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PERSONALITY DISORDERS (K BERTSCH, SECTION EDITOR)

E-Mental Health for People with Personality Disorders: A Systematic Review

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Abstract

Purpose of Review Provision of mental health services through digital technologies (e-mental health) can potentially expand access to treatments for personality disorders (PDs). We evaluated studies on e-mental health for PDs published over the last 3 years (2019–2022).

Recent Findings Studies published in English that used e-mental health to treat people with PDs or PD-related symptoms were identified. We identified 19 studies, including four randomized controlled trials and one meta-analysis. Most interventions were based on Dialectical Behavior Therapy and delivered through smartphone applications for adults with Borderline Personality Disorder [BPD] or related symptoms. User experiences of the interventions were generally positive. Evidence for efficacy was limited.

Summary The current literature on e-mental health for PDs is limited in scope. Research in understudied populations and randomized controlled trials designed to establish efficacy are warranted. It is not yet clear whether e-mental health may be helpful for the treatment of PDs.

Keywords Personality disorders · e-health · Mobile health · Internet · Smartphone · Systematic review

Introduction

Personality disorders (PDs) are characterized by extreme, rigid, and enduring personality traits that significantly deviate from cultural norms and cause significant distress and/or functional impairment [1]. The American Psychiatric Association's Diagnostic and Statistical Manual (DSM-5) [1] defines 10 specific PDs that vary in their cardinal features. For example, Borderline Personality Disorder (BPD) is characterized by intense fear of abandonment along with instability in interpersonal relationships, self-identity, affect, and behavior (e.g., impulsivity) [1]. Schizoid PD, in contrast, is characterized by detachment within social relationships along with a restricted range of emotional expression and a decreased desire for emotional closeness [1]. Approximately 8% of people worldwide suffer from PDs [2]. Those with PDs have elevated rates of comorbid psychiatric disorders and may experience functional impairment, including in social relationships and career development [3]. With the high utilization of health services and occupational impairment, the economic burden associated with PDs is large, exceeding the economic costs of even more prevalent psychiatric disorders (e.g., depressive disorders) [4, 5]. Efficacious and cost-effective treatments are needed given the prevalence and disease burden of PDs.

Evidence-based treatments exist for some PDs. For example, dialectical behavior therapy (DBT) has been recognized as the gold standard for the treatment of BPD [6, 7]. However, access to traditional therapist-delivered psychotherapies such as DBT may be limited for many people due to costs, mental health stigma, and logistical barriers such as travel required to attend therapy appointments [8, 9]. For many, therapists trained in DBT are simply not accessible. E-mental

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health, which provides mental health services through digital information and communication technologies (e.g., smartphone applications, the Internet), has been widely used to promote mental health in the past decade [10, 11]. E-mental health has the potential to increase cost-effectiveness [12], expand access to mental health resources [13], reduce the stigma associated with seeking traditional psychotherapy [14], and provide personalized psychological services [15].

The use of e-mental health in the treatment of PDs has also gained popularity in the past decade and for potentially good reason. As early as 2011, a pilot study suggested that smartphone-delivered DBT effectively reduced emotional distress and substance use craving in BPD patients [16]. The authors of this study highlighted the potential of employing e-mental health to increase the application of DBT skills within daily life. From this perspective, e-mental health may not only expand access to intervention approaches for PDs but also increase the integration of interventions within daily life. This integration may be particularly welcome given the pervasive nature of PDs which are, by definition, characterized by rigid and enduring features that manifest regularly within daily life [1].

Despite this potential, recently published reviews have reported that the effectiveness of e-mental health for PDs (specifically BPD) did not outperform in-person treatments and wait-list comparisons [17••] and most studies on e-mental health for PDs were in the initial stages (e.g., feasibility/usability testing) [18••, 19]. Given the rapid rate of publication in the area of e-mental health, particularly during the COVID-19 pandemic [20], there is a need for an updated review of this growing literature. Moreover, previous reviews did not include protocol papers that can help understand planned studies and highlight the directions that the field is heading.

