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Mobile apps for cognitive restructuring: a review and comparative analysis

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MOBILE APPS FOR COGNITIVE RESTRUCTURING: A REVIEW AND COMPARATIVE ANALYSIS

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DEDICATION

I would like to dedicate this to: my husband who has supported me throughout my entire journey; my children who inspire my work every day; my sister who has always been there for me, and to my best friend Krystle who kept me on track and pushed me to the finish line.

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ABSTRACT

Cognitive restructuring is a central component of cognitive behavioral therapy (CBT) and thought records have for decades been a widely used method for helping clients to identify, evaluate, and modify dysfunctional thoughts. The widespread adoption of mobile technology along with changing habits and expectations of therapy clients have led to the development of numerous mobile apps aimed at replicating this core aspect of CBT. This review identifies, describes, and compares current CBT apps that include digitized versions of thought records. Searches of the Apple App Store, Android Google Play Store, published literature, and relevant websites yielded 19 apps that were reviewed and compared with respect to their representation and sequencing of common cognitive restructuring elements. The apps were also compared across a variety of variables of likely relevance to practicing clinicians, including cost, data security, empirical support, user reviews, provision of additional clinical tools, and the involvement of mental health professionals in their development. The review aims to be a resource for practicing clinicians interested in selecting a cognitive restructuring app that replicates paper-based thought records in digital form. Following a discussion of limitations of the current review, recommendations and future directions are described.

Chapter I: Introduction

Integrating information technology (IT) into health services has become increasingly popular. This integration has been particularly notable in medicine (Harwood et al., 2011), where physicians are increasingly using a wide variety of mobile applications (apps) to facilitate and improve patient care (Cole-Lewis & Kershaw, 2010; Pinnock, Slack, Pagliari, Price, & Sheikh, 2006). The field of psychology has been slower to adopt technological advances (Erhardt & Dorian, 2013; Luxton, McCann, Bush, Mishkind, & Reger, 2011; McMinn, Bearse, Heyne, & Smithberger, 2011; Proudfoot, Gordon, & Pavlovic, 2010). Nonetheless, the integration of technology into the mental health field has gradually progressed from teletherapy (beginning in the 1960s), to CDs and DVDs (in the 1990s), to texting, (in the mid 1990s) to the Internet (in the 1990s), and, most recently, to apps for smartphones and other mobile devices (Cucciare & Weingardt, 2007).

Since their introduction in Apple's App Store in 2008, mental health apps have proliferated rapidly with respect to their numbers, purposes, and their adoption by both clinicians as adjunctive therapy tools and consumers as self-help resources (Chan, Torous, Hinton, & Yellowlees, 2014; Erhardt & Dorian, 2013). Mental health apps for mobile devices can be considered the wave of the future with respect to providing mental health practitioners and their clients with accessible tools with the potential for increasing the reach of clinical services, as well as the efficiency and efficacy of psychotherapy. After providing some descriptive information on mobile technology and mobile apps, this chapter will discuss the advantages of mobile mental health apps, their potential uses by practitioners, and the current state of research regarding their usability, feasibility, and efficacy. The status of cognitive-behavioral therapy (CBT), the centrality of cognitive restructuring (CR) to traditional CBT, and the amenability of

both CBT and CR to the incorporation of mobile apps will then be reviewed, as part of the rationale for the proposed dissertation project. Finally, the aims of the proposed project will be identified.

Mobile Technology

Recent decades have witnessed a revolution in mobile technology. Mobile technology currently refers largely to smartphones and tablet computers, with the former typically encompassing phones, GPS navigation devices, web browsers, and text/instant messaging, among other tools. A smartphone is a mobile phone that offers more advanced computing ability and connectivity than a basic feature phone (Smith, 2012). According to TechCrunch, 80% of all adults who use the Internet now own a smartphone (Perez, 2014). Recent reports estimate there will be over 264 million smartphone users in the U.S. by 2021 (Statista, 2015a). Internationally, smartphone ownership increased from 5% in 2009 to 22% by the end of 2013, which equates to nearly 1.3 billion additional smartphones in use over this period (Heggerstuen, 2013). Notably, an estimated 4 billion people globally will be using smartphones by 2020 (Forbes, 2015).

Additionally, people are increasingly opting to purchase tablets instead of laptop computers, as they are more affordable and portable (Sabino, 2013). Tablets are defined as "a general-purpose computer contained in a single panel" ("Definition: Tablet Computer," n.d., para. 1). According to Statista, the worldwide number of tablet users is forecasted to rise to around 1.46 billion in 2020 (Statista, 2015b).

Mobile Applications

Advances in mobile technology have led to the emergence of mobile software applications, known colloquially as apps. Mobile apps are computer programs developed for handheld devices such as smartphones and tablets (Parson, 2013). The first mobile software

applications became available to download on a mobile device in July 2008, coincident with the emergence of application distribution platforms (e.g., Apple App Store; Donker et al., 2013). Mobile apps currently available for download from online stores offer a seemingly limitless number of functions, ranging from navigation to entertainment, from education to exercise, and beyond. As mobile technology has advanced, it has enabled mobile applications to proliferate. In fact, more than 140 billion apps have been downloaded from the iTunes App store since its inception (Statista, 2016).

Android and iOS are currently the dominant platforms for mobile apps. Seventy-eight percent of developers are designing their apps for android phones, whereas 68% are developing for Android tablets (Murray, 2013). Seventy-three percent of developers are designing their apps for iOS devices (Murray, 2013). Half of smartphone owners download apps to their devices (Duggan, 2013). Android accounts for 58% of smartphone app downloads, with iOS commanding a market share of 75% in tablet apps (Allied Business Intelligence Research, 2013). Worldwide app revenues are forecasted to reach 76.52 billion USD in 2017 (Statista, 2015c). The number of apps available for download in the Apple App Store and through Google Play appears to be fairly comparable. For example, an estimated 2.2 million apps were available in the Apple App Store as of January 2017 (Statista, 2017a) whereas 2.8 million apps were available for download through Google Play as of 2017 (Statista, 2017b). Further, as of 2013, there were 70 different app stores, most notably, the Apple App store for iOS devices and Google Play for Android devices (Afilias Technology, 2013).

Advantages of Mobile Mental Health Apps

Integrating psychology and technology has numerous advantages, many of which serve to facilitate the dissemination of psychological knowledge or the implementation of psychological interventions. A number of the most commonly cited advantages are reviewed below.

Convenience. Apps available on smartphones or tablets are portable and highly accessible across time and settings. They can also free the user (and clinician) from reliance on paper and pen forms (e.g. for mood monitoring, symptom tracking, cognitive restructuring exercises). Apps often provide automatic charting and storing of clinical data, as well as the ability to export content to a therapist for review prior to in-person sessions.

Privacy and security. Mobile apps provide users with more privacy (vs. traditional forms or workbooks) and enable them to engage in therapeutic activities discretely without fear of embarrassment or public shame (Watts et al., 2013). They provide an inconspicuous, stigma-reducing way to review therapy-related materials or to complete self-monitoring or other homework assignments. Additionally, security is improved over paper forms due to password protection provided on the mobile device and, in some cases, on the app itself.

Tool integration. Apps can take advantage of the numerous tools commonly available on mobile devices, such as notification alerts, texting, reminders, Internet browsers, and audio/video capabilities, all of which might be used to facilitate the delivery and/or implementation of therapeutic interventions to the user. Clients may be more likely to complete therapeutic homework when their smartphones are providing reminders and offering the convenience of accessing their assignments at any time or place (Alabi & Gooch, 2011).

Improved efficiency. Mobile apps may provide time and cost savings for consumers of mental health services (Enock & McNally, 2013; Harwood et al., 2011). Mental health apps

themselves tend to be inexpensive, rarely costing users more than a few dollars. For some users with mild levels of psychological difficulties, reliance on a mental health app may obviate the need for face-to-face therapy. For others, the use of apps as an adjunct to therapy may yield savings in terms of more rapid progress and reduced duration of treatment. Mobile apps may enable users to practice and acquire target skills more quickly, while also contributing to generalization of those skills across settings and time. Additionally, clinical data collection is likely to become more efficient and more accurate when done through apps, including those that take advantage of the latest advances in facial recognition and sensing technologies (Gaggioli & Riva, 2013).

Extending the reach of services. Mobile apps (due to many of the characteristics referenced above) have the potential to reduce barriers to accessing treatment related to geography, transportation, physical impairments, cost, and stigma (McGinty, Saeed, Simmons, & Yildirim, 2006). Additionally, apps can provide potential clients with greater access to information about presenting problems, psychological symptoms, and available treatments. Thus, apps may promote greater awareness regarding psychological disorders and how to seek appropriate treatment, leading ultimately to greater utilization of mental health services (Harwood et al., 2011).

Use of Apps by Mental Health Professionals

Mental health clinicians have slowly started to integrate mobile apps into psychotherapy in recent years (Chan et al., 2014; Erhardt & Dorian, 2013; Matthews, Doherty, Sharry, & Fitzpatrick, 2008; Preziosa, Grassi, Gaggioli, & Riva, 2009). Mobile apps can enhance the delivery of traditional mental health services by providing clients with convenient, highly accessible means to extend the work of therapy beyond the therapy room by facilitating

homework completion and enabling them to practice and implement target skills at the "point of performance." For example, Kuhn et al. (2014) found clinicians to be receptive to using a prolonged exposure-based mobile app, as it would help their clients' complete homework. The general public, presumably including those who receive mental health services, also appears to be receptive to using mental health apps. Mental health professionals are beginning to capitalize on this receptivity by increasingly integrating mental health apps into treatment.

Mental health professionals are incorporating apps into their practices both as part of their therapy sessions per se and as adjunctive tools that clients utilize outside of sessions. There are several functions that mobile apps can serve for mental health professionals, including psycho-education, assessment and monitoring, skill building, and facilitating specific interventions/treatments.

Some mental health apps are oriented around providing psycho-education by facilitating access to relevant resources. The focus of such apps for professionals may include practice guidelines, diagnostic criteria, guides to evidence-based psychosocial and pharmacologic interventions, medication databases, peer-reviewed research, and psychology-related news.

Clinicians can also use apps to help conduct various aspects of assessment. For example, apps can aid clinicians in assessing their clients' presenting symptoms, obtaining baseline measures, establishing treatment goals, and tracking progress. Assessment data collected via self-monitoring apps can be easily shared with clinicians, reliably stored, tracked over time, and presented in useful visual displays. Apps can track a variety of clinical variables including mood ratings, thoughts, and a wide range of behaviors (e.g., substance use, disordered eating, sleep, diet, exercise, medication compliance).

Some current mental health apps are oriented around helping clinicians build skills in their clients. Skills targeted by apps include relaxation, mindfulness, cognitive restructuring, emotional regulation, social skills, and parenting techniques. Apps can help individuals develop such skills by providing guided instructions, video tutorials, the recording of practice sessions for therapist review and feedback, as well as the option of real-time coaching by clinicians. Moreover, some apps incorporate gaming elements to elicit greater motivation and reinforcement for practicing and applying target skills (Erhardt & Dorian, 2013).

Clinicians can also use mobile apps in sessions and/or as adjunctive tools to help implement specific interventions or treatments with their clients. Because their use can be adjusted in response to various contextual factors, apps may help patients apply specific therapeutic techniques according to social circumstance, location, activity, and other situational variables. Currently, there are apps that help implement exposure therapy, behavioral activation, automatic thought records, problem-solving therapy and various skills central to dialectical behavior therapy, among others.

Apps as Self-Help Tools

Consumers currently have a wide variety of self-help materials available to them. Increasingly, the traditional forms of self-help resources (viz., books, workbooks) are being replaced or supplemented by digital resources, most notably, websites and mobile apps. Among the advantages of providing self-help material in these digital formats, in contrast to traditional self-help books, is that they are less expensive, more portable and accessible, and more easily updated with revised or additional information.

