Perceptions of the feasibility and acceptability of a smartphone application for the treatment of binge eating disorders: Qualitative feedback from a user population and clinicians

Adrienne S. Juarascio, **Stephanie P. Goldstein**, **Stephanie M. Manasse**, **Evan M. Forman**, and **Meghan L. Butryn**

Drexel University, Department of Psychology, Stratton Hall, 3141 Chestnut Street, Philadelphia, PA 19104, United States

Adrienne S. Juarascio: asj32@drexel.edu; Stephanie P. Goldstein: spg38@drexel.edu; Stephanie M. Manasse: smm522@drexel.edu; Evan M. Forman: emf27@drexel.edu; Meghan L. Butryn: mlb34@drexel.edu

Abstract

Background—Binge eating, a major public health problem, is characterized by recurrent episodes of out-of-control eating in which an individual consumes an unusually large amount of food in a discrete time period. Limitations of existing treatments for binge eating (both in-person psychotherapy and guided self-help) indicate that smartphone applications (apps) may be an ideal alternative or enhancement. An app for binge eating could aid treatment dissemination, engagement, and/or compliance. However, no research to date has examined user perceptions of a therapeutic app for binge eating, which is critical for development.

Objectives—The purposes of the current study were to conceptualize a potential app for binge eating and obtain feedback regarding feasibility and acceptability from target users (i.e., individuals with binge eating) and clinicians specializing in the treatment of binge eating.

Methods—Our team conceptualized a smartphone app that contained self-help material, functions to monitor behavior, and provisions of in-the-moment interventions. We presented this app (e.g., feature explanations, mock screen shots) through phone interviews with clinicians who specialize in the treatment of binge eating (*n*=10), and focus groups with individuals experiencing binge eating (*n*=11). Participants were asked to discuss customization, user burden, terminology, attrition, data visualization, comprehensiveness, reminders, feasibility, acceptability, and perceived effectiveness of the proposed app. Thematic analyses were conducted from qualitative data (e.g., audio recordings and interview notes) obtained via the focus groups and interviews.

Results—Results indicated that our proposed app would be highly feasible and acceptable to users and clinicians, though concerns about the degree of personalization and customizability were noted.

Conclusions—The current study details highly specific feedback and ideas regarding essential app features from target users and clinicians. This information is critical for the development of future apps to treat binge eating. Ways in which data obtained from the current study may be generalized to the development of therapeutic apps for other psychological disorders is discussed.

1. Introduction

1.1. Binge eating disorder

Binge eating is defined as eating an unusually large amount of food within a short amount of time, accompanied by a subjective sense of loss of control over eating. Diagnostic criteria for binge eating disorder (BED) requires that binge episodes cause emotional distress and occur at least one time per week over a three-month time period [1]. BED is the most common eating disorder in the United States, affecting 3.5% of females and 2% of males [32]. Individuals with BED show high rates of psychiatric comorbidity [22,65], impairments in work and social functioning [31,56], reduced quality of life [42,44,52], and suffer medical complications related to obesity [12,33].

1.2. Treatment for BED

The National Institute for Health and Clinical Excellence (2011), along with several recent systematic reviews of the literature, recommend Cognitive Behavioral Therapy (CBT) as the gold-standard treatment for patients with BED. CBT for BED is a psychosocial treatment approach that is typically delivered either individually or in small groups and focuses on teaching patients how to identify, evaluate, and change irrational thoughts and feelings about food and eating, and uses behavioral interventions (e.g., normalization of eating, engagement in alternative activities during high risk periods) to modify eating behavior. A systematic review of randomized controlled trials for BED found that the evidence for CBT was strong, with individual or group CBT reducing binge eating for at least 12 months after treatment [5].

A particular challenge of in-person treatment is that skills learned in the calm of a treatment office cannot be effectively utilized in the "storm" of everyday life [27,66]. Treatment approaches that take place outside the traditional therapy office have been shown to be better at promoting the generalizability of treatment skills [35,36]. Thus, it is desirable to develop treatments that can deliver interventions when and where they are most needed (i.e., in the moment). Another challenge faced by individuals with BED is gaining access to high-quality treatment. Few practitioners are trained in evidence-based treatments, such as CBT for BED [6,8], and those who do have this training are often located far from the patient and/or are not part of insurance panels [30]. For some, the reluctance is based on the stigma

of seeking treatment and/or the intense shame associated with binge eating [28]. For others, it is logistical [28].

1.3. Self-directed CBT for BED

Self-directed CBT, most typically conducted using a self-help book such as "Overcoming Binge Eating" by Christopher Fairburn [18], may be one method to combat the barriers to in-person treatment described in Section 1.2. Self-directed CBT, in conjunction with a limited amount of clinician guidance (i.e., "guided" self-help), has been shown to be an acceptable, feasible, cost-effective and efficacious treatment for BED and is often recommended as the more practical first line of treatment for BED [23,24,38,45,58,60]. Overall, results for guided self-help have been comparable to in-person CBT, with up to 64% of patients reporting abstinence from binge eating by 12 months [59] and significant improvements in eating disorder psychopathology and psychological distress. Additionally, Internet-delivered, unguided self-directed CBT has been shown to produce significant improvements in binge eating, drive for thinness, perceived hunger, and body dissatisfaction, which were maintained at a six-month follow-up [8,37]. The efficacy, high disseminability, and cost-effectiveness of self-help programs have led to suggestions that self-help should be the current first line of treatment for BED.

Although self-help is recommended as a first-line treatment for BED, there are a number of limitations to its widespread use. First, guided self-help is rarely available as a treatment option beyond research studies. Although self-help books can be purchased from most commercial book retailers, the presence of a health care professional who is trained to consult with patients during self-help treatment is limited. The importance of clinician guidance is underscored by the strong evidence that guided self-help has greater efficacy compared to unguided self-help. Second, CBT for BED, regardless of the format, requires the self-monitoring of emotional and eating-related cues and binge eating behaviors, so that behavior and outcomes can be tracked, connections between triggers and binge eating can be established, and strategies to interrupt this process can be planned and utilized [18,41]. However, patients often show poor compliance and low accuracy using typical self-monitoring tools [16,55], even during in-person treatment approaches. Patients using self-directed CBT likely have even greater difficulty remaining compliant with standard self-monitoring tools, thus precluding accurate and helpful identification of binge-trigger connections without additional guidance.

1.4. Smartphone-delivered psychological treatment

One way to improve the provision of guided self-help would be the creation of an easy-to-use technology, such as a mobile application (app), that can track a number of cognitions, emotions, and behaviors relevant to binge eating and prompt the clinician to check-in about ongoing problems implementing the treatment. The widespread accessibility of smartphones shows promise in addressing the lack of availability of traditional self-help and in-person treatments; apps can be widely disseminated and can serve as an ideal clinical management tool for both patients and clinicians [9,13,43].