The current systematic review aims to provide an up-to-date depiction of the literature on e-mental health for PDs, focusing on the last 3 years (2019–2022). For the purposes of the current review, e-mental health was defined to include mental health interventions delivered through smartphones, websites, and other information and communication technologies. Synchronous therapy delivered via telephone or video conferencing (i.e., telehealth/telepsychiatry) was excluded. To most fully characterize recent research on e-mental health for PDs, we did not set any restrictions based on study design (i.e., reviews, perspectives/commentaries, qualitative studies, and protocol papers were included).

Method

Protocol and Registration

The current review was preregistered through the Open Science Framework (https://osf.io/wfu7r/) and complied with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines [21].

Eligibility Criteria

Inclusion criteria were quantitative, qualitative, and mixed-methods studies that used e-mental health to treat people with PDs (e.g., BPD) or that focused on technology-delivered interventions commonly used for the treatment of PDs (e.g., DBT for BPD) regardless of whether they included a sample restricted to people with PDs. Theoretical reviews and perspective/opinion articles on e-mental health for people with PDs were also included. We did not restrict based on publication status (i.e., dissertations were eligible). Studies on synchronous interventions delivered via telephone or video conferencing (i.e., telehealth/telepsychiatry) were not included as the evidence for these is well established. Studies published in languages other than English were excluded.

Information Sources

We searched PubMed for studies on e-mental health for people with PDs. The database was searched from January 1, 2019, to March 7, 2022.

Search

We paired search terms related to e-mental health with terms related to PDs. Search terms were ("smartphone" OR "smart phone" OR "mobile phone" OR "cellular phone" OR "cell phone" OR "mobile app" OR "mobile device" OR "mobile-based" OR "mobile health" OR "mhealth" OR "m-health" OR "iphone" OR "android" OR "tablet" OR "Internet") AND ("personality disorder" OR "dialectical behavior therapy" OR "dbt" OR "dialectical behavioral therapy").

Study Selection

Titles and abstract screening and full-text screening were conducted by the first author (QX) in consultation with the corresponding author (SG). A consensus was reached between the two authors on final decisions for inclusion/exclusion.

Data Collection Process

Study-level data were coded using the standardized spreadsheets developed for the review. The first author (QX) who has experience conducting systematic reviews completed all study-level data coding in consultation with the corresponding author (SG).

Data Items

The following variables were coded for each study: study design (e.g., review, randomized controlled trial/controlled trial); sample characteristics including sample size, clinical condition (e.g., BPD patients), age, country of origin, percentage of female; intervention characteristics including intervention type (e.g., DBT), basis (e.g., DBT-based), and format (e.g., email-based; app-based); outcome type (e.g., usability, BDP symptoms); and main results.

Summary Measures

Since the current study is a systematic review rather than a meta-analysis, no summary measures were used.

Synthesis of Results

The main results of each study were summarized qualitatively.

Results

Study Selection

One hundred and thirty-two articles were retrieved from PubMed using the search terms. Nineteen eligible studies were included in the current review. Among the excluded studies, 107 were excluded during title and abstract screening (57 were not related to e-mental health, and 50 were not related to PDs). Six studies were excluded during full-text screening (three were not related to e-mental health and three were not related to PDs). See Fig. 1 for the PRISMA flow diagram.