There are multiple uses for self-help apps. Psycho-education is a prominent focus or component as individuals can access apps to help facilitate their understanding of a disorder,

identify relevant resources, and familiarize themselves with various established psychosocial and psychotropic treatments. For example, apps oriented around suicide prevention can review common warning signs, help foster social support networks and connect individuals with suicide-related hotlines. Apps can also provide individuals with self-monitoring or self-assessment tools. For example, numerous apps can be set to remind individuals to check-in, in order to rate their moods and note factors that may have influenced them. There are multiple apps designed to help users track a variety of variables ranging from mood to diet to sleep. Mobile apps can also provide self-guided implementation of psychotherapeutic principles and tools. There are apps designed to help users implement a range of psychotherapeutic techniques ranging from self-guided exposures, to cognitive restructuring, to mindful meditation, to token economies. Such apps may help individuals in distress who, for whatever reason, are not seeking professional help, to nonetheless begin a self-guided process of addressing their symptoms at their own pace.

Research on Using Apps in Mental Health

The use and effects of mental health-related mobile apps have been an increasing focus of empirical studies, literature reviews, and special sections within scientific journals; nevertheless, this field of inquiry is still in its infancy. For example, despite smartphone applications having been in existence for over seven years, there are still more clinical trials examining mental health uses of text messaging than mobile apps (Chan et al., 2014). An exhaustive review of the empirical literature on mental health apps is beyond the scope of this chapter. Rather, this section aims to summarize the current state of this research and describe some representative studies.

Several studies on the feasibility and usability of mental health apps have yielded positive results with respect to user satisfaction, perceived usefulness, and improved adherence to various

components of treatment (e.g., self-monitoring; Erhardt & Dorian, 2013). For example, Ahtinen et al. (2013) conducted a 1-month field study ($N = 15$) to assess the feasibility of a mental-wellness training app and to examine its usefulness in helping users learn and integrate stress management skills. Participants benefitted from the app, as it helped them to acquire self-calming skills. Nearly half (47%) of participants commented on how the app helped them to apply mindfulness in their everyday lives, whereas 73% reported preferring the app's audio-guided exercises over text. Of note, the researchers suggested that participants were intrinsically motivated to learn new skills via the app. The results of this study suggest that it is possible to develop engaging mobile apps that are experienced by users as useful for developing target skills and for promoting wellness.

Rizvi, Dimeff, Skutch, Carroll, and Linehan (2011) conducted an uncontrolled pilot study aiming to develop and test the feasibility and outcomes of a mobile app as an adjunct to Dialectical Behavioral Therapy (DBT). The study included 22 participants already enrolled in standard DBT outpatient treatment programs. The app (DBT Coach) was designed to provide coaching in the emotional regulation skill of *opposite action* (to which participants had already been exposed in therapy). Results indicated that the mobile app was engaging and effective. Following the 10-14 day trial, participants typically reported using the app more than once per day and 85% completed the daily assessments that were built into the app. Participants also indicated high degrees of satisfaction with the app. For example, they reported the skill coaching in the app to be helpful 97% of the time and all indicated that they would use the app on their own initiative. Additional findings suggested that use of the app increased participants' knowledge of the target skill and confidence in using it while decreasing the intensity of their distressing emotions, their depressive symptoms, their overall distress, and their urges to use

substances. Overall, the findings from this pilot study indicate that the mobile app was well received and served as a helpful adjunctive tool for teaching DBT skills and promoting their generalization.

Kuhn et al. (2014) conducted a survey study examining the degree to which clinicians (N = 163) were satisfied with a PTSD-related prolonged exposure app as well as how helpful they perceived it to be. Overall, clinicians were found to hold favorable perceptions about using a mobile app to facilitate prolonged exposure therapy. Of note, clinicians who were younger than 40 years old, owned a smartphone, and who had previously used a health care app had more favorable perceptions compared to clinicians who were older than 40 years old, did not own a smartphone, and had not used a health app. The researchers also found that owning a smartphone and having favorable perceptions of the app were significant predictors of clinicians' intentions to use the app in the future. Overall, these findings suggest that mental health clinicians are receptive to using a smartphone app to facilitate components of their clinical practice.

In addition to feasibility and usability studies, promising efficacy findings have begun to emerge with respect to mental health apps. Several such efficacy studies, pertaining to a variety of mental health disorders, have found the use of apps to be associated with reduced symptoms. For example, Gustafson et al. (2014) conducted a randomized clinical trial in which patients exiting residential treatment programs for alcoholism were provided a smartphone app with information, resources, and tools designed to support recovery. They found that patients who received treatment as usual plus the app reported significantly fewer risky drinking days (1.39 vs. 2.75; p = .003) compared to those participants who received treatment as usual (with no app). These findings indicate that mobile apps may be useful in facilitating treatment gains and their maintenance over time.

In a large-scale, uncontrolled pilot study, Parks, Della Porta, Pierce, Zilca, and Lyubomirsky (2012) tracked happiness seekers' usage of a positive psychology-oriented iPhone app that offered access to eight different happiness-increasing activities. They assessed pre-post changes in mood and happiness ratings over an average of 9 days among a subset of 2,928 participants who purchased the app and demonstrated active use by using at least one of the happiness promoting activities more than once. The researchers found that participants' mood and happiness scores improved from the first to second assessment. Moreover, the more participants used the app and the greater variety of activities they practiced, the greater the increases in their self-reported mood and happiness. These results provide preliminary evidence for the ecological validity of using interventions on a mobile app to improve mood and wellbeing.

Watts et al. (2013) conducted a randomized controlled pilot study that compared the efficacy of delivering a partially guided CBT-based program for depression via mobile app vs. a desktop computer. The main purpose was to establish whether a previously validated computerized program remained efficacious when delivered via a mobile app. Despite a small sample size ($N = 35$), significant results were obtained in both experimental groups (mobile app condition and computerized program condition) in terms of reductions in depressive symptoms as measured by PHQ-9, BDI-II and K-10 scores. However, participants in the mobile app condition had larger reductions in depressive symptoms after the three-month follow-up. These findings provide preliminary support for the efficacy of delivering an evidence-based (viz., CBT) program for depression via a mobile phone app.

Donker et al. (2013) conducted a review of the empirical literature on the efficacy of mental health apps for mobile devices. The strict inclusionary criteria required studies to involve

mobile mental health apps that could be downloaded from the Google Play or Apple iTunes stores, an intervention component, mental-health symptom-based outcome measures, and either a pre- to posttest design or one that included a control group comparison. Of 5,464 abstracts examined, only eight trials involving five mental health apps were included in the review (additionally, only 2 of the 5 apps included in the review were available for public download). Consistent with the conclusions noted above, moderate to high usability, helpfulness, and satisfaction ratings were reported for those studies that assessed these variables. With respect to efficacy, the results suggested that the apps included in these trials succeeded in reducing depressive symptoms, stress, anxiety, and substance use, at least at posttest assessment or short-term follow-up.

Thus, the empirical literature conducted to date has yielded promising results with respect to (a) users' receptivity to, perceptions of, and satisfaction with mobile mental health apps and (b) the efficacy of such apps for promoting positive changes in users' symptoms, behaviors, and well-being. However, the conclusions must be considered premature given the relatively small number of studies conducted, the typically small sample sizes, and the preponderance of non-experimental designs that often lack random assignment or control groups. At present, a very small percentage (viz., well less than 1%) of mental health apps available to consumers and clinicians have any research evidence to support their efficacy. As this research literature base continues to grow in volume and quality, mental health professionals will likely develop greater confidence in the efficacy of mobile apps and be more likely to adopt them as part of their clinical practice.

Cognitive Behavioral Therapy

The term CBT applies to a group of psychological treatments rooted in behavioral and cognitive theoretical models and based on scientific evidence. As an approach to treatment, CBT emerged in the 1960s and 1970s, based largely on the seminal work of Albert Ellis and Aaron Beck, and has experienced rapid growth over the subsequent decades. CBT incorporates behavioral theory and therapy, but adds an important role for cognitive mediation. It emphasizes mutual influences between thoughts, emotions and behaviors. A central tenet is the idea that our emotional, behavioral, and physiological reactions to environmental events are often determined in large part by our thoughts and interpretations about those events rather than the events themselves. When those thoughts and interpretations are distorted or otherwise maladaptive, they can contribute to the onset and/or maintenance of mental health problems.

The broad goals of CBT include building a set of skills that enable an individual to be aware of thoughts and emotions; identifying how situations, thoughts and behaviors influence emotions; and improving feelings and overall functioning by changing dysfunctional thoughts and behaviors (Hoffman, Asnaani, Vonk, Sawyer, & Fang, 2012; Stuhlmiller & Tolchard, 2009). CBT typically consists of short-term treatments (often between six and 20 sessions) that focus on teaching clients specific skills (Association for Behavioral and Cognitive Therapies, 2017). CBT is present-centered, problem-focused, collaborative, and active, as it involves helping clients to learn and apply specific skills through in-session practice and frequent homework (Beck, 2011). The key methods of CBT include both behavioral and cognitive strategies. Behavioral methods aim to reduce maladaptive behaviors and promote adaptive ones by systematically applying principles drawn from social learning theory (e.g., modifying antecedents and consequences). Some examples of behavioral interventions include relaxation training, behavioral rehearsal for

social skills, exposure methods to reduce anxiety and avoidance, problem solving, and behavioral activation for depression. Cognitive interventions aim to teach clients to identify and modify maladaptive thoughts, self-statements, and beliefs. They include examining evidence, distancing techniques, strategies for responding to common cognitive distortions, and cognitive restructuring.

Cognitive restructuring (CR) is an integral component of CBT. CR is defined as "structured, goal-directed, and collaborative intervention strategies that focus on the exploration, evaluation and substitution of the maladaptive thoughts, appraisals, and beliefs that maintain psychological disturbance" (Clark, 2014, p. 2). In practice, CR involves teaching individuals how to identify, evaluate, and modify cognitions that appear to be contributing to their distress and/or dysfunction. CR is typically first applied to automatic thoughts (the brief, reflexive thoughts that emerge spontaneously in response to specific situations and that often mediate one's emotional and behavioral responses to such situations) but can also be directed toward changing deeper cognitive structures (e.g., schemas containing one's core beliefs regarding the self, others, relationships, or the world). The three main components of CR include collaborative empiricism, verbal interventions, and empirical hypothesis testing. Collaborative empiricism refers to a therapeutic relationship that involves the clinician and the client sharing their "respective expertise" in order to understand and address the client's problems (Clark, 2014). Cognitive therapists use a variety of verbal interventions to help clients learn how to modify maladaptive cognitions. These include (but are not limited to) examining evidence (often through written Dysfunctional Thought Records), cost/benefit analysis, distancing/decentering (to adopt a different perspective), decatastrophizing, generating alternative explanations, and identifying and countering common cognitive distortions (e.g., all-or-none thinking, mind reading). The last

component, empirical hypothesis testing can be defined as planned behavioral experiments that help clients gather data to test out the validity of their beliefs. Research has indicated that CR is an effective intervention for anxiety and depression and that its use may contribute to the maintenance of treatment effects over time (although it has not been shown to be any more effective than behavioral interventions in terms of short-term symptom improvement; Clark, 2014).

CBT has become a widely practiced form of psychotherapy, representing the predominant orientation of practicing psychologists (Brown, 2013; Gaudiano, 2008). A 2007 study found that 45.4% of randomly surveyed psychologists identified their theoretical orientation as CBT, a rate that exceeded those reported for all other theoretical orientations (Stewart & Chambless, 2007). According to a survey conducted by Shafran et al. (2009), 69% of 2,300 psychologists in the United States use CBT part time or in combination with other therapies to treat depression and anxiety. Part of the reason for the increasing use of CBT by clinicians likely relates to the impressive evidence base that has accrued for its efficacy.

Despite its relatively recent emergence, CBT has amassed the best evidence for its efficacy among all forms of psychotherapy. Hundreds of well-designed studies have served to validate CBT's efficacy in reducing symptoms and relapse rates, with or without medication, for a wide variety of disorders (Beck, 2011). In fact, CBT has been found to be the most effective non-pharmacological treatment for almost all mental disorders studied (Beck, 2011). Thus, it is not surprising that CBT protocols dominate lists of empirically supported treatments (as defined by the APA Division 12 Task Force in 1995; Chambless & Ollendick, 2001) and that they have emerged as the psychosocial treatments of choice for most adult psychological disorders (Roth & Fonagy, 2005). For example, a meta-analytic review conducted by Tolin (2010) concluded that

CBT should be considered the psychosocial treatment of choice for anxiety and depressive disorders. The outcome literature on CBT has become so voluminous that Hofmann, Asnaani, Vonk, Sawyer and Fang (2012) were able to review over 269 *meta-analyses* of CBT, concluding that CBT showed higher response rates than comparison treatments in a majority of studies and that the overall evidence base for CBT was very strong. In addition to this impressive empirical support, the growth of CBT can be attributed, in part, to the ongoing evolution of the theoretical model upon which its based (Beck & Haigh, 2014) and the adaptations of the theory to explain the onset and/or maintenance of an increasingly wide range of disorders and problems (Barlow, 2014).