As of 2013, over half of all adults (56%) own a smartphone and 93% of smartphone users use their phone to access information online [14]. Smartphone users consist of individuals with varying ethnicities, incomes, education, and locations [14]. Furthermore, current mobile statistics have identified approximately 45 billion app downloads from iPhones and Androids combined [50]. Recent estimates have suggested that there are now more than 20,000 health-related apps available for mobile devices [50]. Consequently, using apps as guided self-help could more easily benefit the general population.

In fact, the use of mobile apps has become an increasingly popular method in the assessment and treatment of various psychological disorders. Though a full review of treatment apps for each psychological disorder is beyond the scope of this report, a search conducted in January of 2015 within the Android and iPhone app marketplaces revealed 62 apps for depression, 21 for bipolar disorder, 76 for anxiety, 54 for substance use disorders, 10 for schizophrenia/ psychosis, 12 for eating disorders, and 19 for personality disorders (e.g., primarily borderline, but also including narcissistic, schizoid, and antisocial). The functions range from purely educational (e.g., definition and symptoms of a particular disorder), to assessment (e.g., diagnosis of a disorder, tracking of symptoms), to treatment (e.g., cognitive behavioral treatment, hypnosis, acupuncture). However, these apps have not been assessed for effectiveness and many are not based on empirically supported principles.

Given the burgeoning relevance of mobile apps, research psychologists have begun to formally develop and evaluate treatment apps for depression [7,34,62], bipolar disorder [2,3,11,47], anxiety disorders [20,49], substance use disorders [20,25,39,53,61], schizophrenia [11,21], and borderline personality disorder [53]. However, there have been no BED treatment apps that have been formally evaluated for effectiveness. Given the efficacy of existing internet-based treatments, it appears that smartphone-based provision of CBT for BED (to be utilized either in un-guided or guided self-help format) is a logical next step for treatment delivery as it could combine the benefits of self-help for CBT with in-the-moment tracking and interventions capabilities [15,26,51].

Potential benefits of an app for binge eating could also extend beyond dissemination of CBT; technological advances in smart-phones could improve efficacy of both in-person and self-help treatments. For example, Ecological Momentary Assessment (EMA) is one commonly-used approach to self-monitoring that employs repeated sampling to capture real-time data. Studies that have utilized EMA and other forms of technology-based monitoring with individuals with binge eating have reported high levels of compliance with the prompting and high ease of recording, indicating that technology-based monitoring is a highly feasible and acceptable method of self-monitoring in this population [17,57] and could increase compliance with in-the-moment tracking. Additionally, patients often have difficulty utilizing therapeutic skills during the times in which they might be most useful (e.g., during times of high distress, when having urges to binge, during periods of low motivation) [16,55] and might benefit from in-the-moment provision of interventions. [29] recently coined the term Ecological Momentary Intervention (EMI) to describe the delivery of interventions to people as they go about their daily lives, particularly in moments of need. A number of researchers have highlighted the potential utility of smartphones for EMI, noting that in theory, EMI should be a particularly potent intervention when delivered by

smartphone due to the ability to provide customized interventions [4,46]. A small number of EMI studies that have utilized smartphone-based apps suggest that this is true [19,63].

Thus, the delivery of self-help CBT through mobile platforms such as smartphone apps may address gaps in current self-help treatments for BED by (1) utilizing an easily-accessible, more engaging delivery system for traditional self-help CBT that could be used alone or in-conjunction with on-going treatment, (2) facilitating accurate and informative self-monitoring, and (3) providing a technology-assisted intervention to enhance in-the-moment use of CBT skills and strategies.

1.5. Potential barriers to technology-assisted methods

Smartphone apps are well suited to disseminate CBT while also addressing many of the limitations in both in-person and self-help treatments for BED. However, the extent to which smartphone apps are feasible, acceptable, and effective platforms for intervention delivery requires additional study. As technology-assisted methodology has become increasingly more common, research has begun to address user perceptions related to feasibility and acceptability. Prior focus group research has indicated that when using an app for self-monitoring, users desire prompts and reminders to enter information, but also the freedom to set the frequency of such prompts [10]. Dennison et al.[10] reported, that their focus group noted concerns about the efficacy of EMI, including doubts that the app would not be able to accurately assess when an intervention was necessary or helpful. Furthermore, users worried that an intervention delivered in the moment of distress could draw unwanted attention towards a behavior, and were especially sensitive about the preferred language of specific prompts and interventions. There were also substantial privacy concerns regarding: (1) the protection of identifiable health information from third parties, such as app developers and outside companies, and (2) the app capabilities of automatically collecting location and other data [10].

To date, no research has been conducted to specifically examine the preferences of users with BED. Before intensive time and monetary resources are devoted to programming and testing a sophisticated smartphone app, assessing potential users' and clinicians' perception of potential components of a smartphone app for BED appears warranted.

1.6. Current study

The current study sought to obtain user feedback on features of a smartphone app for BED that would contain self-help CBT, self-monitoring, and EMI. Our team used prior research on BED treatment, existing capabilities of smartphone technology, and examples of intervention apps for other disorders to conceptualize a potential smartphone app that could be created to treat BED. A presentation was created that explained the features of this app along with mock screen shots to allow potential users to report on their perceptions of the proposed app and provide feedback that would enhance the ultimate acceptability, feasibility, and efficacy of the to-be-developed app.

2. Methods

2.1. Participants

Participants included in focus groups met criteria for BED, sub-threshold BED (e.g., reporting objectively large binges less than once a week), or a history of binge eating (e.g., having ever experienced a period of clinically significant binge eating). Individual phone interviews were completed with clinicians who regularly treat BED and/or binge eating.

2.2. Clinicians

Individual phone interviews were conducted with clinicians (n=10, 70% female) recruited from clinics and universities in the Philadelphia area and through the Academy for Eating Disorders listserv. Clinicians were from the east coast region (Pennsylvania, n=4; Massachusetts, n=2; Maryland, n=1), the west coast (n=2), and international (n=1). Most clinicians held a doctoral degree (80%); however, two were master's level clinicians (e.g., MSW). Seventy percent t of the sample was cognitive-behaviorally oriented, with the remainder practicing integrative treatment (20%) or eclectic treatments (10%). Most clinicians (n=7) reported having treated over 15 patients with binge eating pathology, and three had treated between 6 and 15 patients with binge eating pathology. All clinicians reported familiarity with existing treatment-based apps for eating disorders, but only four clinicians reported using these apps in their practice.

2.3. BED user sample

Three small focus groups were conducted with individuals with full, subthreshold, or remitted BED diagnoses (n=2–6 per group). All participants but one were female (n_{female} =10; n_{male} = 1), with ages ranging from 25 to 67 (M=42.81, SD=13.85). One participant did not complete the post-focus group survey, and thus is not included in the following information. Seven participants identified as Caucasian and two identified as African American. Participants were recruited from the Philadelphia community or were referred by clinicians or a behavioral weight loss program. All participants owned smartphones and 60% reported using their apps more than once a day. Fifty percent reported using non-call features (e.g., internet, camera, multimedia) more than once a day. Participants were generally comfortable seeking health-related information or advice from the Internet or other multimedia (60% reported that they 'often' or 'always' sought information from these sources). All but one person had used dieting or physical activity apps, but none of the participants had used apps for eating disorder treatment or recovery.