Study Characteristics

Among the 19 included studies, four (21.05%) were randomized controlled trials (RCTs) [22•–25], one (5.26%) was a nonrandomized controlled trial (NCT) [26], three (15.69%) were RCT protocols [27•–29], six (31.58%) were single-group intervention studies [30–35], two (10.53%) were intervention development studies [36, 37•], and three (15.79%) were reviews [17••, 18••, 38]. The majority of intervention studies ($k = 12$ out of 16, 75.00%) used DBT techniques. Specifically, nine out of the 16 intervention studies (56.25%) were based on DBT (i.e., the interventions were DBT) [23–27•, 30, 32, 34, 35], and three (18.75%) were DBT-informed (i.e., included DBT elements) [29, 31, 37•]. Only four intervention studies (25.00%) did not use DBT techniques [22•, 28, 33, 36]. For the three reviews, one (33.33%) included only DBT-based studies [38], and two (66.67%) did not restrict the interventions to DBT [17••, 18•]. In terms of the delivery format, most studies used smartphone apps to deliver the interventions. Twelve (63.16%) studies were smartphone app-based [17••, 23, 24, 27•, 28, 30–32, 34, 36–38•], five (26.32%) were Internet-based [22•, 25, 29, 33, 35], one (5.26%) was email-based [26], and one review (5.26%) examined various forms of technology (e.g., virtual reality, mobile apps, computer-assisted) [18••]. The vast majority of the studies ($k = 18$ out of 19, 94.74%) were conducted in North America and Europe, only one study [24] was conducted in Argentina.

The average age of the samples included in the current review was 30.11 years old. Samples were on average majority female (83.06%). Among the 19 samples included, nine (56.25%) had BPD diagnosis [18••, 22•, 23, 26, 28, 31–34], six (37.50%) had common symptoms of BPD (e.g., self-injury, suicidality) [17••, 24, 25, 27•, 29, 35], one (6.25%)

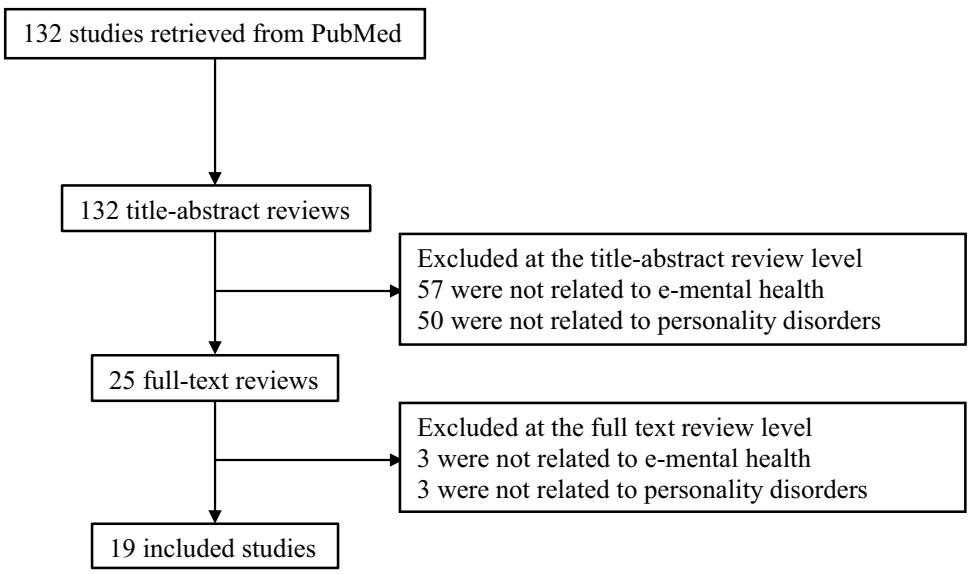

Fig. 1 PRISMA flow diagram

included various PDs (not limited to BPD) [30], two (12.50%) included people assisting in technology development [36, 37•], and one (6.25%) focused on smartphone apps rather than participants [38•].

The design and sample characteristics of included studies are reported in Table 1. The outcomes and results of included studies are shown in Table 2. Below, we discuss the included studies based on their study design.

Randomized Controlled Trials (RCTs) and Nonrandomized Controlled Trials (NCTs)

There were five eligible RCTs and NCTs in the current review. Four [23, 24–26] were based on DBT and one [22•] was based on schema therapy. Two studies delivered interventions through smartphone apps [23, 24], two through the Internet [22•, 25], and one through email [26]. These trials measured a wide variety of outcomes including aspects of feasibility and acceptability (e.g., treatment compliance, dropout rate, acceptability), general outcomes (e.g., disease burden, health care utilization), and BPD symptom-related outcomes (e.g., suicidality, emotion regulation). Four studies reported results comparing an e-mental health condition with a control condition [22•–24, 26]. Results of comparisons between e-mental health interventions and control conditions provided mixed results. We discuss the results of these four studies one by one below. One study [25] involved secondary data analysis of an RCT testing Internet-delivered DBT (iDBT) [39]. However, the included study [25] did not examine differences between the iDBT and control group, but instead focused on predictions of dropout from iDBT based on clinical characteristics and user experience. Results indicated that technological and unknown barriers (i.e., participants were unreachable when user experience was being assessed) as well as perceived usefulness were associated with dropout.