Cognitive Behavioral Therapy and the Integration of Mobile App Technology

As a form of therapy, CBT is particularly amenable to incorporating various forms of technology. The approach's structured format along with its emphases on active client participation, self-monitoring, skill building, and out-of-session assignments to promote behavioral and cognitive changes and to accelerate the acquisition and generalization of target skills all confer a good fit between CBT and the integration of technology.

To date, this integration has largely involved computer- or web-based CBT. Commonly known as computerized CBT (CCBT) or internet-delivered CBT (ICBT), these forms of treatment generally involve delivering CBT via a personal computer or the Internet rather than through face-to-face interactions with a therapist (Enock & McNally, 2013; Nordgren et al. 2014). Interventions can be delivered using an array of multimedia formats and interactive features to engage users and, ideally, promote treatment efficacy. One such computer-based CBT program is Web-TraC, a short-term (eight approximately 50-minute sessions) treatment focused on teaching the user both behavioral and cognitive skills to alleviate depressive symptoms. Other

computer-based CBT programs offer multi-step interventions for individuals suffering from anxiety, as well as homework activities that build upon topics covered in the weekly sessions (Nordgren et al. 2014).

A considerable body of empirical literature has led to CCBT's emergence as a proven, cost-effective, evidence-based treatment for individuals with depression and anxiety (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Andersson & Titov, 2014; Cuijpers et al., 2009; Nordgren et al., 2014; Marks et al., 2003; Spek et al., 2007; Stuhlimiller & Tolchard, 2009). For example, a meta-analysis of 17 studies found both web-based and computer-delivered interventions to produce beneficial mental health outcomes in university students (Davies, Morriss, & Glazebrook, 2014). Hoidfodt et al. (2013) examined the effectiveness of a therapist-assisted web-based CBT program for individuals suffering from mild to moderate depression. They found that the program was not only helpful in reducing depressive symptoms and anxious worry, but that participants also experienced significant improvements in global life satisfaction. Notably, another meta-analysis of Internet-based psychotherapeutic interventions found that their efficacy did not differ from traditional face-to-face interventions for a variety of presenting problems (Barak, Hen, Boniel-Nissim, & Shapira, 2008). Despite generally modest clinical outcomes and concerns with high attrition rates (Burns et al., 2011), support for CCBT was sufficiently high for the National Institute for Health and Clinical Excellence (NICE) to recommend that it be made available as part of the UK's National Health Service for those with mild- to moderate-depression in lieu of immediate treatment with antidepressant medication (Enock & McNally, 2013).

The efficacy of computerized and Internet-based CBT, along with the near ubiquity of smartphones appear to make the integration of mobile apps into the practice of CBT both

promising and inevitable. Thus, it is not surprising that mobile apps related to CBT, like those associated with mental health more generally, have begun to proliferate. Of note, available apps parallel various treatments that fall under the CBT umbrella (e.g., traditional Beck-oriented CBT, third wave approaches such as Dialectical Behavioral Therapy, Acceptance and Commitment Therapy, and Mindfulness) and facilitate specific CBT-related techniques (e.g., self-monitoring, cognitive restructuring, behavioral activation, exposure, mindful meditation, and opposite action). As discussed above, empirical data on mobile mental health apps (many of which are CBT-related) is emerging. Although compromised by some methodological concerns, these data are nonetheless promising with respect to the potential of CBT-related mobile apps to improve the efficacy and efficiency of this popular form of therapy.

Rationale

CBT is currently the preeminent approach to psychotherapy with respect to evidence-based practice and the training of mental health practitioners. It has also become among the most widely practiced forms of therapy. Subsequent to the emergence and widespread adoption of mobile technology and mobile apps, there has been rapid acceleration in the development of CBT-related apps for therapy and self-help. Many of these apps focus on or include tools to help users implement the cognitive restructuring (CR) interventions that lie at the heart of the dominant form of cognitive therapy developed by Aaron Beck. The early research regarding the usability and efficacy of mental health apps has yielded promising results. Therefore, it appears inevitable that mobile app technology will increasingly be integrated into the everyday practice of CBT. To stay current and competitive, clinicians will need to familiarize themselves with existing CBT-related mobile apps. However, few resources currently exist to guide clinicians in

identifying and evaluating CBT-related apps of potential relevance to their practice. Thus, a need exists for a review of existing CBT-related mobile apps to help guide clinicians.

Aims

The dissertation aims to conduct a review that will provide descriptive information and a comparative analysis of existing CBT-related mobile apps. Due to the extensive and heterogeneous nature of existing mobile apps that could be regarded as CBT-related, as well as the centrality of cognitive restructuring interventions to the predominant form of CBT, the review will be limited to apps that include a cognitive restructuring component based on digitized versions of thought records. It is hoped that such a review will help guide CB-oriented clinicians in identifying and selecting mobile apps relevant to their practice.

Chapter II: Method

CBT has become a widely practiced form of psychotherapy and is the predominant orientation of practicing mental health professionals (Brown, 2013; Gaudiano, 2008). Hundreds of well-designed studies have served to validate the efficacy of CBT in reducing symptoms and relapse rates for a wide variety of disorders (Beck, 2011). Many CBT protocols that have been established to be efficacious include a cognitive restructuring (CR) component. CR, a core technique of traditional "second-wave" cognitive therapies, involves identifying, evaluating, and modifying faulty thoughts and schemas (Clark, 2014).

Mental health professionals are increasingly incorporating apps into their practices, both within their therapy sessions per se and as adjunctive tools that clients utilize outside of sessions. Mobile apps can serve many functions for mental health professionals and their clients, including psycho-education, assessment and symptom monitoring, skill building, and facilitating the implementation of specific interventions. Many mental health apps that might be adopted by practitioners are CBT-based and include a CR component, but no review or comparative analysis exists at present to guide clinicians or those seeking self-help resources in selecting from among these apps. This study produced an overview and comparative analysis of existing CBT-related mobile applications that include a thought record-based CR component.

Research Approach

The focus of the dissertation was to review existing CBT-based mobile applications that include a thought record-based CR component. The following steps were taken in order to conduct the review. In order to become familiar with the general topic area related to the dissertation, the student-researcher reviewed the literature on the integration of mobile technology and mental health, with a particular focus on CBT-based mobile applications. The

relevant literature was identified through searches of the following electronic EBSCOhost databases: PsychInfo, Academic Search Complete, PubMed, Communication and Mass Media Complete, Scopus, and Science Direct. Specific search terms were used to help identify the literature on technology and psychotherapy in general and on mobile apps and CBT more specifically. These terms included psychotherapy, therapy, technology, e-therapy, m-health, mobile development platforms, computer applications, apps, mobile apps, mobile applications, cognitive behavior therapy, cognitive behavioral therapy, CBT, cognitive therapy, and behavior therapy, along with various combinations of these terms.

Following this review of relevant background literature, the mobile apps included in the review were identified. Inputting specific search terms into the search tools provided on both the Apple (iOS) App Store and the Android Google Play Store was the primary method. The search terms included thought, journal, mood, anxiety, tracker, therapist, therapy, depression, thinking, cognitive therapy, e-therapy, psychotherapy, CBT, therapy, cognitive restructuring, cognitive modification, thought record, cognitive behavior therapy, and cognitive behavioral therapy. Secondary methods of identifying apps for the review included published articles/chapters, websites and blogs pertaining to mental health apps, and resource sections of websites for professional organizations pertaining to CBT (e.g., Association for Behavioral and Cognitive Therapies, Academy of Cognitive Therapy). Lastly, app platforms (viz., Apple App Store and Google Play Store) were reviewed, using the same steps as noted above in order to identify any new apps relevant to this review that were unavailable at the time of the initial search.

Inclusionary Criteria

The inclusionary criteria for the app review were as follows: (a) CBT-based apps that included a CR component, (b) developed for the iOS and/or Android/Google Play platforms (as

these platforms dominate the mobile app market), (c) developed for smartphones and/or tablets, (d) available in English, (e) available in the US market, and (f) designed to provide a digitized version of a thought record.

Exclusionary Criteria

The exclusionary criteria for the app review included the following: (a) CBT apps that lacked a CR function, (b) solely-audio based (e.g., no text-entry), and (c) delivered as computer-based programs or web applications using server-side or client-side processing (e.g., JavaScript, Facebook) to provide an application-like experience within a web browser.

Data Collection for Apps Selected for Review

Once the apps included in this review were identified, descriptive data were gathered on each of them. The sources used to gather data on each app included the app's home page on the Apple App Store and/or Google Play Store, the app's website (when applicable), and published scholarly literature (e.g., journal articles, chapters) that included information on any of the target apps. The latter were identified via a literature search with the app name being a key word/search term. Websites and blogs devoted to or including app reviews (e.g., http://sylvainroy.blogspot.com, http://xyo.net/, www.appannie.com, www.appcrawlr.com, www.myhealthapps.net) were also utilized to gather information regarding apps related to CBT. The researcher then conducted a Google search for each target app to identify any relevant sources that were missed through other avenues. Finally, app developers were contacted through email to inquire about the status of empirical support for their app, as well as any additional information relevant to this review. Of note, some apps did not provide an associated website or contact information for their developers.

Each app was reviewed separately within a summary table through headings addressing a common set of categories. Column headings within the summary table included the app name and website, developer, year released and most recent update, platform, app store category (e.g., "Health & Fitness," "Medical"), number of customer ratings and the quality of those ratings (viz., average star rating), empirical/research support, cost, and links to the app's website (where applicable). The researcher identified if appropriate disclaimers regarding privacy, sharing data, and if seeking out mental health services were included within the app (i.e., statement about when a consumer should seek out therapy with a mental health professional), as well as whether mental health professionals were involved in the app's development. A narrative overview of these summary table data, highlighting overarching themes and notable similarities and distinctions across the reviewed apps, is provided in the discussion section.

Derivation of Common CR Elements

Various cognitive restructuring (CR) techniques aimed at teaching clients to identify and modify maladaptive thoughts are central to cognitive therapy (Newman, 2016). Mobile apps incorporating CR have largely done so by replicating the use of traditional "Automatic Thought Records" in digital form. In order to provide a basis for evaluating and comparing these digitized versions of thought records, descriptions of traditional CR using thought records provided by four expert sources were reviewed (i.e., Beck, 2011; Greenberger & Padesky, 2016; Leahy, 2003; Wright, Basco, & Thase, 2006). This process identified the following elements as being common to most of these expert descriptions: (a) describe the situation, (b) identify automatic thought(s), (c) rate belief in automatic thought(s), (d) identify emotion(s), (e) rate intensity of emotion(s), (f) evaluate automatic thought(s; for example, prompting the user to consider the evidence for and against their thoughts), (g) modify automatic thought(s), and (h) evaluate

impact on emotion(s; Beck, 2011; Greenberger & Padesky, 2016; Leahy, 2003; Wright et al., 2006). Although the majority of these expert sources sequenced these common elements in the order presented above, there were some exceptions. For example, Greenberger and Padesky (2016) have the identification and rating of emotion preceding rather than following the identification of automatic thought(s). However, for the purpose of this dissertation, the common elements in the sequence noted above was considered the standard against which the identified CR apps were evaluated.

Chapter III: Results

This review aimed to produce an overview and comparative analysis of existing CBT-related mobile applications that include a cognitive restructuring (CR) component based on automatic thought records. As described in detail in the previous chapter, methods used to identify these apps included targeted searches of the two dominant mobile app platforms (viz., Apple App Store & Google Play), the scholarly literature, and mental health websites and blogs. Descriptive data for each app were gathered and summarized in table form. This chapter summarizes the yield of the search and compares how well the identified apps represent the common elements of CR before describing and comparing them across a variety of variables relevant to practicing clinicians.