2.4. Procedure

Two doctoral students and a postdoctoral fellow conducted interviews and focus groups. Prior to viewing the presentation, users and clinicians were first asked to describe what features would be ideally present in an app designed to reduce binge eating (in order to gather information without bias incurred by viewing the presentation). Participants then were walked through a presentation of screenshots and functions from the app prototype and were presented with use cases for several app functions (e.g., entering data, reporting a binge episode, receiving an "in-the-moment" intervention, requesting a coping strategy, and

communicating through the clinician portal). Participants were asked to provide feedback on the use cases described to determine whether these proposed app functions were acceptable to potential users.

2.4.1. App prototype—The prototype app described to users and clinicians had several planned functions: manual data entry, automated data entry, machine learning algorithm, CBT-based self-help learning modules, coping strategies, data visualization (feedback), and a clinician portal. Throughout the presentation, participants were provided with an overview of the envisioned system architecture (e.g., the relationship between app components themselves, and relationship between the user and app components). Below is a brief overview of functions and architecture, as was presented to participants.

Manual data entry would allow easy one-touch recording of food intake, emotions, and binges into the app. This type of self-monitoring has been proven an essential feature of CBT for BED, as it promotes a greater awareness of behavior [18]. Furthermore, this function would interface with the machine learning algorithm to accurately predict future binge episodes.

Automated data entry would include time-stamping, geolocation services, the automatic detection of physical activity (through accelerometer connection) and weight (through wireless scale connection). Automated data entry would also provide important contributions to the machine learning algorithm.

The machine learning algorithm would be intended to analyze the established relationships between binge triggers (e.g., emotion, food intake, location, time) and binge episodes, and use this information (provided to the app through the manual and automated data entry functions)to predict future binge episodes. For example, the system could "learn" that when the user enters a risky location (e.g., a supermarket) after a reported emotional experience (e.g., shame), a binge is likely to occur. The next time that the manual and automated data entry reveal these conditions to be in place, the app would issue an alert to the user, indicating that he or she is at risk for a binge episode. At this point, the app would automatically provide a brief preventative intervention personalized to the binge triggers that are present for a given user. As in the above example, the app might suggest that the user avoid entering the supermarket so that a binge could potentially be prevented.

The app would also contain CBT learning modules and coping strategies for intervention. CBT learning modules are interactive, and could be utilized in a guided or self-directed manner, thus allowing the app to serve as a self-help intervention similar to other effective self-help protocols for BED. The CBT learning modules would be adapted from "Overcoming Binge Eating", and contain interventions for regularizing eating, self-monitoring food intake, addressing binge triggers, and coping with distressing internal experiences [18]. The app also would contain brief empirically-supported coping strategies. The user could request assistance at any moment by accessing the coping strategies menu that would allow a user to name a currently occurring problem (e.g., thoughts excusing a binge) and receive a matching strategy (e.g., staying motivated, uncoupling thoughts and actions).

Several of the user actions (e.g., manual and automated data entry, and progression through the CBT learning modules) would also be translated to the clinician portal. This portal would allow clinicians to view users' in-the-moment behavior patterns thus improving communication between clinician and user, and enhancing treatment outcome.

2.4.2. Discussion content and analysis—Clinicians and users were encouraged to provide commentary on proposed app functions (as described above) and suggestions for additional functions based on prior experiences. Designated topics of discussion included: customization, user burden, terminology, attrition, data visualization, comprehensiveness, and reminders. In addition to individual app features, participants offered feedback on the general feasibility, acceptability, and perceived effectiveness of using a mobile BED treatment app. Interviews and focus groups were conducted until themes and feedback became redundant. Thematic analyses were conducted from qualitative data (e.g., audio recordings and interview notes) and synthesized into major themes identified in the Results section. Because user and clinician feedback was consistent thematically, data from both sets of users is grouped together by theme. The Institutional Review Board of Drexel University reviewed and approved the focus group and interview protocols.

3. Results

3.1. Feasibility and acceptability of a smartphone app for BED

Overall, both groups reported that the features of the proposed app appeared to be feasible to integrate into their lives and practices. Users expressed enthusiasm for the app as a whole, and 100% of participants expressed interest in testing the proposed app if it were to be developed as presented. Clinicians were eager to use such an app in their practices; in fact, many inquired about the potential cost and availability. Specifically, clinicians believed that components of the proposed app would enhance treatment delivery and effectiveness, specifically in the areas of compliance with self-monitoring, CBT-based self-help, and utilization of coping strategies. In addition to feasibility, users and clinicians believed strongly in the potential effectiveness of the app to assist in reducing binge eating. Many clinicians (n=8) indicated that they would recommend the app, if developed, to patients in their practice. In addition to the positive views of potential feasibility and acceptability of the proposed app, users and clinicians provided qualitative feedback on technology-assisted self-monitoring and intervention. For examples that represent the theme of feasibility and acceptability, salient quotes from both users and clinicians are provided below.

User:"A lot of us have gone through so many different programs. Honestly, it's not for lack of knowing that we binge eat. We are probably more educated on nutrition and behaviors than anyone else. For me…I'm not doing it because I don' know, but it's because you're compelled to do it for other reasons, so it comes down to what can help me with that. It is the behavior change that I am having a difficult time with."

User: "People that don't have access to therapy, it may be helpful to them, because they've never had that kind of assistance. They've been bombarded with weight loss programs, and that just doesn' address the underlying issue. There is definitely more of an educational piece to it, which is good."

Clinician: "Other clinicians would definitely use an app like this based on conversations I've had. Everyone I talk to believes it's a great way to use technology."

Clinician: "I think other clinicians would use this. It depends though…not a lot of clinicians do real BED treatment. People need to be educated on it and a lot more clinicians need to know about CBT. I also think academics and hospitals would use something like this."

3.2. Technology-assisted self-monitoring

3.2.1. User burden—In order to build a comprehensive EMI system, the proposed app would require a considerable time investment on the part of users, specifically, completing daily entries regarding moods, meals, medications and binge episodes both in the moment and retrospectively. Relieving user burden while still maintaining app function was a major concern for our team in conceptualizing the app prototype. However, the level of user obligation proposed in the prototype described did not appear to alarm users or clinicians. In fact, many users requested options for entering more information (e.g., specific food intake, thoughts, environmental factors) as they saw fit.

User: "Recording the detail would be helpful because then when I go and have a discussion about it, I might actually recall some of the detail. Depending on how many weeks later it is, I might be unsure what was happening on the day of a binge, but clearly…something was going on."