As noted, four studies directly compared e-mental health interventions with control conditions for people with PDs or PD-related symptoms. All four studies focused on adult samples. Laursen et al. [23] compared DBT delivered via a mobile diary app with paper-based diary cards. Relative to the paper-based diary card condition, the app group showed improved effects on suicidal behavior but inferior effects on measures of depression, quality-adjusted life years, and borderline severity, with no differences between the groups on health care utilization. Rodante et al. [24] evaluated the preliminary effectiveness of augmenting DBT with an app compared to DBT alone. Combining DBT with an app produced superior effects on suicide and self-harm relative to DBT alone. Moreover, the DBT app was rated as having good acceptability by participants. Alavi et al. [26] compared the effectiveness of email-delivered DBT with in-person DBT in a nonrandomized design. Emotion regulation difficulties improved from pre- to post-test in both conditions, but the two groups did not differ in changes in emotion regulation difficulties. Klein et al. [22•] studied the relative effectiveness and safety of adding an Internet-based schema therapy to treatment-as-usual (TAU) and TAU only. Results showed that the addition of an Internet-based schema therapy did not improve BPD severity or serious adverse events (e.g., self-injury, drug intoxication) compared to TAU only. In summary, among the four studies comparing e-mental health with a control condition, one showed a superior effect of the e-mental health intervention to the control condition [24], two did not find differences in effectiveness [22•, 26], and one showed a mixture of results favoring the e-mental health or the control condition depending on the outcome measure [23].

RCT Protocols

There were three eligible RCT protocols. Han et al. [27•] aimed to compare a DBT-based smartphone app with a matched attention control. They also planned to understand user experiences of the app through qualitative interviews. According to the protocol, this would be the first trial to examine the effectiveness of a smartphone app-based DBT intervention on suicidal and related mental health outcomes for young adults. Kaess et al. [29] reported the development and evaluation plan for an online intervention informed by cognitive behavioral therapy and DBT for youth with repetitive non-suicidal self-injury. According to the authors, it would be the first RCT to apply an Internet-based intervention for youth with self-injury. Helweg-Jørgensen et al. [28] aimed to evaluate the effectiveness of a smartphone app-based self-monitoring intervention compared with a pen-and-paper self-monitoring (control condition) during DBT treatment for BPD. The authors reported that this would be the first trial to evaluate an app-based self-monitoring system for BPD treatment.

Single Group Intervention Studies

There were six eligible single-group intervention studies. Four were DBT-based [30, 32, 34, 35], one was DBT-informed [31], and one was non-DBT (schema therapy) [33]. In terms of the delivery format, four were app-based [30–32, 34] and two were Internet-based [33, 35]. Five out of the six studies evaluated aspects of feasibility and acceptability of the interventions [30–34]. In general, participants had positive experiences with the interventions (e.g., high satisfaction, high ratings on usability). Among the six studies, Whiteside et al. [35] was the only one that evaluated effectiveness. They found reductions in suicidal thoughts

