36.4)	25 (15.4)	78 (48.2)
Complexity: (α = .78)				
The PE app will make it more complicated for me to deliver PE	3.08 (1.39)	93 (57.8)	48 (29.8)	20 (12.4)
Learning to use the PE app will be too time-consuming	3.10 (1.32)	92 (57.5)	45 (28.1)	23 (14.4)
The PE app will be too complicated to use for most of my patients	3.61 (1.28)	70 (43.8)	53 (33.1)	37 (23.1)
Future use intention				
I would use the PE app	5.39 (1.53)	15 (9.3)	24 (14.9)	122 (75.8)
Endorsement				
I would recommend the PE app to colleagues	5.17 (1.42)	11 (6.8)	51 (31.7)	99 (61.5)

[a] Item was reverse scored prior to aggregation

the VA PE training and evaluation program. The survey included 22 items assessing participants' perceptions of using the PE app in terms of its relative advantage, compatibility, and complexity (see Table 2 for items). Two additional items focused on their intention to use the app (future use intention) and recommend it to colleagues (endorsement) if it were available. Items were rated on a 7-point Likert-type scale that ranged from 1=Strongly Disagree to 7=Strongly Agree. For the Relative Advantage and Compatibility subscales, negatively scaled items were reverse-scored prior to aggregation. For the Complexity subscale, all items were negatively scaled; thus, lower scores indicated more favorable perceptions (i.e., disagreement that the app would be too complicated to use). Alphas ranged from .75 to .94 for the three sub-scales, demonstrating adequate internal consistency (see Table 2).

Procedure

Study procedures were approved by the local VA hospital research and development committee and affiliated university IRB. VA PE-trained clinicians ($n = 954$) were sent an email describing the study with an invitation to participate by accessing the web survey through an embedded hyperlink in the message. One week later, a follow-up email invitation was sent to those who had not accessed the survey from the initial invitation. This resulted in an overall response rate of 17 % of the VA PE-trained

clinician population. The sample was not statistically significantly different ($p > .05$) from the larger population of VA PE-trained clinicians on key demographic indicators such as profession, gender, clinic type, and number of PE patients seen per week. Age was not available for the larger population of VA PE-trained clinicians but years of clinical experience since finishing their professional degree was used as a proxy for age ($r = .68$) and it did not significantly differ ($p > .05$) for those who did and did not participate in the study.

Statistical Analyses

Data were analyzed using PASW Statistics 18. Descriptive statistics (frequencies, means, and standard deviations) were used to report summary outcomes. To test if participant characteristics accounted for differences in the mean ratings of perceptions of the app, future use intention, and endorsement, independent samples t-tests were employed. Finally, to test if clinician characteristics and perceptions of the app predicted intention to use it in the future, a multiple regression analysis was conducted.

Results

Overall, participant perceptions of using the PE app were generally favorable but not very strong, as indicated by the means of the subscales: Relative Advantage ($M = 4.92$, $SD = 1.04$), Compatibility ($M = 4.55$, $SD = 0.95$), and Complexity ($M = 3.26$, $SD = 1.10$). On average, participants agreed that they would use the app ($M = 5.39$, $SD = 1.53$) and recommend it to colleagues ($M = 5.17$, $SD = 1.42$) if it were available (see Table 2 for item information).

Table 3 reports the means of the perception subscales and future use intention and app endorsement items based on clinician characteristics along with t tests analyzing mean differences. Because there were no significant differences found between older cohorts of participants (ages 40–49, 50–59, and 60+) on any of the outcome measures and due to the small number of respondents in the 20–29 range ($n = 3$), age was dichotomized into younger (<40 years old) and older (≥40 years old) for analysis purposes. On all the perception subscales, younger participants rated the app significantly more favorably than did older participants and reported greater intention to use the app and recommend it to colleagues if it were available (see Table 3). A similar pattern emerged for smartphone owners relative to those participants who did not own a smartphone. Participants who indicated that they had used or were currently using a smartphone app with patients as an adjunct to treatment were considered to be "early adopters." These early adopters rated the app significantly more favorably than did their counterparts and reported greater intention to use the app and recommend it to colleagues if it were available.