Clinician: "I think that patients would use this function. To me it has the right amount of detail where it is not annoying, but it's a good amount of information."

A major challenge appeared to be striking a balance between requiring a minimal amount of user entry while offering options to enter more information, as there was variation in what specific types of information users considered important. For instance, when discussing meal entry, some users wanted the option to record the specific content of meals, while others did not consider this necessary.

User: "For all the features, I think it is important to toggle detail on and off. There may be periods where I'm particularly struggling and I want to be detailed and there may be periods where I am not struggling and it won't be that meaningful."

Clinicians and users that were in treatment noted that using an app to self-monitor would replace paper-and-pen self-monitoring and thus would not demand a significant addition of time burden above and beyond traditional forms of self-monitoring. In fact they noted that an app may reduce burden due features that support increased ease of self-monitoring.

Clinician:"I don't think it's too much of a burden. We'd be asking them to do the same thing on paper in treatment. For people who are tech savvy, they would actually prefer this."

3.2.2. Privacy and language—Most users did not express major concerns about data privacy and security of the information entered into the app. Many users were comfortable with sharing the information entered into the app with their clinicians. However, a subset of

users requested the option to not share data with clinicians, indicating that this feature should be customizable.

User: "I wouldn't be as honest in the app if it went straight to someone else [my therapist]. It's a level of privacy that's just not there if I give people access."

Clinician: "Many patients who binge feel embarrassed. They hide that information from people. People need to know that in order for the app to be helpful they need to be honest."

Users also requested the use of sensitive language in the self-monitoring portions of an app. Users felt that most app features, especially responses to self-monitoring, should be worded carefully due to the sensitive nature of binge eating and emotions that accompany the behavior. For example, several users expressed concern with using terms that are confusing, or clinical in nature (e.g., "binge" or "binge episodes"). Users asserted acronyms (e.g., BED or CBT) should not be used and some reported feeling that these terms would be off-putting and reduce their use of an app.

3.2.3. Reminders—Both users and clinicians were strong proponents of built-in app reminders and alerts, e.g., alerts when new content is available and reminders to record data. Users reported that reminders would be most helpful in times of need, or for behaviors that they are most unlikely to change. Examples of specific requested reminders included to bring a snack to work, or to exercise/eat specific healthy foods. Clinicians echoed the users' comments, and added that reminders and alerts would serve as tools to enhance awareness of triggers associated with binge eating.

User: "I like the prompt because I'm least likely to [use the app] when it is most likely to be helpful."

Clinician: "It is very easy for a person to be prompted periodically about the affective states, being more attuned to them might make users less likely to binge."

When asked about the potential saturation of reminders, users reported this was not of concern, as long as reminders were kept brief. Clinicians added that the language of reminders could be utilized as reinforcement for behavior change.

User: "This one app sends me reminders. And I don't even read them…I don't know why but I want to delete them. I guess if the app could have reminders with short text then that would be helpful. I get so caught up with not caring and not paying attention, and during those times it is just not helpful."

Clinician: "Maybe the app could provide reinforcement messages that pop up, like, 'you tracked for 5 days in a row!', 'We haven't heard from you in a while, let's check in?'. In the long term, maybe it could be more maintenance focused, like, 'You haven't had a binge in x amount of days, nice work!'

Clinicians and users cited customizability of frequency and type as key to making reminders and alerts useful rather than burdensome. Although most were in agreement that reminders to self-monitor would be useful, desired frequency of these prompts was highly varied.

Thus, participants all agreed that reminders should be a customizable feature, with the option to choose the desired frequency and types of reminders.

3.2.4. Comprehensiveness—Many users stated the ability to comprehensively track all behaviors in one place would enhance an app's value. Several users from the groups were tracking calorie intake and physical activity via an app, and stated that these features should also be available in a treatment app for BED. Users reported needing to use two or three apps to track desired behavior would decrease likelihood that they would continue to use a BED treatment app.

User: "I would like an app that interfaces with my food record app so that I didn't have to go back and forth. That would be my ideal because I'm in there all day, every day anyway."

Furthermore, users and clinicians requested more optional fields for data entry. For instance, many users wanted the option to enter more information when desired (e.g., a "notes" feature where they could record additional thoughts or feelings).

User: "Even if there are some aspects that are a little more complicated, I think people who really have an issue will use [the app] because for some people it is their last resort. It is accurate to say that people will use [the app]. There is just not a lot available. If people could [recover from binge eating] on their own, they would."

Clinician: "People can have the same diagnosis, but everything is so individualized. People have different physical activity and diet needs. It needs to be very customizable."

3.2.5. Data visualization—Many clinicians were proponents of data visualization (e.g., graphs, charts) as a form of feedback. Some clinicians cautioned that graphs are often difficult to interpret and suggested that access to verbal summaries as well. Clinicians indicated that data visualizations and summaries are not only a valuable tool for behavior change, but also a possible method to enhance user engagement.

Clinician: "This could be good to track their progress in graph form to promote awareness. This is something that gives them the sense that they're making progress."

Although all users agreed that feedback was essential, there were differing opinions on the preferred form of feedback. Some users found graphs and figures to be an intuitive way to view behavior patterns over time, but others struggled with how to interpret this form of feedback.

User: "I'm not sure that I like the idea of a graph; that just might not be the best way to present it. I like having my data, but I think I would like text or a summary. Not everyone is data-driven, and sometimes graphs aren't totally intuitive."

3.3. Technology-assisted interventions

3.3.1. Risk and intervention alerts—Overall, users and clinicians were enthusiastic about alert features, especially in the form of customized interventions in the moments of distress.

User: "If the binge is just starting, or happening in that moment, then I don't have to remember any coping strategies. Until these coping skills become habit, then the app will help me learn."

User: "We all have the same compelled feeling to eat, but then we all have different triggers for that, it is really a personal illness in a sense. No binge is created equal."

In addition to an EMI alert system, both groups suggested random or scheduled "check-ins" utilizing the alert system, in which the app would ask them about their day, or provide encouraging statements. Users suggested the ability to "snooze" an alert if they were not able to utilize the intervention in that specific moment, but wanted a reminder later.

Clinician: "My ideal app for BED would have a way to check in during times of the day that are proble matic [for me].It would make it more likely [for me] to have support when the binge is about to happen, and perhaps delivering interventions after a binge occurs."

Clinicians and users desired for the phrasing of reminders and alerts to be less clinical (e.g., "You may be at risk for a binge episode") and more personal and caring (e.g., "Looks like you might be in trouble, how can I help you?"). They believed that the more that these alerts could mimic what a check-in from a therapist would look like, the greater the user acceptability of the app.

Clinician: "'You are currently at risk' is a strong statement. It could be softened. Also, what exactly does it mean to say you're at risk?"