Table 1 Design and sample characteristics of included studies

Study	Design	Sample	Clinical characteristics	Age	Country of origin	% female	Intervention	Intervention basis	Format
Alavi et al. [26]	NCT	107 BPD patients	BPD	n/a	Canada	77.57%	DBT	DBT-based	Email-based
Austin et al. [30]	Single group	24 PD patients receiving DBT	PD	28.9	Denmark	95%	DBT	DBT-based	App-based
Derks et al. [36]	Intervention development	5 adult BPD patients, 4 health care professionals, 3 user-centered design (UCD) experts	People assisting in technology development	28 for patients, 52 for health care professionals, n/a for experts	Netherlands	Patients: 100%, health care professionals: 50%, experts: n/a	Ambulatory biofeedback to increase emotional awareness	Non-DBT	App-based
Frías et al. [18••]	Review	15 studies on e-Health for BPD patients	BPD	n/a	n/a	n/a	n/a	Include DBT studies	Technology-based
Frías et al. [31]	Single group	25 adult BPD patients	BPD	35.8	Spain	84%	Second- and third-wave cognitive-behavioral techniques	DBT-informed	App-based
Han et al. [27•]	RCT protocol	378 young adults with suicidal thoughts	Symptoms of BPD	n/a	Australia	n/a	DBT	DBT-based	App-based
Helweg-Joergensen et al. [32]	Single group	16 adult BPD patients and 23 therapists	BPD	28 for patients and 44 for therapists	Denmark	n/a	DBT	DBT-based	App-based
Helweg-Jørgensen et al. [28]	RCT protocol	80 adult BPD patients receiving DBT treatment	BPD	n/a	Denmark	n/a	Self-monitoring of symptoms and skills training progress	Non-DBT	App-based
Ilagan et al. [17••]	Review	12 studies on smartphone applications for BPD ($n=408$ adults with BPD symptoms)	Symptoms of BPD	32.3	6 studies in US, 3 European, 2 Australia, 1 multi-national	48.00%	Smartphone interventions targeting suicide and self-harm, emotion regulation	Include DBT studies	App-based
Kaess et al. [29]	RCT protocol	700 youth with repetitive non-suicidal self-injury (NSSI)	Symptoms of BPD	n/a	Germany	n/a	Intervention including elements of CBT and DBT	DBT-informed	Internet-based
Klein et al. [22•]	RCT	204 adult BPD patients	BPD	32.4	Germany	91.70%	Self-management intervention based on schema therapy	Non-DBT	Internet-based

Table 1 (continued)

Study	Design	Sample	Clinical characteristics	Age	Country of origin	% female	Intervention	Intervention basis	Format
Köhne et al. [33]	Single group	25 adult BPD patients	BPD	28.86	Germany	87.50%	Schema therapy	Non-DBT	Internet-based
Laursen et al. [23]	RCT	78 adult BPD patients	BPD	29	Denmark	87.18%	Therapist-delivered DBT + registering emotions, urges, and skills used in mobile diary app vs. paper-based diary cards	DBT-based	App-based
O'Grady et al. [37•]	Intervention development	6 clinical design experts, clinicians providing feedback, 18 students with technology experience for app evaluation	People assisting in technology development	n/a	Ireland	n/a	Safety plan, diary tracking moods, thoughts, sleep, and DBT diary card	DBT-informed	App-based
Rodante et al. [24]	RCT	21 adults with suicide risk or self-harm behaviors	Symptoms of BPD	29.86	Argentina	80.95%	DBT	DBT-based	App-based
Schiffler et al. [34]	Single group	13 transitional age youth with BPD	BPD	20.1	Austria	92.31%	DBT	DBT-based	App-based
Whiteside et al. [35]	Single group	3670 website visitors with suicidal thoughts	Symptoms of BPD	n/a	US	n/a	DBT	DBT-based	Internet-based
Wilks et al. [25]	RCT	59 suicidal and heavy episodic adult drinkers	Symptoms of BPD	38	US	69.50%	DBT	DBT-based	Internet-based
Wilks et al. [38•]	Review	21 apps	apps	n/a	n/a	n/a	DBT	DBT-based	App-based

RCT randomized controlled trial, *NCT* non-randomized controlled trial, *PD* personality disorder, *BPD* borderline personality disorder, *DBT* dialectical behavior therapy