Identification of CR Apps

The use of the previously described search terms initially yielded a total of 305 apps. Applying the inclusionary and exclusionary criteria to those apps that continued to be available for download reduced the total to 19 unique mobile apps. Twelve of these apps were developed solely for Apple iOS, four were developed solely for Google Play, and three were developed for both platforms.

Representation of Common CR Elements

As described in the previous chapter, expert sources were reviewed to identify common elements to thought record-based cognitive restructuring. The inclusion of these eight common elements in currently available CR apps along with additional elements of CR, non-CR coping skills, and psychoeducational content pertaining to CBT and/or one or more mental health disorders are summarized in Table A1 (See Appendix A). The identified apps include on average, five of the eight common CR elements, and all have at least three of these elements.

Although only four (21%) include all of these elements, 17 apps (89%) include at least five of the eight core components. The common elements most frequently represented include "Describe the Situation" (18 apps; 95%), "Identify Automatic Thought(s)" (19 apps; 100%), "Identify Emotion(s)" (17 apps; 89%), "Rate Intensity of Emotion(s)" (16 apps; 84%), "Evaluate Automatic Thought(s; e.g., prompting the user to consider the evidence for and against their thoughts; 17 apps; 89%), and "Modify Automatic Thought(s)" (19 apps; 100%). The elements least frequently represented include "Rate Belief in Automatic Thought(s)" (6 apps; 32%), and "Evaluate Impact on Emotion(s)" (15 apps; 79%). Although all the identified apps, as per the inclusionary criteria, include a thought record-based CR component, most (17 apps; 89%) also include additional CR elements (e.g., labeling cognitive distortions) and many include additional (non-CR) coping tools (e.g., guided breathing, journaling; 8 apps; 42%) and/or psychoeducational content (8 apps; 42%; see discussion below).

Comparing Available CR Apps

Table B1 (see Appendix B) compares the CR apps identified in the current review across a variety of variables likely to be relevant to practicing cognitive behavioral therapists. The emergence of CR apps, like mental health apps more generally, is a recent phenomenon, with the earliest of these apps being released in 2009 and the majority (15; 79%) being released since 2011. Of note, the pace of CR app development seems to be accelerating.

With respect to distribution platforms, CR apps are disproportionately developed for the Apple App Store. Sixty-three percent of the available CR apps were developed exclusively for the App Store whereas only 21% were developed exclusively for Google Play (16% were developed for both platforms). For both platforms, CR apps can typically be found in the "Health and Fitness" category, though some appear in the "Lifestyle" and "Medical" categories.

Additional tools. A majority of the publically available CR apps are multifaceted in that their functionality extends beyond the common CR elements discussed above. Some of these additional components relate to CR whereas others do not. Seventeen (89%) of the identified apps provide CR-components outside of the eight "common elements" identified for this review. These include having users rate the strength of their modified thoughts, label their cognitive distortions, and review strategies to combat cognitive distortions. The most frequent additional CR tool (present in 84% of the reviewed apps) involves having the user label the specific cognitive distortions that apply to their identified thoughts. Notably, however, only 68% of these apps provide users with definitions for the cognitive distortion labels that they are directed to apply to their thoughts. Five (26%) apps provide specific strategies or tips for combating and responding adaptively to common cognitive distortions. Four apps (21%) prompt the user to rate the strength of their belief in their modified thought.

Additional non-CR components include providing coping skill(s; other than CR) and psychoeducation. Non-CR coping skills include meditation, deep breathing, muscle relaxation, behavioral activation, journaling, and mindfulness. Eight (42%) of the reviewed apps provide tools related to one or more of these skills, with relaxation strategies being the most commonly represented. The psychoeducation component, also present in eight (42%) of the identified apps, typically consists of providing a description of disorders (depression, anxiety) and/or explaining CBT (e.g., interconnectedness of thoughts, feelings, and behaviors).

Inclusion of desirable elements. Although numerous desirable qualities can be identified for CBT-apps with a CR component, this section will focus on four: (a) the involvement of a mental health professional in the app's development, (b) provision of ethical safeguards, (c) empirical support, and (d) low cost.

Fourteen of the reviewed apps (74%) cite the involvement of mental health professionals in their development, although the nature and extent of that involvement was often unspecified. Mental health professionals (primarily clinical psychologists or licensed clinical social workers) appear to have been involved in the development of 14 (74%) of the identified apps. Five (26%) of the reviewed apps were developed by individuals who are not mental health professionals (e.g., current or former CBT therapy clients, persons citing CBT as a personal passion).

Relevant ethical safeguards include disclaimers and measures to protect the security of users' personal data. The most common disclaimer in CR-apps, like other mental health apps, is a statement clarifying that the app is not intended to substitute for professional mental health services and encouraging users to seek such services should they believe that they might be suffering from a mental health disorder. Fourteen (74%) of the apps provide a disclaimer stating that the app is not a substitute for professional mental health services, and most of these apps also encourage consumers to seek out professional services under certain conditions. Of note, some apps provide general information on how to go about seeking a mental health professional, but most do not provide any specific guidelines.

Security measures include a touch ID and numeric or text passcode identification to open the app. Although all apps are provided with a layer of security offered by the password protection on smartphones themselves, only 10 (53%) of the 19 reviewed apps have a separate security option within the app. With respect to the protection of user data, 14 apps (74%) explicitly inform the user that their personal identifiable information is not collected or stored anywhere but on the user's personal device. Three (16%) apps did not provide any information on their policies with respect to collecting user data.

Although two apps (10%) report gathering anonymous data for research purposes (with a user opt-out option), there is very little empirical data published on the usability or efficacy of the apps included in the current review. Of the 19 reviewed apps, only one (5%) has empirical support and it derives from an uncontrolled study employing an unselected, opportunistic sample (viz., Kinderman et al., 2016). The developers of seven (36%) apps reported to the author that there was no completed or in-progress research related to their apps. One (5%) app developer reported research on their app is in progress but as of yet unpublished. Although developers of the remaining apps failed to respond to inquiries about completed or ongoing research, web- and literature searches suggest that no studies pertaining to these apps have been published.

With respect to cost, prices for the reviewed apps range considerably but most could be considered low cost. The reviewed apps range in price from free to $10.99. One app (5%) is $0.99, six apps (32%) are between $1 and $5, and five (26%) cost more than $5. Although seven (37%) of the reviewed apps are available for free, three (16%) of these free apps offer in-app purchases (e.g., to unlock additional content) and one offers a subscription model (wherein users pay a monthly fee in order to access additional features, such as the ability to export data).

Target audience and problems. Information provided within the apps themselves or on their associated websites was reviewed in an effort to identify the primary targeted clinical problems and users for each app. Target problems were more clearly discernable than target users. Most developers did not identify target users explicitly. Two (10%) of the apps identified were specifically designed for youth. However, it is likely that the focus on CR apps skewed the findings toward adult-oriented apps. With respect to target problems, the majority of the reviewed apps are designed to improve mood, with many specifically targeting depression and/or anxiety. Once again, the specific focus on thought record-based CR apps likely contributed to

this finding, as thought records have traditionally been applied toward the reduction of depressive and anxious symptoms.

In theory, CR apps can be used as stand-alone self-help tools or as adjuncts to therapy (e.g., to help teach and practice targeted skills, to share data with a provider). Apps that enable users to send content to a provider via text or email would appear to be particularly well suited to being therapeutic adjuncts. Although the reviewed apps typically did not specify whether they were designed to be used as self-help tools, therapeutic adjuncts, or both, 15 (79%) allow sharing of user-entered data, presumably for the purpose of integrating it into ongoing therapy with a mental health professional.

User reviews. One way to gauge how apps are being receiving by users is through the reviews posted on the Apple App Store and Google Play distribution platforms. On both platforms, users can post ratings on a Likert scale ranging from 1-5 stars (with one being least favorable and 5 being most favorable) as well as written comments (reviews) about apps that they have downloaded. The number of ratings and reviews varies widely across apps (e.g., the number of ratings ranges from 0 to over 5,000), but the number of star ratings for any given app typically far exceeds the number of written reviews. Six apps (32%) had more than ten written reviews, six apps (32%) had fewer than ten written reviews, and 7 (37%) had no written reviews. Although lay users post most of these reviews, some come from mental health professionals.

Overall, the user review data suggest that these CR apps are generally positively received. Averages are not calculated when an app has an insufficient number of ratings, though neither platform identifies the threshold used for "insufficient." Average ratings were not provided for seven (37%) of the reviewed apps. Collectively, the average rating for the remaining apps was 4.0, with average ratings for the individual apps ranging from 3.0 to 5.0.

Eleven apps (58%) had an average rating of 4.0 or higher whereas only one (5%) had an average rating of less than 4.0.

Chapter IV: Discussion

The aim of this dissertation was to conduct a review providing descriptive information and a comparative analysis of existing CBT-related mobile apps that include a thought record-based cognitive restructuring (CR) component. Nineteen such CR apps were identified and reviewed with respect to their representation and sequencing of common CR elements and their inclusion of additional (non-CR) clinical content. Supplemental information about each app of likely relevance to clinicians considering their use was also gathered.

Commentary

Although the number of CR-related apps that replicate thought records remains relatively small, the pace of their development appears to be increasing. The majority of these apps are low cost or free and developed for the Apple App Store platform. Although most limit their content to CR (in the form of a digitized thought record, as per the inclusionary criteria), a number of these apps provide users with additional coping skills as well (e.g., relaxation, behavioral activation). Most had mental health professional involvement in the development of the app (typically psychologists or social workers), though more than a quarter apparently did not. With respect to securing user data, it is concerning that nearly half of the apps reviewed did not provide app-based protections (e.g., touch ID; passcodes).

Given that this review focused specifically on apps that include digitized versions of the thought record-based CR process, it is notable that relatively few of the identified apps include all of the common elements of CR as identified from expert sources. However, nearly all of the apps include both a majority of the CR elements and additional CR components (most commonly, the step of labeling cognitive distortions represented in one's automatic thoughts). The CR element of having the individual rate the degree to which he or she believes the

identified automatic thought was the least represented (appearing in less than a third of the apps). It appears that the developers of these apps opted to rely far more on changes in intensity of distressing emotions rather than changes in the degree of belief in one's own thought as a means to measure the impact of the CR process. There is also variation in the sequencing of the elements of CR (e.g., whether the process begins with describing a situation in which one experienced distress or with identifying and rating the distressing emotion itself). Thus, clinicians interested in integrating one of these apps into their practice should consider which replicate both the elements and the sequencing that they employ when implementing CR with their clients.

This review, like other reviews of mental health apps (Bakker, Kazantzis, Rickwood, & Rickard, 2016; Donker et al., 2013), underscores the lack of controlled outcome research in this burgeoning area. Among the apps reviewed here, only one has been the focus of any published empirical research (which involved an uncontrolled study employing an unselected, opportunistic sample[1]) and only one additional app appears to be in the process of being evaluated empirically. It is thus unfortunate that, at present, clinicians cannot rely on findings from controlled trials to help inform their decisions about which CR apps to adopt.

Given the lack of empirical data from controlled studies, clinicians will need to rely, in part, on user ratings and reviews in order to evaluate CR apps. Unfortunately, this is a less than ideal data source for a variety of reasons (e.g., few or no posted reviews for some apps; wide variability in the number of ratings available across apps, inconsistency in the way raters use the 1-5 star scale, ambiguity with respect to the bases for low or high numerical ratings, various types of bias related to the sources and content of ratings and reviews). Nonetheless, ratings and

[1] This study found statistically significant favorable changes to both negative and positive mood intensity associated with the use of the "Catch It" app (Kinderman et al, 2016).

reviews do represent a source of user-generated data that clinicians can consider when evaluating CR apps. There is enormous variability in the number of ratings and reviews provided across the apps included in the current review (ranging, for ratings, from none to over 1,000). Notable, only 7 (27%) of the apps had over 100 reviews. Presumably, conclusions drawn about apps with hundreds of ratings and reviews are more reliable and potentially more valid than those from apps with few ratings and reviews. It is encouraging that, in general, these CR apps appear to be well received by users, with an overall mean rating of 4.3 (out of 5) and a range of 3.5 to 5.0. A systematic review of the qualitative comments provided in user reviews was beyond the scope of this project.