In the current sample, younger participants were significantly more likely to be early adopters of apps in care ($n = 28$, 48.3 %) than were older participants ($n = 24$, 23.5 %), $X^2(1, n = 160) = 10.32$, $p < .01$. There was also a statistical trend for younger participant to be more likely to own smartphones ($n = 48$, 82.8 %) than were older participants ($n = 71$, 68.9 %), $X^2(1, n = 161) = 3.68$, $p < .06$. Given these findings, supplemental analyses controlled for age when examining the relationships between smartphone ownership, early adoption, and perception subscales. For all subscales, smartphone ownership and early adoption were significant independent predictors of attitudes after controlling for age.

Clinician characteristics (age, smartphone ownership, and early adoption) and the perception subscales (relative advantage, compatibility, complexity) were simultaneously entered into a multiple regression model predicting future use intention (see Table 4). Regression diagnostics showed linearity between predictors and outcomes as well as error normality, independence, and homoscedasticity. Smartphone ownership ($B = .21$) and clinician perceptions about

Table 3 Perceptions based on participant characteristics

	Age			Smartphone owner			Early adopter		
	<40 years ($n = 58$) M (SD)	≥40 years ($n = 103$) M (SD)	t	Yes ($n = 120$) M (SD)	No ($n = 42$) M (SD)	t	Yes ($n = 53$) M (SD)	No ($n = 108$) M (SD)	t
Relative advantage	5.26 (0.69)	4.73 (1.15)	3.19**	5.06 (1.02)	4.51 (0.98)	3.04**	5.43 (0.86)	4.66 (1.03)	4.65***
Compatibility	4.83 (0.80)	4.39 (1.00)	2.85**	4.69 (0.97)	4.17 (0.78)	3.12**	4.99 (0.94)	4.33 (0.89)	4.41***
Complexity	3.02 (1.08)	3.39 (1.10)	−2.08*	3.06 (1.11)	3.82 (0.86)	−3.97***	2.79 (0.96)	3.50 (1.09)	4.06***
Future use intention	5.93 (1.21)	5.08 (1.62)	3.50**	5.77 (1.36)	4.31 (1.49)	5.86***	6.23 (0.94)	4.98 (1.60)	5.21***
Endorsement	5.57 (1.26)	4.95 (1.47)	2.70**	5.43 (1.38)	4.41 (1.26)	4.17***	5.90 (1.19)	4.82 (1.39)	4.80***

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4 Summary of multiple regression analysis for variables predicting future use intention of PE app ($n = 158$)

Variable	*B*	*SE B*	*β*
Age	−.182	.168	−.057
Smartphone owners	.740***	.184	.213
Early adopter	.246	.181	.075
Relative advantage	.579***	.114	.394
Compatibility	.231	.138	.144
Complexity	−.250*	.107	−.180
R^2		.622	
$F(6, 152)$		41.761***	

Age dichotomous variable

* $p < .05$, *** $p < .001$

relative advantage ($B = .39$) and complexity ($B = -.18$) explained a significant proportion of the variance in future use intention ($R^2 = .62$).

Discussion

Overall, VA PE-trained clinicians appear to hold generally favorable perceptions of using a smartphone app as an adjunct to PE. Clinicians agreed that the app would offer a relative advantage to existing PE practices and would be compatible with their own and their patients' values and needs and disagreed that the app would be too complicated to use. Clinicians who were younger than 40 years old, owned a smartphone, and had used an app in care held more favorable perceptions than those who were older than 40, did not own a smartphone, and had not used an app in care. Finally, owning a smartphone and having favorable perceptions of the app's relative advantage and complexity were significant predictors of an intention to use the app in the future.

Should our sample of VA clinicians be representative of the larger population of mental health clinicians, these findings would suggest that the field is receptive to using a smartphone app with PE. Consistent with the results of this study, PE Coach has been downloaded over 16,000 times in the time it has been publically available (February 2012–October 2013). However, we did find significant variability in perceptions of the app and intention to use it based on clinician characteristics. Thus, PE Coach dissemination efforts might target PE clinicians who do not own smartphones and are not familiar with apps for mental health. These clinicians may need basic training involving actual exposure to smartphones and apps so they can observe and evaluate their potential first hand. These clinicians as well as others who have never used an app as an adjunct to treatment should receive information that also highlights the relative advantages of the PE app while emphasizing its ease of use for both themselves and their patients. Previous research on the dissemination of other innovations in health services has found that efforts designed to affect potential adopters' perceptions of an innovation are promising, including efforts intended to reduce complexity and increase the observed benefits of such interventions (Greenhalgh et al. 2004). In addition, given that early adopters of innovative practices are considered to be opinion leaders who can influence the adoption decision of others within their communities of practice (Rogers 2003), it is encouraging for dissemination purposes that a substantial percentage (33 %) of clinicians have already used apps in care and this group reported the most favorable perceptions of the PE app.