Table 2 Outcomes and results of included studies

Study	Outcomes	Main results
Alavi et al. [26]	Difficulties in emotion regulation	Difficulties in emotion regulation improved from pre- to post-intervention in both groups; no significant difference between two groups
Austin et al. [30]	User experience	Qualitative themes: (1) positive experiences using app; (2) app perceived to promote therapist-client relationship Quantitative: large variation in user engagement; dropout rate < 10%
Derks et al. [36]	Usability and user experience	Patients rated as "good," therapists "OK," and experts between "OK" and "acceptable"
Frías et al. [18••]	Outcomes from any stage of the clinical research cycle (e.g., feasibility, efficacy, safety, satisfaction, efficiency)	Technology conceived as adjunctive interventions, DBT commonly included, most studies focused on initial stages of clinical research cycle
Frías et al. [31]	Usability and acceptability	App considered user-friendly and highly satisfactory
Han et al. [27•]	Suicide-related outcomes, emotional distress, well-being, distress tolerance, help seeking, risk factors, app satisfaction, and adherence	n/a
Helweg-Joergensen et al. [32]	User experience	Qualitative: patients satisfied with app; inside-out innovation (new work tasks created when implementing and communicating of modifications needed in the app) decreased perceived usability among therapists Quantitative: Patients rated usability high, therapists rated as average; older age was negatively associated with usability
Helweg-Jørgensen et al. [28]	DBT skill learning, BPD symptoms	n/a
Ilagan et al. [17••]	BPD symptoms, general psychopathology, dropout	Effect of app-based interventions on BPD-related symptoms and general psychopathology not different from in-person interventions or waitlist; dropout rate 0–56.7% (average = 22.5%)
Kaess et al. [29]	NSSI, comorbid symptoms, quality of life	n/a
Klein et al. [22•]	BPD symptoms, serious adverse events	Both groups significantly decreased BPDSI and number of SAEs from pre-test to 12 months; no differences between groups
Köhne et al. [33]	Therapeutic relationship	Qualitative: participants formed good therapeutic relationship with tool; found tool helpful, supportive, and always there but less flexible than human therapists Quantitative: therapeutic relationships with the tool were lower than with therapists, although both were high
Laursen et al. [23]	QALYs, depression, BPD symptoms, suicidal behavior, health care use, treatment compliance, usability, and acceptability	Paper group > app on depression, QALY, borderline severity; app group > paper group on suicidal behavior in models adjusted for baseline characteristics; no differences in engagement or healthcare utilization in models adjusted for baseline characteristics
O'Grady et al. [37•]	Usability and acceptability	Overall positive evaluation of the app, especially on the user interface design and value of user confidentiality
Rodante et al. [24]	Acceptability and suicide risk	Good acceptability to be used as an adjunct to therapy for suicide and self-harm; greater improvement in suicide risk and self-injury in the app-based intervention + DBT condition vs. DBT only
Schiffler et al. [34]	User experiences and subjective influence of the app	Themes: positive and negative experiences with DBT skills; NSSI frequency slightly reduced, self-destructive thoughts did not change; both positive and negative attitudes toward self-injury; dealing with disorder-specific symptoms; prevention of self-harm; generally positive attitude toward skills apps

Table 2 (continued)

Study	Outcomes	Main results
Whiteside et al. [35]	Suicidal thoughts, negative emotions	Significant reductions in suicidal thoughts and negative emotions after viewing website
Wilks et al. [25]	User experience, dropout	Pretreatment clinical characteristics (i.e., alcohol use severity, suicide ideation) not related to dropout; urge to quit at session 1 not related to dropout; session 1 perceived usefulness and pretreatment presence of technological and unknown barriers predicted dropout
Wilks et al. [38•]	Usability and engagement	Most apps were stand-alone interventions without the support of therapists; average user "star" rating was high; overall usability and engagement of the apps minimally acceptable

DBT dialectical behavior therapy, *BPD* borderline personality disorder, *NSSI* non-suicidal self-injury, *BPDSI* borderline personality disorder severity index, *SAEs* serious adverse events, *QALYs* quality-adjusted life years

and negative emotions after visiting the website focused on suicidality.