Limitations of the Current Review

The current review has a number of limitations. Mobile apps including a CR tool intended to mirror a thought record might have been missed in the initial search or might have been released since the search was completed. Additionally, any CR apps developed for platforms other than Apple App Store and Google Play (e.g., Windows Store, Amazon App Store, Blackberry World) were excluded. Also excluded were CBT-oriented apps with a CR component that does not aim to replicate a thought record (e.g., Bust PTSD).

Other limitations relate to how current and complete the provided information is regarding the apps included in this review. Given the frequency with which existing apps are updated, some of the information provided on the reviewed apps may no longer be current. Additionally, some information is incomplete because it was either unavailable or not sufficiently detailed to clarify the status of certain apps. For example, the original release date for apps that have been updated is unavailable on the Google Play platform. For other apps, the

nature and extent of the involvement of mental health professionals in their development is unclear.

Recommendations

The results of the current review suggest a number of steps likely to benefit both consumers seeking self-help resources and clinicians deciding which apps to recommend to their clients. Although it is understandable why developers would choose not to narrow their potential consumer base by specifying the target users and target problems for their apps, efforts should nonetheless be made to clarify in greater detail the groups the apps are designed to help and the types of symptoms they are intended to alleviate. This would enable a more careful process of optimizing the match between user and app. The ability of clinicians and consumers to adequately vet apps would also be enhanced if more detailed information were provided about the involvement of mental health professionals in the app-development process, including the credentials of those involved and the specific nature of their contributions. Although 74% of the CR apps in the current review had some form of mental health professional involvement, the qualifications of those professionals and the nature of their involvement were often unclear.

Components of these apps designed to familiarize users and potential users with their purpose, features, and operation were often found to be lacking. Absent or underrepresented on some of the websites associated with these apps was content helping users to understand and navigate the apps, the provision of supplemental resources, and, in some cases, contact information for the developers. Video-based tutorials for clinicians and the public should be included within the app or on the associated website in order to position users to be familiar with the key features and navigation of the app so as to maximize its benefits. Additionally, the amount and quality of psychoeducational material within these apps themselves pertaining to

CBT and/or particular mental health disorders could be improved, as less than half of the reviewed apps contained such content.

Nearly all the apps included in the current review are only available in English.[2] Given the rapid adoption of digital technology around the globe and by demographically diverse groups within nations, the reach and impact of leading CR apps could be expanded considerably were they to be made available to non-English speaking populations.

The lack of data from controlled trials to guide CBT clinicians (and savvy consumers) in their selection of CR apps (and mental health apps in general) is a significant shortcoming in the burgeoning field of mobile mental health. Empirical investigations employing randomized control trials should be conducted in order to systematically examine the usability, acceptability, and efficacy of the available CR apps. Although initial trials may well involve the developers of the apps being studied, future research would ideally be conducted by investigators unaffiliated with those apps, so as to reduce the potential for investigator bias. Once the efficacy of some of these CR apps is established, controlled trials comparing the efficacy of leading CR apps (both as self-help tools and as therapeutic adjuncts) should be pursued.

It is also recommended that developers of these and future CR apps improve their efforts to secure the privacy of user data. Over 40% of the apps reviewed here did not include passcodes or touch ID security features within the app itself. Not only should these features be standard components of mental health apps, but also encryption should be considered for any user information that is sent over the Internet (e.g., a thought record summary sent to one's therapist). Although app accreditation programs that are well developed, widely used, and broadly accepted

[2] The Adult, Teen, and Kid CBT*ABC way apps are also available in Spanish.

have yet to be established, their emergence might ultimately compel developers to improve their efforts to protect user data.

Future Directions

In addition to the aforementioned recommendations pertaining to CR apps, a number of future directions for the field can be identified. The focus of future app reviews could be expanded to include CR apps that do not aim to replicate thought records and to focus on CBT-based apps more generally. Additional research efforts pertaining to CBT apps should be aimed at conducting qualitative analyses of user reviews and clarifying how often apps that are downloaded are actually used and how they are used (e.g., via app usage data).

In some ways, currently available technology is being underutilized in the type of apps included in the current review and future efforts should aim to make such apps smarter and more individually tailored. Most of the apps reviewed here merely replicate paper thought records in digitized form and provide information via static text. Greater engagement and impact are likely to result from apps that learn about the user over time, provide summative, data-based insights about the user's mood, behavior, and/or thinking habits, and individually tailor recommendations to users[3]. The increased incorporation of gamification strategies to engage and motivate users represents another avenue to enhance currently available CBT apps.

The proliferation of mental health apps needs to be matched by efforts to promote their acceptance and implementation among clinicians. Many practitioners, particularly those who have been licensed for some time, may be relatively unaware of the range of CBT-based apps available and how they might be used to enhance their practices and benefit their clients. These

[3] The *Moodnotes* app reviewed herein provides an example of such efforts through its provision of an "Insights" tool that aggregates user-entered data over time to provide tailored information on a person's use of the app, typical moods, and most common thought distortions along with adaptive strategies to respond to each.

gaps might be addressed through workshops at professional conferences, web- and print-based features produced by professional organizations, direct marketing and advertising efforts to professionals (e.g., via community boards for psychological associations), and through YouTube videos and podcasts.

Conclusion

CR has long been a cornerstone of cognitive therapy, yet the field is still in the early stages of developing and integrating mobile apps designed to facilitate this aspect of treatment. Nonetheless, a variety of these apps exist and they show considerable promise for enhancing traditional therapeutic efforts to teach clients to appreciate the impact of their thinking on their moods and to identify and alter dysfunctional thoughts that are contributing to their distress. It is hoped that the current review proves to be helpful to practicing clinicians interested in selecting a CR app intended to replicate traditional paper-based thought records in digital form. It should help mental health professionals to familiarize themselves with these apps, compare them across a variety of relevant dimensions, and make more informed choices when selecting a CR app to incorporate into their clinical work.

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APPENDIX A

Components of Current Cognitive Restructuring (CR) Apps

App Name	CR Component	Additional Components

Table A1

Components of Current Cognitive Restructuring (CR) Apps

	Describe Situation	Identify Automatic Thought(s)	Rate Belief in Automatic Thought(s)	Identify Emotion (s)	Rate Intensity of Emotion(s)	Evaluate Automatic Thought(s)[a]	Modify Automatic Thought(s)	Evaluate Impact on Emotion(s)	Rate Belief in Modified Thought	Label Cognitive Distortion	Includes Non- CR Coping Skill(s)	Psycho-education[b]
Adult CBT*ABC way	Yes 1[c]	Yes 2	Yes 3	Yes 4	Yes 5	Yes 6	Yes 7	Yes 9	Yes 8	Yes[d] 10	No	No
Catch It	Yes 3	Yes 4	No	Yes 1	Yes 2	Yes 5	Yes 6	Yes 7	No	No	No	Yes
CBT Thought Record Diary	Yes 3	Yes 4	No	Yes 1	Yes 2	Yes 6	Yes 7	Yes 8	No	Yes[e] 5	No	No
Cloud Clinic	Yes 1	Yes 4	No	Yes 2	Yes 3	Yes 6	Yes 7	Yes 8	No	Yes[e] 5	Yes	Yes
Cognitive Diary CBT Self-Help	Yes 1	Yes 4	Yes 5	Yes 2	Yes 3	Yes 7	Yes 8	Yes 10	Yes 9	Yes[e] 6	No	Yes
Depression CBT Self-Help Guide	Yes 1	Yes 4	Yes 5	Yes 2	Yes 3	Yes 7	Yes 9	Yes 10	Yes 9	Yes[e] 6	Yes	Yes
iCBT	Yes 1	Yes 4	No	Yes 2	Yes 3	Yes 6	Yes 7	Yes 8	No	Yes[e] 5	No	No
iCouch CBT	Yes 1	Yes 2	No	Yes 3	Yes 4	No	Yes 6	Yes 7	No	Yes[e] 5	No	Yes
Kid CBT*ABC way	Yes 1	Yes 2	No	Yes 3	Yes 4	Yes 5	Yes 6	Yes 7	No	No	No	No

(continued)

	Describe Situation	Identify Automatic Thought(s)	Rate Belief in Automatic Thought(s)	Identify Emotion (s)	Rate Intensity of Emotion(s)	Evaluate Automatic Thought(s)[a]	Modify Automatic Thought(s)	Evaluate Impact on Emotion(s)	Rate Belief in Modified Thought	Label Cognitive Distortion	Includes Non- CR Coping Skill(s)	Psycho-education[b]
MoodKit-Mood Improvement Tools	Yes 1	Yes 4	No	Yes 2	Yes 3	Yes[f]	Yes 6	Yes 7	No	Yes[e] 5	Yes	Yes
Moodnotes	Yes 1	Yes 4	No	Yes 2	Yes 3	Yes 8	Yes 6	Yes 7	No	Yes[e] 5	Yes	No
Mood Tools-Depression Aid	Yes 3	Yes 4	No	Yes 1	Yes 2	Yes 6	Yes 7	Yes 8	No	Yes[e] 5	Yes	Yes
NeatCBT	Yes 1	Yes 2	No	Yes 3	Yes 4	No	Yes 6	Yes 7	No	Yes[e] 5	No	No
Pacifica	Yes 2	Yes 3	No	Yes 1	No	Yes[f]	Yes 5	No	No	Yes[e] 4	Yes	No
Pocket CBT	Yes 1	Yes 2	Yes 3	Yes 4	Yes 5	Yes 8	Yes 7	No	No	Yes[d] 6	No	No
Stress & Anxiety Companion	Yes 1	Yes 2	No	No	Yes 3	Yes[f]	Yes 5	Yes 6	No	Yes[d] 4	Yes	Yes
Teen CBT*ABC way	Yes 1	Yes 2	Yes 3	Yes 4	Yes 5	Yes 6	Yes 7	Yes 9	Yes 8	No	No	No
The CBT App	Yes 1	Yes 2	Yes 5	Yes 3	No	Yes 4	Yes 7	No	No	Yes[e] 6	Yes	Yes
Thought Challenger	No	Yes 1	No	No	No	Yes 2	Yes 4	No	No	Yes[e] 3	No	No

Note. Table reflects CR app as of October 10, 2016. [a]Includes content to guide clients in the evaluation and/or modification of automatic thoughts. [b]Includes psychoeducational content related to cognitive behavioral therapy and/or one or more mental health disorders. [c]Numbers convey sequencing of CR components within an app. [d]Cognitive distortions are listed but not defined. [e]Cognitive distortions are listed and defined. [f]Guidance on evaluating thoughts provided via an "i" (information) or a "?"screen.