3.3.2. Intervention content—The presented app proposed to provide momentary coping strategies in addition to CBT-based self-help learning modules. Clinicians suggested that material should incorporate more visual components (e.g., charts, tables, videos, audio) and fewer text-heavy components. They also suggested adding other evidence-based strategies, such as acceptance-based strategies, dialectical behavior therapy, and mindfulness meditation exercises. Some clinicians feared that users might not fully understand content, as many psychological concepts (e.g., restructuring thoughts) are complex. However, they did believe these interventions would be a useful tool as an adjunct to in-person therapy.

Clinician: "I don't know if you're going to get effective cognitive therapy through self-help. It's a long shot that patients would learn a lot. It can be a useful back up once done in therapy, but I would be concerned that they wouldn't fully understand if it was used stand alone."

Users felt that CBT-based coping strategies would be particularly helpful especially in times of high emotional distress. Users also reported that the text was not a problem and that they would prefer to have the information available to them.

User: "A lot of times after I've binged, I fall into deep despair and shame, and I can't seem to get out of it. The app could help me with some of these feelings so that they don't spiral out of control… I would need something that would stop me from going down the hole."

User: "I don't mind all of the text…this is where it is important to have all of the information. Because this is where you're going to learn. When you have an urge, you might be able to read instead of eat."

Many users did want the interventions and coping strategies to be more personalized by only providing strategies for the issues they were personally struggling with and allowing content that is most used and highest rated to be offered first. Furthermore, users wanted to be able to "save" strategies that they found the most helpful.

3.4. Attrition

A major concern of developers was the potential for boredom after prolonged use. Clinicians suggested that the way to combat attrition from an app would be to continually reinforce entry of information with messages, a level system, and with feedback. Clinicians expressed confidence that users would continue to complete entries as long as users felt their data was being utilized in a way that was facilitating treatment. Clinicians believed attrition could be further prevented if the app is used in conjunction with in-person treatment, allowing therapists to reinforce the use of the app.

Clinician: "How do you get an app to stick? You might get people who try it, but without the prompting of a provider, they might drop off really quickly. Patients do it for the first month, and we think they stop because they're not getting specific feedback. Timely and personalized feedback will motivate users to record."

While users, too, endorsed the idea that feedback was integral, they were skeptical to the notion that feedback alone would keep them interested in the long term. Users believed that the only way to keep users interested was to continually program and release new functions and content for the app.

User:"I would keep using the app if it continued to update. There has to be new features and new things about it. After a while it is just going to be the same thing – it may become routine, it may become boring. Something else new and shiny is going to catch our attention, that's usually the challenge is having to stay on top of it and to have more frequent updates."

4. Discussion

Overall, results from focus groups indicate that a smartphone app that incorporates a self-help program for BED in conjunction with personalized EMI and technology-assisted self-monitoring would be highly feasible and acceptable to users and clinicians. Users reported that such an app would significantly increase the ease of self-monitoring and would have the potential to help reduce binge eating, thus improving quality of life. Clinicians reported that this type of app could substantially enhance standard treatment by facilitating accurate self-monitoring and assisting users in enacting concepts from the therapy office in everyday life. Hence, initial user and clinician feedback support the idea that an app incorporating components of EMI self-help for BED could facilitate treatment outcome for individuals with BED.

Users and clinicians also helped identify app components and features that would be vital for the app to realize its potential impact on treatment. First, across users and clinicians, customizability emerged as the most important facilitator of app use. Specifically, users and clinicians were proponents of customized interventions (i.e., in-the-moment delivered interventions customized to the user's specific triggers and risk level), as well as the ability to personalize the type and quantity of information entered and the frequency of reminders and alerts. Users and clinicians were enthusiastic about the potential ability of machine learning algorithms to automatically draw associations between binge eating triggers (collected via EMA-based self-monitoring) and binge eating episodes specific to the individual. They believed that EMA and EMI have the potential to be more accurate standard paper-and-pencil methods and effectively deliver the personalized interventions in moments of high distress. Users and clinicians also frequently cited customizability as the solution to potential differences in how the app may be used (e.g., frequency of reminders and alerts, and amount of information that should be self-monitored). In fact, users preferred that more features be included in an app than most individuals would use (e.g., options to track several types of behavior), with the ability to omit information or turn off certain functionalities.

A preference for an abundance of entry options has implications for app design. For example, in order for the interface to be most useful and intuitive for the user, design of apps that include numerous self-monitoring variables should creatively implement design solutions that allow for one-touch entry of each of the variables (perhaps with symbols or graphics representing different variables), with options to add more detail only if indicated by the user (e.g., a symbol indicating an "add more detail" option). Additionally, graphs and summaries of data and patterns may be useful for allowing to make the most use of the wealth of data entered into the app (although such summaries and graphs should be very simple to interpret). Given feedback from users that app content could appear too clinical in nature, especially given that sensitive information will be entered, it may be important for the design of the app to appear gentle and friendly, and to include encouraging statements to make users comfortable.

The importance of customizability also translates to general psychotherapeutic app development outside of binge eating; users differ in their treatment needs and thus to facilitate use, many options for customizability of reminders, alerts, variables to self-monitor should be available to users. Additionally, harnessing machine-learning technology to personalize the interventions that are delivered to users (rather than using" canned" generic interventions for all participants) holds high appeal to users and clinicians, and may in fact have the ability to enhance standard treatments. This type of personalized EMI intervention is a particularly good fit for binge eating, but may also warrant testing for other disorders and behaviors that are episodic and predictable in nature, such as problem drinking, self-injury, and drug addiction. In fact, there is preliminary support for the feasibility and acceptability of EMI for such behaviors [29]. Because of the complex nature of these behaviors (including binge eating), it is likely that users and clinicians would desire a similar level of personalization and customizability for EMI systems designed to treat episodic behaviors outside of binge eating.

A related concern for both clinicians and users was continued user engagement after initial interest in the app waned. Reinforcement used in other smartphone apps, such as level attainments, badges, and the ability to "unlock" privileges were frequently referred to by users and as potential methods of encouraging long-term use of the app. Clinicians were optimistic that the data visualization functions, in which users and clinicians can view graphical representations of behaviors (e.g., binges, skipped meals, moods, etc.) over time, could facilitate long term use of an intervention app. However, many users were doubtful that such reinforcements would be strong enough. As such, future development of psychological treatment apps should test multiple methods of facilitating continued user engagement, such as visual feedback and level attainments/badges, and regularly survey users regarding usefulness of such features.

In our sample, privacy and data sharing did not elicit great concern for either clinicians or users, however it has been noted as an important element in previous research on app development [48]. Studies show that, generally, users understand the importance of automatized data collection, but often feel threatened by apps that utilize geolocation and other methods to collect this data [10,64]. In prior studies, some users felt that they would be more comfortable with a password protection system for their apps, however, others reported that password-protected entry would be a burden that dissuades them from using the app [10,48]. The best option may be to offer users the option of password-protecting their app, but not require its use.