Intervention Development Studies

There were two eligible intervention development studies. O'Grady et al. [37•] developed and tested a smartphone app that provided interactive safety planning and promoted DBT skill generalization for people with suicide risk. The app was designed as an adjunct to face-to-face therapy by a multidisciplinary team of experts (e.g., computer science, clinical psychology). Clinician input was used in the iterative design process to finalize the app. In terms of usability, students with technology experience provided overall positive evaluations of the app, especially on its user privacy protection and user interface design. Derks et al. [36] developed a wearable biofeedback app to facilitate emotional awareness in people with BPD. Multiple user groups, including patients, therapists, and user-center design experts, were involved in the app development process. The three user groups perceived the app to be useful and easy to use.

Reviews

Three reviews were included. One systematic review [38•] focused on 21 DBT apps downloadable in Google Play and iOS app stores and found that the average user "star" rating was good (4.39 out of 5). However, ratings of user experience made by two independent reviewers on the Mobile App Rating Scale found usability and acceptability to be on average minimally acceptable (3.41 out of 5.00). Frías et al. [18••] reviewed technology-delivered psychosocial interventions for people with BPD. They found that the majority of the interventions were designed as an adjunct to traditional therapy and about half of the interventions were DBT-based. The review also suggested that the focus of almost all studies was on the tests of feasibility, acceptance, and usability, that is the initial phases of the clinical research cycle.

The clearest empirical evaluation of e-mental health for PDs came from a meta-analysis of seven RCTs conducted by Ilagan et al. [17••]. The authors found that smartphone apps targeting BPD symptoms were not superior to control conditions (Hedges' $g = -0.05$, 95% confidence interval [−0.24, 0.14], where a lower value favors the control condition). Of note, only one of the control conditions was a waitlist, with the remainder involving various active interventions including TAU conditions (e.g., specialized outpatient suicide prevention clinic; [40]). Thus, the null results may indicate that e-mental health interventions are not effective at augmenting active controls rather than that e-mental health interventions do not improve outcomes in the absence of treatment.

Discussion

The current study aimed to summarize recent developments in the use of e-mental health for the management of PDs and PD-related symptoms. As with mental health care in general [41], there is a clear interest in applying digital technologies to expand access to treatment options in the area of PDs and to augment existing treatments and increase access to care.

Our search produced 19 articles published since 2019 that focused on this topic. The modal study was focused on DBT or DBT techniques, employed a smartphone-based intervention, was conducted in North America or Europe, included adult females, and included participants with BPD or common symptoms of BPD. The recent literature in this area provides some encouragement: studies evaluating intervention feasibility and acceptability tended to report promising results, clinician and expert evaluation of e-mental health technologies provided positive evaluations, and currently available DBT apps have good user ratings and minimally acceptable expert-rated usability and acceptability.

At once, when restricting discussion to the most rigorous design for evaluating effectiveness (that is, RCTs), the actual empirical evidence demonstrating the efficacy of e-mental health for PDs appears limited. Of the three RCTs reviewed, one found that augmenting DBT with an app improved outcomes over DBT alone [24], one found that augmenting TAU with Internet-based schema therapy did not improve outcomes [22•], and one found that therapist-delivered DBT paired with a mobile diary app improved some but not all outcomes relative to therapist-delivered DBT paired with paper diary cards [23]. This lack of robust evidence for efficacy was mirrored in the one meta-analysis of RCTs included in this review. In a meta-analysis of seven RCTs, Ilagan et al. found that smartphone apps targeting BPD symptoms did not outperform control conditions, most of which involved forms of in-person TAU [17••]. This lack of robust evidence is not unique to PDs and recent broad reviews of digital mental health suggest similar challenges when results are compared to a more rigorous and randomized control group [11].

Ultimately, it is not possible at present to draw definitive conclusions regarding the potential of e-mental health for PDs. The recent scientific literature on this topic provides a mixture of encouraging and at least somewhat discouraging results (i.e., null effects from meta-analysis; [17••]). However, several specific future directions for work in this area follow from the current literature reviewed.