APPENDIX B

Cognitive Restructuring (CR) Mobile Apps (as of October 10, 2016)

Table B1

Cognitive Restructuring (CR) Mobile Apps (as of October 10, 2016)

Name/ Website	Developer	Year Released/ Most Recent Update[a]	Plat-form	Cate-gory	Mean Star Rating[b]	Number of Customer Reviews[c]	Cost	Involvement of Mental Health Prof-essionals	Security[d]	"Not a Substitute for Therapy" Disclaimer	Exportable User data[e]	Empirical Support
Adult CBT*ABC way www.tikalbaytek.com	TikalBayTek, Inc.	2012/2012	Apple App Store	Health & Fitness	Apple App Store[f]	2	$6.99	Yes	No	Yes	Yes	No
Catch It-Making Sense of Your Moods appstore.liv.ac.uk/catch-it/	Universities of Liverpool and Manchester	2014/2016	Apple App Store; Google Play	Lifestyle	Apple App Store[f] Google Play 4.2 (*N* = 83)	Apple App Store: 1; Google Play: -	Free	Yes	Yes	Yes	Yes	Yes[g]
CBT Thought Record Diary moodtools.org	MoodTools	2015/2016	Apple App Store; Google Play	Medical (Apple) Health & Fitness (Google)	Apple App Store: 4.0 (*N* = 11) Google Play: 4.2 (*N* = 193)	Apple App Store: 9 Google Play: -	Free	No	Yes	Yes	Yes	No
Cloud Clinic cloudclinic.net.au	Cloud Psychology Pty Ltd.	2013/2013	Apple App Store	Medical	Apple App Store[f]	0	$7.99	Yes	Yes	Yes	Yes	No
Cognitive Diary CBT Self-Help excelatlife.com	Excel at life	2011/2015	Google Play	Medical	Google Play: 4.2 (*N* = 1,248)	-	Free[h] ($7.99)	Yes	Yes	Yes	No	No
Depression CBT Self-Help Guide excelatlife.com	Excel at Life	2016 (update)	Google Play	Medical	Google Play: 4.2 (*N* = 1,287)	-	Free[h] ($7.99)	Yes	Yes	Yes	No	No
iCBT bonfireda.com	Bonfire Development Advisors	2010/2016	Apple App Store	Medical	Apple App Store: 4.0 (*N* = 66)	45	$5.99	No	Yes	No	Yes	No
iCouch CBT icouch.me/	iCouch Inc	2011/2015	Apple App Store	Health & Fitness	Apple App Store: 3.5 (*N* = 34)	26	$2.99	No	Yes	No	Yes	No

(continued)

Name/ Website	Developer	Year Released/ Most Recent Update[a]	Plat-form	Cate-gory	Mean Star Rating[b]	Number of Customer Reviews[c]	Cost	Involvement of Mental Health Prof-essionals	Security[d]	"Not a Substitute for Therapy" Disclaimer	Exportable User data[e]	Empirical Support
Kid CBT*ABC way tikalbaytek.com	TikalBayTek, Inc.	2012/2012	Apple App Store	Health & Fitness	Apple App Store[f]	0	$6.99	Yes	No	Yes	Yes	No
MoodKit-Mood Improvement Tools thriveport.com/	Thriveport, LLC	2011/16	Apple App Store	Health & Fitness	Apple App Store: 4.5 (*N* = 368)	278	$4.99	Yes	Yes	Yes	Yes	No[i]
Moodnotes moodnotes.thriveport.com/	Thriveport, LLC and ustwo	2015/16	Apple App Store	Health & Fitness	Apple App Store: 4.5 (*N* = 468)	299	$3.99	Yes	Yes	Yes	Yes	No
Mood Tools-Depression Aid moodtools.org/	MoodTools	2016 (update)	Google Play	Medical	Google Play: 4.3 (*N* = 2,181)	-	Free[h] ($1-$49.99)	Yes	No	No	Yes	No
NeatCBT nathanmckaskle.com	Nathan McKaskle	2015/16	Apple App Store	Health & Fitness	Apple App Store[f]	2	$1.99	No	No	No	Yes	No
Pacifica -Anxiety, Stress, & Depression relief based on CBT & Mindfulness thinkpacifica.com	Pacifica Labs, Inc.	2015/16	Apple App Store; Google Play	Health & Fitness	Apple App Store: 4.5 (*N* = 1,082) Google Play: 4.3 (*N* = 5,120)	720	Free[h]	Yes	Yes	No	Yes[j]	No
Pocket CBT pocketcbt.com	Cogitate Software Ltd	2014/16	Apple App Store	Health & Fitness	Apple App Store[f]	2	$4.99	Yes	No	Yes	Yes	No
Stress & Anxiety Companion www.companionapproach.com	Prosper	2014/15	Apple App Store	Health & Fitness	Apple App Store: 5.0 (*N* = 16)	14	$4.99	Yes	No	Yes	Yes	No
Teen CBT*ABC way tikalbaytek.com	TikalBayTek, Inc.	2012/12	Apple App Store	Health & Fitness	Apple App Store[f]	0	$6.99	Yes	No	Yes	Yes	No
The CBT App[k]	Kristian Daoud	2014/14	Apple App Store	Medical	Apple App Store[f]	1	$0.99	No	No	Yes	Yes	No
Thought Challenger intellicare.cbits.northwestern.edu/	CBITs	2016 (update)	Google Play	Health & Fitness	Google Play: 4.1 (*N* = 13)	-	Free	Yes	No	Yes	No	No

Note. Dashes convey unreported/unavailable data. [a]Year released not available for Google Play apps that have been updated. [b]Based on 1-5 star ratings in U.S. market only. [c]The Google Play platform does not provide the total number of reviews submitted for its apps. [d]Touch ID and/or passcode protection within the app itself. [e]Via email, text, and/or airprint. [f]Insufficient number of ratings to generate a mean. [g]Kinderman et al., 2016. [h]Paid version available (e.g., subscription model, to remove advertisements, to access additional features). The figure in the parentheses refers to the cost of the paid version or the monthly subscription fee. [i]Research in progress. [j]Available only with a paid subscription. [k]No Website available.

APPENDIX C

Summary Tables of Selected Materials

Table C1

Selected Books: Literature Table

Author/Year	Book Title/Ed.	Summary	Key Points	Comments
Beck, J.S (2011)	Cognitive behavior therapy: Basics and beyond	The leading text for students and practicing therapists who want to learn the fundamentals of cognitive behavior therapy (CBT)	Book demonstrates how to engage patients, develop a sound case conceptualization, plan treatment, and structure sessions effectively. Core cognitive, behavioral, and experiential techniques are explicated and strategies are presented for troubleshooting difficulties and preventing relapse. An extended case example and many vignettes and transcripts illustrate CBT in action.	Reproducible clinical tools, including the Cognitive Therapy Rating Scale and other therapist and client materials, can be downloaded and printed; This edition contains new elements including: chapters on the evaluation session and behavioral activation. Increased emphasis on the therapeutic relationship, building on patients' strengths, and homework
Barlow, D. (Ed.) (2014).	Clinical handbook of psychological disorders (5th ed.).	This clinical reference guide is recognized as the premier guide to understanding and treating frequently encountered psychological disorders in adults	Showcasing evidence-based psychotherapy models, it presents state-of-the-art information on each clinical problem and explains the conceptual and empirical bases of their respective therapeutic approaches. Procedures for assessment, case formulation, treatment planning, and intervention are described in detail. Also includes extended case examples with session transcripts illustrating each component of treatment	New topics included in this edition include: treatment innovations, the latest empirical findings, and changes to diagnostic criteria in DSM-5. It also includes added chapters on acceptance-based treatment of generalized anxiety disorder, comorbid depression and substance abuse, demonstrating a transdiagnostic approach, and sleep disorders
Roth, A., Fonagy, P. (2005)	What works for whom? A critical review of psychotherapy research (2nd ed.)	The second edition provides a systematic, comprehensive, and balanced evaluation of the current status of all major psychotherapeutic approaches	Detailed evidence is presented for the efficacy of widely used interventions for frequently encountered mental disorders and for special populations, including children and adolescents and older adults. The concepts that underpin psychotherapy research are explicated, and methodological challenges in translating research into practice addressed. The paper also examined the impact of therapist and client characteristics on outcome, regardless of the specific interventions used	The book illustrates evidence demonstrating CBT as a strongly supported therapy of choice for most of the psychological disorders in adults

Table C2

Selected Journal Articles: Literature Table

Author/Year	Journal/Vol.	Title	Purpose	Summary/Key Findings/Methods/Demographics	Comments
Ahtinen, A., Mattila, E., Valkkynen, P., Kaipainen, K., Vanhala, T., Ermes, M., Sairanen, E., Myllymaki, T., & Lappalainen, R. (2013)	Journal of Medical Internet Research, 1(2)	Mobile mental wellness for stress management: feasibility and design implications based on one-month field study	The objective of this study was to study the usage, acceptance, and usefulness of a mobile mental wellness training application among working-age individuals, and to derive preliminary design implications for mobile apps for stress management	1 month field study with 15 working age participants. Usage of the app was studied based on the usage log files of the application. Changes in wellness were measured by three validated questionnaires on stress, satisfaction with life, and psychological flexibility at the beginning and end of the study and by user experience questionnaires after one week's and one month's use. Additionally user experience interviews were also conducted after one-month's use. Five design implications were derived: (1) provide exercised for everyday life, (2) find proper place and time for challenging content (3) focus on self-improvement and learning instead of external rewards (4) guide gently but do not restrict choice, and (5) provide an easy and flexible tool for self-reflection.	Mood charting within the app helped identify clients emotions as they arise in a session, app was used adjunctively to help put into place coping skills learned in the session.
Alabi, H.I., & Gooch, B. (2011).	ACM Digital Library	The accessibility tool kit	The paper focuses on the creation of an inclusive mobile application, design tools and techniques.	The authors discuss the accessibility tool kit they developed. The application was based on existing and future research in the realm of accessibility. Initially, this tool kit was only available to academic researchers developing user studies. The authors noted the most common design standard was to design for the average user and successful usage of a mobile device usually requires physical stability, tactility, accuracy, and control.	The paper walks the reader through the steps utilized to develop a mobile application. The authors suggest that efforts needs to be extended to provide designers a forum to receive advice, support, documentation and code examples to support their accessibility needs
Barak, A., Hen, L., Boniel-Nissim, M., & Shapira, N. (2008).	Journal of Technology in Human Services, 26(2/4)	A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions.	The paper focused on empirical articles published on the effectiveness of non-traditional therapy forms. Research on the effects of online therapy, including type of therapy (self-help web-based therapy versus online communication-based etherapy) are reviewed. Strong support for the adoption of online psychological interventions are provided	The study researched 64 empirical articles that examined the effectiveness of online therapy of different forms and performed a meta-analysis of all the studies reported in them. These studies involved a total of 9,764 clients who were treated through various internet-based psychological interventions for a variety of problems, whose effectiveness was assessed. The overall mean weighted effect size was found to be 0.53, which the authors indicated as similar to the average effect size of traditional, face-to-face therapy. The findings of this meta-analysis, and review of additional internet therapy studies not included in the meta-analysis, provide strong support for the adoption of online psychological interventions as a legitimate therapeutic activity and suggest several insights in regard to its application	CBT was found to be more effective than any other therapeutic technique applied online. Behavioral techniques were rated as inferior to any other therapeutic techniques supporting the position of critical literature to focus solely on CBT focused apps.

(continued)

Author/Year	Journal/Vol.	Title	Purpose	Summary/Key Findings/Methods/Demographics	Comments
Beck, A. T., & Haigh, E. A. P. (2014)	Annual Review of Clinical Psychology, 10	Advances in cognitive theory and therapy: The generic cognitive model.	Highlights the generic cognitive model which represents a set of common principles that can be applied across the spectrum of psychological disorders. The updated theoretical model provides a framework for addressing significant questions regarding the phenomenology of disorders not explained in previous iterations of the original model.	New additions to the theory include continuity of adaptive and maladaptive function, dual information processing, energizing of schemas, and attentional focus. The model includes a theory of modes, an organization of schemas relevant to expectancies, self-evaluations, rules, and memories. A description of the new theoretical model is followed by a presentation of the corresponding applied model, which provides a template for conceptualizing a specific disorder and formulating a case.	The GCM has the potential to be the only empirically supported general theory of psychopathology. The model may aid in training and dissemination by serving as an alternative to traditional cognitive behavioral therapy protocols.
Burns, M.N., Begale, M., Duffecy, J., Gergle, D., Karr, C.J., Giangrande, E., Mohr, D.C. (2011).	Journal of Medical Internet Research, 13(3)	Harnessing context sensing to develop a mobile intervention for depression.	The purpose of this study was to investigate the technical feasibility, functional reliability, and patient satisfaction with Mobilyze!, a mobile phone- and Internet-based intervention including ecological momentary intervention and context sensing.	8 adults with major depressive disorder were enrolled in a single-arm pilot study to receive Mobilyze! and complete clinical assessments for 8 weeks. Brief telephone calls and emails with a clinician were used to promote adherence. Promising accuracy rates (60% to 91%) were achieved by learners predicting categorical contextual states (e.g., location). For states rated on scales (e.g., mood), predictive capability was poor. Participants were satisfied with the phone application and improved significantly on self-reported depressive symptoms and interview measures of depressive symptoms. Participants also became less likely to meet criteria for major depressive disorder diagnosis; Comorbid anxiety symptoms also decreased.	Mobilyze! is a scalable, feasible intervention with preliminary evidence of efficacy. The authors identify app as the first ecological momentary intervention for unipolar depression, as well as one of the first attempts to use context sensing to identify mental health-related states.
Chambless, D.L., & Ollendick, T.H. (2001).	Annual Review of Psychology, 52, 685-716	Empirically supported psychological interventions: controversies and evidence	Focused on the work of several task forces and other groups reviewing empirically supported treatments in the United States, United Kingdom and elsewhere - also a long list of empirically supported treatments were identified	Arguments for and against identification and dissemination of empirically supported treatments were provided; no evidence was found that empirically supported treatments could not be beneficially applied in real clinical settings by those trained or supervised in their use and little support for whether they affect quality of life	CBT protocols dominate lists of empirically supported treatments--as defined by the APA Division 12 Task Force