Notably, our results appear to be consistent with existing qualitative research on computer-based interventions for eating disorders. Two studies have reported on participant feedback after completing a computer-based treatment for bulimia nervosa. Similar results from the current study, participants appreciated the accessibility of a technology-delivered intervention, the abundance of specific skills delivered by the intervention, and the psycho education related to the maintenance factors of eating disorders [40]. Though enhanced availability has typically been identified as an advantage of technology-based interventions, research has found that this abundance of treatment material can overwhelm patients without clinician guidance, subsequently contributing to lowered motivation to engage with treatment [54]. This result is consistent with our finding that clinicians were doubtful of the capability of users to remain motivated to use the app without guidance from a clinician. Lastly, participants report that the computer-based interventions should be more tailored so that the treatment feels more individualized [40]. This feedback directly overlaps with our study results, in which users indicated that all features must be highly customizable and flexible. In sum, it appears that much of our results are synergistic with that of computer-based research, indicating that several of the above conclusions may be applied to computer-based intervention development for eating disorders. However, some differences in feedback (e.g., interventions' lack of discretion), reveal that there are also unique facets to each intervention modality.

4.1. Future directions

The current study provides several directions for future research. First, research should examine whether machine learning algorithms can accurately predict instances of binge

eating, as the promise of EMI relies on accurate prediction. Research should also examine the efficacy of in-the-moment risk alerts and interventions in preventing binge eating episodes. Additionally, future research should focus on the effectiveness and efficacy of smartphone-delivered self-help interventions, as much of the research thus far has focused on internet-delivered interventions not designed specifically for a smartphone. Another potential area of future research is examining different methods for sustaining app engagement (e.g., reinforcements, gamification).

Overall, users and clinicians agreed that technology-assisted self-monitoring and technology-assisted interventions (specifically, coping strategies and EMI) were key functions particularly well-suited to delivery via a smartphone app. While the effectiveness of such components has sparsely been investigated in the current literature, it is possible these two components represent the major role that smartphone technology has to play in improving outcomes in cognitive-behavioral treatment for many psychiatric disorders in addition to BED. In particular, behaviors and disorders characterized by an episodic, predictable pattern (e.g., bulimia nervosa, substance abuse, and self-injury) may benefit from similar areas of research to potentially enhance treatments with smartphone-delivered interventions and EMI. Future research should investigate how specific components of technology-assisted self-monitoring and interventions can affect outcomes.

4.2. Limitations

The current study presents with several limitations. First, our sample size was small, limiting our ability to generalize to the population of individuals with binge eating pathology and clinicians who treat BED and other disorders where binge eating is a core feature. Furthermore, users and clinicians were enrolled in response to an advertisement for giving feedback on a smartphone app for BED, which may bias our sample to individuals who would be open and perhaps more likely to use therapeutic smartphone apps than the general population of users and clinicians. Lastly, because the app prototype reviewed in this study was limited to treating binge eating behavior, generalization to the development of EMIs and therapeutic apps for other disorders or purposes may be limited.

4.3. Conclusions

Despite these limitations, user opinions in our study lent strong support to the idea that self-help CBT delivered via smartphone is feasible, acceptable, and has the potential to enhance treatment for BED and disorders with binge eating. Given the recent rise in popularity of incorporating technology into treatments for psychological disorders, the current study adds to the literature specific ideas of what users and clinicians find to be necessary and useful features (e.g., EMI, customizability) of future apps used to treat BED, as such information, especially for EMI, is sparse at this time.

While the feedback given was specifically based on a prototype app for BED, such information is valuable more generally for developing therapeutic apps. Primarily, users appear to be most concerned with having a relationship with the app that feels therapeutic, or even simulates therapy. For instance, they desire an app to be customizable such that it feels as if the app is "getting to know" them. Similarly, therapeutic apps should also make use of

gentle language, particularly surrounding sensitive problem areas (e.g., binge eating, depression). The most salient concern of both clinicians and users (and likely app developers) is that of user engagement (e.g., prolonged interest and use of the app). In this respect, the involvement of games, new features, frequent prompting, reward systems, and clinician encouragement should be incorporated into therapeutic apps as much as possible. While these principles can be generalized to many therapeutic apps, frequent consultation with the target user (e.g., focus groups, alpha testing) is also essential to engage specific users, provide necessary and desired features, and ultimately boost outcomes and quality of life for individuals with psychological disorders.

References

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders: DSM-5. Arlington, VA: American Psychiatric Publishing; 2013.

2. Bardram, JE.; Frost, M.; Szántó, K.; Faurholt-Jepsen, M.; Vinberg, M.; Kessing, LV. Designing mobile health technology for bipolar disorder: a field trial of the MONARCA system. Paper Presented at the Proceedings of the Sigchi Conference on Human Factors in Computing Systems; 2013.

3. Bardram, JE.; Frost, M.; Szántó, K.; Marcu, G. The MONARCA self-assessment system: a persuasive personal monitoring system for bipolar patients. Paper Presented at the Proceedings of the 2nd ACM SIGHIT International Health Informatics Symposium; 2012.

4. Bauer S, Moessner M. Technology-enhanced monitoring in psychotherapy and e-mental health. J. Ment. Health. 2012; 21(4):355–363. [PubMed: 22548363]

5. Brownley KA, Berkman ND, Sedway JA, Lohr KN, Bulik CM. Binge eating disorder treatment: a systematic review of randomized controlled trials. Int. J. Eat. Disord. 2007; 40(4):337–348. [PubMed: 17370289]

6. Bulik CM, Brownley KA, Shapiro JR. Diagnosis and management of binge eating disorder. World Psychiatry. 2007; 6(3):142. [PubMed: 18188431]

7. Burns MN, Begale M, Duffecy J, Gergle D, Karr CJ, Giangrande E, Mohr DC. Harnessing context sensing to develop a mobile intervention for depression. J. Med. Internet Res. 2011; 13(3)

8. Carrard I, Crépin C, Rouget P, Lam T, Golay A, Van der Linden M. Randomised controlled trial of a guided self-help treatment on the internet for binge eating disorder. Behav. Res. Ther. 2011; 49(8): 482–491. [PubMed: 21641580]

9. Chan SR, Torous J, Hinton L, Yellowlees P. Mobile Tele-Mental Health: Increasing Applications and a Move to Hybrid Models of Care. In Healthcare, 2, Multidisciplinary Digital Publishing Institute. 2014:220–233.

10. Dennison L, Morrison L, Conway G, Yardley L. Opportunities and challenges for smartphone applications in supporting health behavior change: qualitative study. J. Med. Internet Res. 2013; 15(4)

11. Depp CA, Mausbach B, Granholm E, Cardenas V, Ben-Zeev D, Patterson TL, Jeste DV. Mobile interventions for severe mental illness: design and preliminary data from three approaches. J. Nerv. Ment. Disease. 2010; 198(10):715. [PubMed: 20921861]

12. Dohm, F-A.; Striegel-Moore, RH.; Tomb, M.; Pike, KM.; Wilfley, DE.; Fairburn, C. Health-care Utilization Among Eating Disorders, Healthy Control, and Psychiatric Control Women, Vancouver. Paper presented at the Academy for Eating Disorders; 2001.