A number of study limitations should be considered when attempting to draw conclusions from the current findings. Foremost among these is that because the app had not yet been released, participants did not actually see or use it; instead, their perceptions of the app were based on an objective, brief description of its major features and functions. As a result, participants may not have had adequate information to envision the app (especially those with little to no experience with smartphone apps), which may have created uncertainty evaluating it resulting in ratings clustering around the scale midpoint ("Neither agree nor disagree"). Likewise, because the app was not available, future use intention was used as a proxy for actual adoption of the app. Lastly, we employed a measure that was specifically developed for this study and it has limited psychometric support.

Limitations should also be considered when attempting to generalize these findings beyond the current sample. First, the participation rate of VA PE-trained clinicians was low (17 %). Although no differences were found between our sample and the larger population of VA PE-trained clinicians on key demographic variables, the sample may have differed in important ways that cannot be discerned (e.g., maybe those with more favorable attitudes about smartphone apps or even PE participated in the study, positively skewing results or attenuating effects). Second, VA clinicians and settings may differ significantly from other clinician groups and settings. For example, VA has been widely praised for its system-wide use of a computerized patient medical record system and resultant improvements in care (Jha et al. 2009). VA has also been a leader in the development and deployment of mobile apps for mental health, including its highly downloaded (125,000+ as of October 2013) and professionally acclaimed PTSD Coach (Kuhn et al. in press). Thus, VA providers may be more technology-savvy and amenable to integrating new technologies into care than other clinician groups. VA also serves a specific population of patients

(i.e., military veterans who are predominantly male) whose conditions and concerns may not reflect those of patients in other care settings. For example, many veterans express concerns about the stigma of mental illness and privacy (Vogt 2011). Finally, given that the study focused on a particular app, it cannot be known how well these findings would generalize to clinician perceptions of other apps.

Overall, the findings reported in this study indicate that mental health clinicians may be receptive to bringing technology into their practice. This is important because technologies, in addition to supporting delivery of specific evidence-based interventions, may allow practitioners to serve more clients and address a wider array of patient needs. It is increasingly recognized that traditional modes of individual and small group treatment delivery fail to enable widespread diffusion of evidence-based interventions and that technologies (e.g., web and phone interventions) can potentially reduce costs of intervention while improving client engagement and scalability of services (Kazdin and Blasé 2011; Rotheram-Borus et al. 2012).

This study is the first of which we are aware to assess mental health clinician perceptions of the use of a smartphone app to support an evidence-based psychotherapy. Given the potential relevance of apps to a range of evidence-based interventions and treatments (Luxton et al. 2011), positive clinician responses may have implications beyond PE and the diagnosis of PTSD. Additional research is needed to determine whether these findings generalize to other apps, populations of clinicians, and disorders. Future research is also required to determine what factors drive actual adoption and spread (and sustained use) of the PE app, as well as other apps designed for use in mental health care. These efforts should also investigate other factors related to adoption beyond clinician perceptions of app characteristics, such as additional demands that may be placed on clinicians when integrating apps into care (e.g., training requirements, addressing technical issues), contextual and system variables, and obviously, patients' perceptions and use of these types of apps.

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Appendix

Objective description of the features and functions of the PE app, PE Coach

- Recording sessions and playing them back. This includes being able to make multiple recordings in session (e.g., one for the session material and one for imaginal exposure).
- Completing the PCL assessment and saving and tracking the data.
- Scheduling PE appointments with reminders
- Providing psychoeducation about PTSD (e.g., common reactions) and PE (e.g., the rationale), including audio-visual presentations of the content
- Breathing retraining, including learning about breathing retraining, watching an audio-visual presentation on how to do breathing retraining, and practicing it with the help of an audio-visual material.
- Recording and reviewing homework, as well as setting homework reminders
- Creating an in vivo hierarchy and SUDS ratings
- Selecting and rating in vivo homework items, as well rating imaginal exposure homework assignments

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