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Chan, S.R., Torous, J., Hinton, L., & Yellowlees, P. (2014)	Healthcare, 2	Mobile Tele-Mental Health: Increasing Applications and a Move to Hybrid Models of Care	This paper provides an overview of mobile telemental health and its current trends, as well as future opportunities as applied to patient care in both academic research and commercial ventures. For the purposes of the paper, smartphone devices were targeted	Advantages of mobile devices—in the context of healthcare—can be used for treatment monitoring and adherence, appointment reminders, community mobilization, health promotion, health surveys and surveillance, patient monitoring, decision support systems, and patient recordkeeping, as well as for the delivery healthcare of direct patient services via audio or video systems. Although smartphone use has pervaded mainstream culture, health applications are less pervasive. Disadvantages were found to include: low healthcare penetration rates for application usage slow, unequal access to mobile devices. Different age groups, for instance, have lower rates of adoption of mobile devices, low socioeconomic status still prevents some patients from being able to afford them. Finally, the use of technology itself is dependent on the patient's technological aptitude and understanding how to effectively use digital information, and thus, e-health literacy is paramount, and this still affects a proportion of the population who are older than those "digital natives" who have lived their whole lives with the Internet	The paper excluded personal digital assistant (PDA) devices that did not include a network connection, and cellular phones and early smartphones that did not include modern smartphone capabilities including advanced processing power, graphics, ability to run mobile applications, and interactive capabilities such as touchscreens.
Clough, B.A., & Casey, L.M (2011)	Clinical Psychology Review 31	Technological adjuncts to enhance current psychotherapy practices: a review	The purpose of the paper was to examine technological adjuncts used to enhance psychotherapy practice. Four types of technological adjuncts were identified; mobile phones, personal digital assistant (PDAs), biofeedback, and virtual reality.	Research has shown mobile phones and PDAs to be effective for electronic data collection and intervention techniques. Although these two devices provide similar services, mobile phones may be a more practical and feasible choice for clinicians due to increased functionality and high penetration rates. Mobile phones also have the added advantage of being personally and socially linked with client programs. This may increase client engagement during and between therapy sessions, and increase adherence with homework tasks. Applications may also be able to remind clients to take required medications throughout the day. There is a current lack of research investigating client compliance to technological adjuncts in traditional face-to-face therapy. Interestingly, researchers have also speculated that client compliance may be greater for mobile phone adjuncts than for other technological adjuncts. Mobile phones have been found to be popular even among people who may not normally use computers or other technologies	This review also identified limitations of technologies currently used. The psychological community would benefit from standardized procedures and software for devices, as well as ethical guidelines for their use. Appropriate data management systems are also a necessity. Importantly, technologies should fit with the treatment protocol and be acceptable to both therapist and client

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Cole-Lewis, H., Kershaw, T. (2010)	Epidemiologic Reviews, 32	Text messaging as a tool for behavioral change in disease prevention and management	This review provides an overview of behavior change interventions for disease management and prevention delivered through text messaging	Twelve randomized controlled trials published between 2005 and June 2009 of interventions for disease prevention and management using text messaging were reviewed. Nine countries were represented, only one of which is a developing country. Evidence on behavior change and clinical outcomes was compiled from randomized or quasi-experimental controlled trials of text messaging interventions published in peer review journals by June 2009. Only those using text messaging as a primary mode of communication were included. Seventeen articles representing 12 studies (5 disease prevention and 7 disease management) were included. Intervention length ranged from 3 months to 12 months, none had long-term follow-up, and message frequency varied. Of 9 sufficiently powered studies, the majority of studies found evidence of a short-term effect regarding a behavioral or clinical outcome related to disease prevention and management. Of those that found no evidence of effect, only one had sufficient power to detect an effect in the primary outcome. 8 found evidence to support text messaging as a tool for behavior change. Effects exist across age, minority status, and nationality.	Evidence for text messaging in disease prevention and management interventions was observed for weight loss, smoking cessation, and diabetes management. Effects appeared to exist among adolescents and adults, among minority and nonminority populations, and across nationalities. This evidence is consistent with existing literature suggesting that mobile phones are a useful tool for interventions
Cucciare, M., Weingardt, K.R. (2007)	Clinical Psychology, 11(2)	Integrating information technology into the evidence-based practice of psychology	The study reviewed randomized controlled studies control studies conducted between 1999 and 2006 that have used information technology (IT) systems to assist clinicians in the delivery of evidence based practices (EBP)	The study stated the use of IT in mental health services delivery can result in extending the reach of these services to individuals to geographical and other barriers that limit the access to care, reducing stigma associated with certain psychological problems and providing a cost effective method for delivering EBP. The article also highlighted the strengths of these integrations such as: reducing the cost of treatment, the amount of time spent conducting treatment, without jeopardizing treatment efficacy, extending the reach of EBP to individuals who would otherwise not be able to access it and reducing stigma allowing individuals to disclose emotional problems and increasing awareness and demand of mental health services.	This article highlighted the scarcity of research needed to clarify cost effectiveness. Additionally, the authors, although emphasizing the effectiveness of IT integration with psychology do not suggest clinicians create their own IT systems but rather utilize what has already been established and provide these resources to patients.

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Davies, E.B., Morriss, R., Glazebrook, C. (2014)	Journal of Medical Internet Research, 16	Computer-Delivered and Web-Based Interventions to Improve Depression, Anxiety, and Psychological Well-Being of University Students: A Systematic Review and Meta-Analysis	The intent of the study was to systematically review and analyze trials of Web-based and computer-delivered interventions to improve depression, anxiety, psychological distress, and stress in university students.	Several databases were searched using keywords relating to higher education students, mental health, and eHealth interventions. The eligibility criteria for studies included in the review were: (1) the study aimed to improve symptoms relating to depression, anxiety, psychological distress, and stress, (2) the study involved computer-delivered or Web-based interventions accessed via computer, laptop, or tablet, (3) the study was a randomized controlled trial, and (4) the study was trialed on higher education students. Trials were reviewed and outcome data analyzed through random effects meta-analyses for each outcome and each type of trial arm comparison. Cochrane Collaboration risk of bias tool was used to assess study quality. A total of 17 trials were identified, in which seven were the same three interventions on separate samples; 14 reported sufficient information for meta-analysis. The majority (n=13) were website-delivered and nine interventions were based on cognitive behavioral therapy (CBT).	The findings suggest Web-based and computer-delivered interventions can be effective in improving students' depression, anxiety, and stress outcomes when compared to inactive controls,
Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M., & Christensen, H. (2013)	Journal of Medical Internet Research, 15, e247	Smartphones for Smarter Delivery of Mental Health Programs: A Systematic Review	The authors goal was to systematically review the research evidence supporting the efficacy of mental health apps for mobile devices (such as smartphones and tablets) for all ages.	A comprehensive literature search (2008-2013) in MEDLINE, Embase, the Cochrane Central Register of Controlled Trials, PsycINFO, PsycTESTS, Compendex, and Inspec was conducted. The authors included trials that examined the effects of mental health apps (for depression, anxiety, substance use, sleep disturbances, suicidal behavior, self-harm, psychotic disorders, eating disorders, stress, and gambling) delivered on mobile devices with a pre- to posttest design or compared with a control group. The control group could consist of wait list, treatment-as-usual, or another recognized treatment. In total, 5464 abstracts were identified. Of those, 8 papers describing 5 apps targeting depression, anxiety, and substance abuse met the inclusion criteria. Four apps provided support from a mental health professional. Results showed significant reductions in depression, stress, and substance use. Within-group and between-group intention-to-treat effect sizes ranged from 0.29-2.28 and 0.01-0.48 at posttest and follow-up, respectively.	The majority of apps that are currently available lack scientific evidence about their efficacy. Given the small number of studies and participants included in this review, the high risk of bias, and unknown efficacy of long-term follow-up, current findings should be interpreted with caution, pending replication. Two of the 5 evidence-based mental health apps are currently commercially available in app stores.
Enock, P.M., McNally, R.J., (2013).	The Behavior Therapist 36	How mobile apps and other web-based interventions can transform psychological treatment and the treatment development cycle	The article describes recent developments in computer-based treatment we will refer to modern computer-based treatment as "web-based," given the nearly ubiquitous use of the Internet for delivering computerized content.	Web-TRaC methods constitute a new approach for developing, testing, disseminating, continually evaluating, and optimizing web-based treatments. Web-TRaC offers benefits that the traditional psychotherapeutic treatment development cycle lacks.	their usefulness will surely be limited for some populations, such as low-functioning patients and those unable to access the delivery platforms.

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Erhardt, D., Dorian, E. (2013)	Independent Practitioner, 33(1)	Going mobile: a case vignette illustrating the integration of mobile technology in psychotherapy	This article provides a case vignette drawn from the authors work using MoodKit app they developed.	The article utilizes MoodKit app which is based on principles and techniques of cognitive behavioral therapy. The app was developed as a self-help resource or to enhance psychotherapy. The app used in the vignette utilizes four distinct "tools" (1) behavioral activation (2) cognitive restructuring (3) journaling & (4) mood tracking. Overall the case illustrated numerous advantages associated with mental health apps: It reduces the dependence of paper forms while protecting privacy, it allowed access to therapeutic information and techniques, was convenient, elicited higher levels of client engagement and accelerated the pace of therapy by promoting more frequent practice and more rapid acquisition and generalization of targeted skills.	Despite their very recent introduction, it is clear that mobile apps represent an extremely useful adjunctive tool with the potential to make therapy more accessible, efficient, and portable for clients while improving the implementation and impact of therapeutic interventions
Gaggioli, A., Riva, G. (2013).	Studies in Health Technology and Informatics, 184	From Mobile Mental Health to Mobile Wellbeing: Opportunities and Challenges	In this contribution, we describe recent developments in the field of mobile healthcare (or mHealth), by focusing in particular on mobile mental health applications.	In this paper, recent developments in the field of mobile healthcare (or mHealth) are described, by focusing in particular on mobile mental health applications. Potential benefits associated with this approach include: inducing positive and pleasant experiences; supporting individuals in reaching, and engaging in self-actualizing experiences. Finally, technology helps to support and improve the connectedness between individuals, groups, and organizations. Open challenges associated with the implementation of mobile health care is also provided including: lack of evidence-based validation, privacy, security and ethical concerns.	The combination of smart phones, wearable sensor devices and social media offer new ways of monitoring and promoting mental and physical wellbeing.
Gaudiano, B.A. (2008)	Evidence-Based Mental Health, 11	cognitive-behavioral therapies: achievements and challenges	This paper provides a thorough overview of the advantages in using CBT as well as the challenges clinicians face with implementing this evidence-based practice.	This review paper provides a introductory background on CBT including reasons related to why CBT is considered an increasingly popular and evidence based practice, criticisms of traditional CBT, introduction on what is considered "third-wave" CBT (i.e., DBT & ACT), and future considerations for CBT: refined understanding of the most effective and essential strategies contained in this approach.	CBT is a preferred orientation for a majority of psychologist due to its "common-sense and clear principles."
Gustafson, D., McTavish, F., Chih, M., Atwood, A., Johnson, R., Boyle, M., Levy, M., Driscoll, H., Chisholm, S., Dillenburg, L., Isham, A., & Shah, D. (2014)	JAMA Psychiatry (need volume)	A smartphone application to support recovery from alcoholism	to determine whether patients leaving residential treatment for alcohol use disorders with a smartphone application to support recovery have fewer risky drinking days than control patients	unmasked randomized clinical trial involving 3 residential programs; 349 patients who met the criteria for DSM-IV alcohol dependence when they entered residential treatment were randomized treatment as usual (n=179) or treatment as usual plus a smartphone (n=170) with the Addiction-Comprehensive Health Enhancement Support System (application designed to improve continuing care for alcohol use disorders). The intervention and follow-up period lasted 8 and 4 months. For the 8 months of	patients who received treatment reported lower mean number of risky drinking days-This study indicated how clinicians can use apps to facilitate interventions with their clients outside of session