13. Donker T, Petrie K, Proudfoot J, Clarke J, Birch M-R, Christensen H. Smartphones for smarter delivery of mental health programs: a systematic review. J. Med. Internet Res. 2013; 15(11)

14. Duggan, M.; Smith, A. Cell Internet Use. 2013. Retrieved 1/27/2014, 2014, from <http://pewinternet.org/Reports/2013/Cell-Internet.aspx> (2013)

15. Ebert D, Tarnowski T, Gollwitzer M, Sieland B, Berking M. A transdiagnostic internet-based maintenance treatment enhances the stability of outcome after inpatient cognitive behavioral

therapy: a randomized controlled trial. Psychother. Psychosom. 2013; 82(4):246–256. [PubMed: 23736751]

16. Edelman RE, Chambless DL. Adherence during sessions and homework in cognitive-behavioral group treatment of social phobia. Behav. Res. Ther. 1995; 33(5):573–577. [PubMed: 7598680]

17. Engel SG, Wonderlich SA, Crosby RD. Self-report data and ecological momentary assessment. Assessment Eating Disord. 2005:203.

18. Fairburn, CG. Overcoming Binge Eating. The Guilford Press; 1995.

19. Fanning J, Mullen SP, McAuley E. Increasing physical activity with mobile devices: a meta-analysis. J. Med. Internet Res. 2012; 14(6)

20. Fletcher, RR.; Tam, S.; Omojola, O.; Redemske, R.; Kwan, J. Wearable sensor platform and mobile application for use in cognitive behavioral therapy for drug addiction and PTSD. Paper presented at the Engineering in Medicine and Biology Society, EMBC, 2011 Annual International Conference of the IEEE; 2011.

21. Granholm E, Ben-Zeev D, Link PC, Bradshaw KR, Holden JL. Mobile assessment and treatment for Schizophrenia (MATS): a pilot trial of an interactive text-messaging intervention for medication adherence, socialization, and auditory hallucinations. Schizophr. Bull. 1. 2011. 2011 sbr 155.

22. Grilo, CM. Eating Disorders and Obesity: A Comprehensive Handbook. NYC: Guilford Press; 2002. Binge Eating Disorder; p. 178-182.

23. Grilo CM, Masheb RM. A randomized controlled comparison of guided self-help cognitive behavioral therapy and behavioral weight loss for binge eating disorder. Behav. Res. Ther. 2005; 43(11):1509–1525. [PubMed: 16159592]

24. Grilo CM, Masheb RM, Salant SL. Cognitive behavioral therapy guided self-help orlistat for the treatment of binge eating disorder: a randomized double-blind placebo-controlled trial. Biol. Psychiatry. 2005; 57(10):1193–1201. [PubMed: 15866560]

25. Gustafson DH, Shaw BR, Isham A, Baker T, Boyle MG, Levy M. Explicating an evidence-based, theoretically informed, mobile technology-based system to improve outcomes for people in recovery for alcohol dependence. Substance Use Misuse. 2011; 46(1):96–111. [PubMed: 21190410]

26. Hedman E, Andersson E, Lindefors N, Andersson G, Rück C, Ljótsson B. Cost-effectiveness and long-term effectiveness of Internet-based cognitive behaviour therapy for severe health anxiet. Psychol. Med. 2013; 43(02):363–374. [PubMed: 22608115]

27. Helbig S, Fehm L. Problems with homework in CBT: Rare exception or rather frequent. Behav. Cogn. Psychother. 2004; 32(03):291–301.

28. Hepworth N, Paxton SJ. Pathways to help-seeking in bulimia nervosa and binge eating problems: A concept mapping approach. Int. J. Eat. Disord. 2007; 40(6):493–504. [PubMed: 17573682]

29. Heron KE, Smyth JM. Ecological momentary interventions: incorporating mobile technology into psychosocial and health behaviour treatments. Br. J. Health Psychol. 2010; 15(1):1–39. [PubMed: 19646331]

30. Hewitt S. Time to Heal: Eliminating Barriers to Coverage for Patients with Eating Disorders under the Affordable Care Act, A. 2013

31. Hsu L, Mulliken B, McDonagh B, Krupa Das S, Rand W, Fairburn C, Shikora S. Binge eating disorder in extreme obesity. Int. J. Obes. 2002; 26(10):1398–1403.

32. Hudson JI, Hiripi E, Pope HG Jr, Kessler RC. The prevalence and correlates of eating disorders in the national comorbidity survey replication. Biol. Psychiatry. 2007; 61(3):348–358. [PubMed: 16815322]

33. Johnson J, Spitzer R, Williams J. Health problems impairment and illnesses associated with bulimia nervosa and binge eating disorder among primary care and obstetric gynaecology patients. Psychol Med. 2001; 31(08):1455–1466. [PubMed: 11722160]

34. Kauer SD, Reid SC, Crooke AHD, Khor A, Hearps SJC, Jorm AF, Patton G. Self-monitoring using mobile phones in the early stages of adolescent depression: randomized controlled trial. J. Med. Internet Res. 2012; 14(3):e67. [PubMed: 22732135]

35. Kazantzis N, Deane FP, Ronan KR. Homework assignments in cognitive and behavioral therapy: a meta-analysis. Clinic. Psychol. Sci. Pract. 2000; 7(2):189–202.

36. Kazantzis N, Lampropoulos GK, Deane FP. A national survey of practicing psychologists' use and attitudes toward homework in psychotherapy. J. Consult. Clin. Psychol. 2005; 73(4):742. [PubMed: 16173863]

37. Ljotsson B, Lundin C, Mitsell K, Carlbring P, Ramklint M, Ghaderi A. Remote treatment of bulimia nervosa and binge eating disorder: a randomized trial of internet-assisted cognitive behavioural therapy. Behav. Res. Ther. 2007; 45(4):649–661. [PubMed: 16899213]

38. Loeb KL, Wilson GT, Gilbert JS, Labouvie E. Guided and unguided self-help for binge eating. Behav. Res. Ther. 2000; 38(3):259–272. [PubMed: 10665159]

39. Marsch, L. Computer-delivered psychosocial treatment for substance use disorders. Presentation in symposium on Neurobehavioral and Technological Mechanisms to Improve the Efficacy and Effectiveness of Substance Abuse Treatment Paper presented at the American Psychological Association Annual Meeting; 2011.