Future Directions

One key future direction is continuing to examine e-mental health in populations that have been to date understudied. It was encouraging to see RCT protocol papers focused on e-mental health for youth and adolescents. This may be a population particularly amenable to e-health interventions and with clear mental health needs [42, 43], particularly during the COVID-19 pandemic [44]. It may be valuable to investigate the effects of e-mental health for people with PDs living in middle- and low-income countries where access to DBT is even more limited and may often be nonexistent. Given the potentially limited access to mental health care in these countries [45], e-mental health may be a cost-effective means for reducing the burden of disease associated with PDs [46]. As noted, e-mental health interventions may well provide benefits above and beyond no treatment, even if they fail to outperform other interventions or demonstrate benefits above and beyond TAU conditions. However, it remains unclear if this benefit is unique to these digital interventions or more driven by placebo, social interactions involved in partaking in a study, or simply interacting with technology. Still, in contexts where TAU is not available, e-mental health may be highly attractive. There also may be PDs and PD-related symptoms other than BPD that are amenable to e-mental health (e.g., antisocial PD, avoidant PD) that have as yet not been studied.

Another future direction may be the evaluation of more sophisticated, intensive, and/or integrated e-mental health approaches. This may involve the incorporation of greater provider guidance (which has been shown to improve outcomes for app-supported smartphone interventions; [47]). It could also involve the use of advancements in e-mental health technologies, such as passive sensing. This might include features that alert participants prior to high-risk behaviors and offer responsive and personalized support. Such innovations have been effectively implemented to reduce risky behaviors in other populations (e.g., alert participants recovering from alcohol use disorders when they are geographically proximal to a place they used to drink; [48]). E-mental health interventions including various just-in-time adaptive and ecological momentary interventions such as nudges delivered via text messages may help manage the impulsivity that can be associated with some PDs [1] as they have for supporting behavior change generally [49–51].

An important question to consider for future RCTs and meta-analyses is which control condition should be used. While ultimately comparisons with other active interventions including comparisons with robust TAU conditions will be essential for establishing the efficacy of e-mental health for PD beyond non-specific factors and for guiding treatment decision making, less rigorous comparisons including comparisons with waitlists and no treatment controls may be informative at the current stage. That said, it may not always be ethically feasible to randomize

participants to no treatment (e.g., if participants are reporting elevated risk for suicidality or self-harm), in which case some degree of TAU may be essential.

Limitations

The current study has several limitations. First, our review focused exclusively on the past several years and may have neglected to include relevant studies published before 2019. As noted in the introduction, research on apps for PD has been active for over a decade [16]. We also only searched PubMed and may have missed studies not indexed there. The number of studies evaluated was relatively modest and insufficient to allow a quantitative synthesis of results (i.e., meta-analysis). The specific samples of studies retrieved were relatively homogeneous (i.e., primarily focused on smartphone-based interventions including DBT-related content for adult females in North America or Europe) and included relatively modest sample sizes in the RCTs which may have limited statistical power to detect differences between the e-mental health conditions and the control groups.

Conclusions

The current study provided mixed evidence for the potential of e-mental health for the treatment of PDs and PD-related symptoms. On the one hand, it appears that these approaches are feasible and acceptable to participants and are being designed in some instances using best practices (e.g., user-centered design, multidisciplinary teams, incorporating feedback from patients and providers; [36, 37•]). At once, the actual empirical evidence demonstrating through RCTs that e-mental health interventions improve outcomes for people with PDs or PD-related symptoms is currently lacking. We are hopeful that future large-scale RCTs conducted with attention to the scientific meaning of various control condition types, studies conducted with youth and adolescents, and studies conducted in low- and middle-income countries may help clarify whether e-mental health may be able to fulfill its potential to reduce the disease burden associated with PDs.

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Declarations

Ethics Approval Not applicable.

Consent to Participate Not applicable.

Conflict of Interest The authors declare that they have no competing interests.

Human and Animal Rights This article does not contain any studies with human or animal subjects performed by any of the authors.

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• Of importance
•• Of major importance

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