40. McClay C-A, Waters L, McHale C, Schmidt U, Williams C. Online cognitive behavioral therapy for bulimic type disorders delivered in the community by a nonclinician: qualitative study. J. Med. Internet Res. 2013; 15(3)

41. Mitchell, JE. Binge-eating Disorder: Clinical Foundations and Treatment. New York: Guilford Press; 2008.

42. Mond JM, Owen C, Hay P, Rodgers B, Beumont P. Assessing quality of life in eating disorder patients. Qual. Life Res. 2005; 14(1):171–178. [PubMed: 15789951]

43. Musiat P, Goldstone P, Tarrier N. Understanding the acceptability of e-mental health-attitudes and expectations towards computerised self-help treatments for mental health problems. BMC Psychiatry. 2014; 14(1):109. [PubMed: 24725765]

44. Perez M, Warren CS. The relationship between quality of life binge-eating disorder and obesity status in an ethnically diverse sample. Obesity. 2012; 20(4):879–885. [PubMed: 21512512]

45. Peterson CB, Mitchell JE, Engbloom S, Nugent S, Mussell MP, Crow SJ, Thuras P. Self-help versus therapist-led group cognitive-behavioral treatment of binge eating disorder at follow-up. Int. J. Eat. Disord. 2001; 30(4):363–374. [PubMed: 11746298]

46. Proudfoot J. The future is in our hands: The role of mobile phones in the prevention and management of mental disorders. Aust. N. Z. J. Psychiatry. 2013; 47(2):111–113. [PubMed: 23382507]

47. Puiatti, A.; Mudda, S.; Giordano, S.; Mayora, O. Smartphone-centred wearable sensors network for monitoring patients with bipolar disorder. Paper Presented at the Engineering in Medicine and Biology Society, EMBC, 2011 Annual International Conference of the IEEE; 2011.

48. Ramanathan N, Swendeman D, Comulada WS, Estrin D, Rotheram-Borus MJ. Identifying preferences for mobile health applications for self-monitoring and self-management: focus group findings from HIV-positive persons and young mothers. Int. J. Med. Inf. 2013; 82(4):e38–e46.

49. Repetto C, Gaggioli A, Pallavicini F, Cipresso P, Raspelli S, Riva G. Virtual reality and mobile phones in the treatment of generalized anxiety disorders: a phase-2 clinical trial. Personal Ubiquitous Comput. 2013; 17(2):253–260.

50. research2guidance, Mobile Health Market Report 2013–2017 The Commercialization of mHealth Application. 2013; 3

51. Richards D, Richardson T. Computer-based psychological treatments for depression: a systematic review and meta-analysis. Clin. Psychol. Rev. 2012; 32(4):329–342. [PubMed: 22466510]

52. Rieger E, Wilfley DE, Stein RI, Marino V, Crow SJ. A comparison of quality of life in obese individuals with and without binge eating disorder. Int. J. Eat. Disord. 2005; 37(3):234–240. [PubMed: 15822089]

53. Rizvi SL, Dimeff LA, Skutch J, Carroll D, Linehan MM. A pilot study of the DBT coach: an interactive mobile phone application for individuals with borderline personality disorder and substance use disorder. Behav. Ther. 2011; 42(4):589–600. [PubMed: 22035988]

54. Sánchez-Ortiz V, House J, Munro C, Treasure J, Startup H, Williams C, Schmidt U. A computer isn't gonna judge you: a qualitative study of users' views of an internet-based cognitive behavioural guided self-care treatment package for bulimia nervosa related disorders-studies on anorexia bulimia and obesity. Eat. Weight Disord. 2011; 16(2):93–101.

55. Schmidt NB, Woolaway-Bickel K. The effects of treatment compliance on outcome in cognitive-behavioral therapy for panic disorder: quality versus quantity. J. Consult. Clin. Psychol. 2000; 68(1):13. [PubMed: 10710836]

56. Spitzer RL, Yanovski S, Wadden T, Wing R, Marcus MD, Stunkard A, Horne RL. Binge eating disorder: its further validation in a multisite study. Int. J. Eat. Disord. 1993; 13(2):137–153. [PubMed: 8477283]

57. Stein KF, Corte CM. Ecologic momentary assessment of eating-disordered behaviors. Int. J. Eat. Disord. 2003; 34(3):349–360. [PubMed: 12949927]

58. Striegel-Moore RH, Wilson GT, DeBar L, Perrin N, Lynch F, Rosselli F, Kraemer HC. Cognitive-behavioral guided self-help for the treatment of recurrent binge eating. J. Consult. Clin. Psychol. 2010; 78(3):312. [PubMed: 20515207]

59. Striegel R, Lynch F, Dickerson JF, Perrin N, DeBar L, Wilson GT, Kraemer HC. Cost-effectiveness of guided self-help treatment for recurrent binge eating. J. Consult. Clin. Psychol. 2010; 78(3): 322–333. [PubMed: 20515208]

60. Sysko R, Walsh BT. A critical evaluation of the efficacy of self-help interventions for the treatment of bulimia nervosa and binge-eating disorder. Int. J. Eat. Disord. 2008; 41(2):97–112. [PubMed: 17922533]

61. Valdivieso-López E, Flores-Mateo G, Molina-Gómez J-D, Rey-Reñones C, Uriarte M-LB, Duch J, Valverde A. Efficacy of a mobile application for smoking cessation in young people: study protocol for a clustered randomized trial. BMC Public Health. 2013; 13(1):1–6. [PubMed: 23280303]

62. Watts S, Mackenzie A, Thomas C, Griskaitis A, Mewton L, Williams A, Andrews G. CBT for depression: a pilot RCT comparing mobile phone vs. computer. BMC Psychiatry. 2013; 13(1):49. [PubMed: 23391304]

63. West JH, Hall PC, Arredondo V, Berrett B, Guerra B, Farrell J. Health behavior theories in diet apps. J. Consumer Health Internet. 2013; 17(1):10–24.

64. Wiehe SE, Carroll AE, Liu GC, Haberkorn KL, Hoch SC, Wilson JS, Fortenberry JD. Using GPS-enabled cell phones to track the travel patterns of adolescents. Int. J. Health Geogr. 2008; 7(1):22. [PubMed: 18495025]

65. Wilfley DE, Pike KM, Dohm F-A, Striegel-Moore RH, Fairburn CG. Bias in binge eating disorder: how representative are recruited clinic samples. J. Consult. Clin. Psychol. 2001; 69(3)

66. Wilson GT. Psychological treatment of eating disorders. Annu. Rev. Clin. Psychol. 2005; 1:439–465. [PubMed: 17716095]

Summary table

What was already known?

- Smartphone apps are well-suited to disseminate treatment for binge eating.

- Users of other apps report that they wish to record a wealth of information when monitoring behaviors, but want this function to be customizeable.

- Other focus groups doubted the potential effectiveness of momentary interventions.

- App users have previously identified privacy and sharing as a concern.

What this study added?

- The current study is the first to examine perceptions among individuals with binge eating regarding a therapeutic app specifically for binge eating.

- The current study is the first to examine clinician perceptions of a therapeutic app for binge eating.

- Results identified specific features essential for a therapeutic app (for binge eating or other disorders) to be effective and acceptable to both users and clinicians .