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Harwood, T.M, & Pratt, D. (2011)	Professional Psychology: Research and Practice, 42(6),	Technology, Telehealth, Treatment Enhancement, and Selection	The article summarized some of the key developments in the field and underlined some of the ethical and clinical implications of these technological applications in clinical psychology	This article discussed the ethical and clinical implications of technological applications in psychology. It reviewed the relevant research literature and offered suggestions for future research in the crossroads of technology and psychology. From general to specific, this article moved from technology and psychology, to telehealth, to VR, and lastly to a detailed discussion of the application of STS to a computer program named InnerLife	The article briefly described different approaches to telehealth and extract from extant research literature suggestions for future research in areas of overlap between technology and psychology
Hoifodt, R.S., Lillevoll, K.R., Griffiths, K.M., Wilsgaard, T., Eisemann. M., Waterloo, K., & Kolstrup, N. (2013)	Journal of Medical Internet Research, 15, e153	The Clinical Effectiveness of Web-Based Cognitive Behavioral Therapy With Face-to-Face Therapist Support for Depressed Primary Care Patients: Randomized Controlled Trial	To evaluate the effectiveness and acceptability of a guided Web-based intervention for mild to moderate depression, which could be suitable for implementation in general practice.	Participants (N=106) aged between 18 and 65 years were recruited from primary care and randomly allocated to a treatment condition comprising 6 weeks of therapist-assisted Web-based cognitive behavioral therapy (CBT), or to a 6-week delayed treatment condition. The intervention included the Norwegian version of the MoodGYM program, brief face-to-face support from a psychologist, and reminder emails. The primary outcome measure, depression symptoms, was measured by the Beck Depression Inventory-II (BDI-II). Secondary outcome measures included the Beck Anxiety Inventory (BAI), the Hospital Anxiety and Depression Scale (HADS), the Satisfaction with Life Scale (SWLS), and the EuroQol Group 5-Dimension Self-Report Questionnaire (EQ-5D). All outcomes were based on self-report and were assessed at baseline, post intervention, and at 6-month follow-up. Results: Post intervention measures were completed by 37 (71%) and 47 (87%) of the 52 participants in the intervention and 54 participants in the delayed treatment group, respectively. Of the 52 participants in the treatment program, 31 (60%) adhered to the program, and overall treatment satisfaction was high.	The intervention combining MoodGYM and brief therapist support can be an effective treatment of depression in a sample of primary care patients. The intervention alleviates depressive symptoms and has a significant positive effect on anxiety symptoms and satisfaction with life. The reduction of depression and anxiety symptoms was largely maintained at 6-month follow-up, and positive gains in life satisfaction were partly maintained.

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Hoffmann, S.G., Asnaani, A., Vonk, I.J., Sawyer, A.T., Fang, A. (2012).	Cognitive Therapy and Research, 36	The efficacy of cognitive behavioral therapy : a review of meta-analyses.	The goal of this review was to provide a comprehensive survey of meta-analyses examining the efficacy of CBT.	Authors identified 269 meta-analytic studies and reviewed of those a representative sample of 106 meta-analyses examining CBT for the following problems: substance use disorder, schizophrenia and other psychotic disorders, depression and dysthymia, bipolar disorder, anxiety disorders, somatoform disorders, eating disorders, insomnia, personality disorders, anger and aggression, criminal behaviors, general stress, distress due to general medical conditions, chronic pain and fatigue, distress related to pregnancy complications and female hormonal conditions. Additional meta-analytic reviews examined the efficacy of CBT for various problems in children and elderly adults. The strongest support exists for CBT of anxiety disorders, somatoform disorders, bulimia, anger control problems, and general stress. Eleven studies compared response rates between CBT and other treatments or control conditions. CBT showed higher response rates than the comparison conditions in seven of these reviews and only one review reported that CBT had lower response rates than comparison treatments.	In general, the evidence base of CBT is very strong. However, additional research is needed to examine the efficacy of CBT for randomized controlled studies. Moreover, except for children and elderly populations, no meta-analytic studies of CBT have been reported on specific subgroups, such as ethnic minorities and low income samples.
Kuhn, E., Eftekhari, A., Hoffman, J.E., Crowley, J.J., Ramsey, K.M., Reger, G.M., Ruzek, .I. (2014)	Administration and Policy in Mental Health and Mental and Mental Health Services Research, 41	Clinician perceptions of using a smartphone app with prolonged exposure therapy.	This study investigated mental health clinicians' perceptions of a patient-facing smartphone application (app) for prolonged exposure (PE) therapy for posttraumatic stress disorder, before its public release	163 mental health clinicians' were involved. After reading a description of the app, participants rated perceptions of it based on diffusion of innovations theory constructs. Perceptions were generally favorable regarding the app's relative advantage over existing PE practices, compatibility with their values and needs, and complexity. Age (40 years), smartphone ownership, and having used apps in care related to more favorable perceptions. Smartphone ownership, relative advantage, and complexity significantly predicted intention to use the app if it were available. These findings suggest that clinicians are receptive to using a PE app	this technology may allow practitioners to serve more clients and address a wider array of patient needs. traditional modes of individual and small group treatment delivery fail to enable widespread diffusion of evidence-based interventions and that technologies (e.g., web and phone interventions) can potentially reduce costs of intervention while improving client engagement and scalability of services

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Luxton, D.D., McCann, R.A., Bush, N.E., Mishkind, M.C., & Reger, G.M. (2011)	Professional Psychology: Research and Practice, 42(6)	mHealth for Mental Health: Integrating Smartphone Technology in Behavioral Healthcare	The article provides an overview of smartphone use in behavioral healthcare and discusses options for integrating mobile technology into clinical practice.	The article discusses the use of "apps" within clinical practice. Specifically, the authors demonstrate how the smartphones two-way communication functionality brings new capabilities for telemental health: apps can be used to self-monitor and assess symptoms, these assessments can then be shared with clinicians to improve mental health and generalize skills beyond therapy office. apps can help patients audio record homework review including date stamping increasing homework compliance. apps can be coaches providing real time audio and visual instruction when a patient practices a skill. areas of concern include: security and privacy, usability and acceptance issues, and quality standards and safety.	The article provides a good definition of smartphones and provides a breakdown of mobile phone and application based software statistics. The paper highlights reasons why mobile technology should be integrated into clinical practice and discusses limitations, practical issues and recommendations for moving forward with mobile technology integration
Marks, I.M., Mataix-Cols, D., Kenwright, M., Cameron, R., Hirsch, S., & Gega, L. (2003).	British Journal of Psychiatry, 183	Pragmatic evaluation of computer –aided self-help for anxiety and depression.	Open evaluation of a free clinic giving immediate computer-aided cognitive-behavioral therapy (CBT) self-help plus brief advice from a therapist.	Test of outcome of self referrals who used one of four computer aided CBT systems for depression, phobia/panic, general anxiety or obsessive-compulsive disorder. The equivalent of one full-time clinician managed 355 referrals over a year. Of the 266who had a screening interview 79% were suitable. Completers and non-completers of computer-aided CBT had similar pre-treatment features, with very chronic, moderately severe problems. Completers of the computer aided self-help had a mean total of an hour's live therapist supportover12 weeks. They improved significantly and clinically meaningfully with three of the four systems and felt 'fairly satisfied'. Improvement resembled that in controlled and other trials of computer-aided CBT.	Computer-aided self help is a 'clinician extender' that greatly cuts per patient therapist time without impairing improvement. It could reduce the per-patient cost of CBT.
Mathews, M., Doherty, G., Sharry, J., & Fitzpatrick, C. (2008)	British Journal of Guidance & Counselling 36(2)	Mobile phone mood charting for adolescents	The paper examines the potential benefits of the mobile phone for self-charting moods in comparison to existing methods in current practice. The paper describes a mobile phone application designed by the authors which allows adolescents to record moods on their personal mobile phones	The paper presents evidence that the mobile phone may be an effective platform for allowing many adolescents to record their moods, although some may still prefer other methods like paper charts. The study found that adolescents are more likely to complete a mood diary that is presented on a mobile phone than when a similar diary is presented as a paper chart. The mobile phone diary was able to appraise compliance. this was cost-effective, user friendly and client centered. The mobile phone also has limitations such as cost of data transmission and screen size and the mobile phone is not for all situations or for all clients	The authors propose that a personal mobile device is more suitable for adolescents than other devices

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McGinty, K.L., Saeed, S., Simmons, S.C., YilDirim, Y. (2006)	Psychiatric Quarterly, 77	Telepsychiatry and e-Mental Health Services: Potential for Improving Access to Mental Health Care	The authors discuss the required technology, common common applications and barriers associated with the implementation of telepsychiatry and e-mental health services.	Authors highlight how access to adequate mental health services is still problematic in many parts of the United States, especially rural areas. The authors utilized "The New Freedom Commission on Mental Health" as the basis for needing a transformation of the mental health care delivery system in the United States. This transformed system would be focused on building resilience and facilitating recovery. One way to address these identified disparities would be promoting the use of telepsychiatry and e-mental health services. Definitions, applications and barriers to introducing these technologies are discussed.	
Nordgren, L., Hedman, E., Etienne, J., Bodin, J., Kadowaki, A., Eriksson, S., Lindkvist, E., Andersson, G., Carlbring, P (2014)	Behaviour Research and Therapy, 59	Effectiveness and cost-effectiveness of individually tailored Internet-delivered cognitive behavior therapy for anxiety disorders in a primary care population: A randomized controlled trial	The aim of this trial was to investigate the effectiveness and cost-effectiveness of ICBT when tailoring the treatment to address comorbidities and preferences for primary-care patients with a principal anxiety disorder	One hundred participants were recruited through their primary-care contact and randomized to either treatment or an active control group. The treatment consisted of 7e10 weekly individually assigned modules guided by online therapists. At post-treatment, 46% of the treatment group had achieved clinically significant improvement on the primary outcome measure (CORE-OM) and between-group effect sizes ranged from d ¼ 0.20 to 0.86, with a mean effect of d ¼ 0.59. At one-year follow-up, within-group effect sizes varied between d ¼ 0.53 to 1.00. Cost analysis showed significant reduction of total costs for the ICBT group, the results were maintained at one-year follow-up and the incremental cost-effectiveness ratio favored ICBT compared to control group.	Individually tailored ICBT is an effective and cost-effective treatment for primary-care patients with anxiety disorders with or without comorbidities.
Pinnock H, Slack R, Pagliari C, Price D, Sheikh A. (2006).	Primary Care Respiratory Journal, 15(4),	Professional and patient attitudes to using mobile phones technology to monitor asthma: a questionnaire survey	The authors aimed to explore the attitudes of patients and primary care professionals to using mobile technology in order to monitor asthma	The participants were provided a piloted questionnaire with closed and open-ended questions and assessing attitudes to using electronic self-monitoring. Responses were obtained from 43% professionals and 52% patients. Patients rated the technology positively and considered that it may help clinicians to provide care, especially during acute attacks. Both professionals and patients had concerns about the time and cost implications	The low completion rate probably reflects the current status of mobile phone facilitated care as a minority interest for early adopters of technology. Using mobile technology raised questions of clinical benefit impact on self-management and concerns about workload and cost

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Preziosa, A., Grassi, A., Gaggioli, A., & Riva, G. (2009)	British Journal of Guidance and Counselling, 37(3)	Therapeutic Applications of the mobile phone	The paper investigated the clinical interventions mobile phones have successfully applied. The paper also discussed these opportunities through the presentation of results of two different studies based on the use on the mobile phone for anxiety management	The paper proposed the approach that investigated the potential of mobile phone multimedia capabilities for clinical care. (1) use of capabilities can help maintain the patient-therapist beyond the therapist consulting room. (2) another critical issue that can be administered is the compliance with treatment which improves the effectiveness of care (3) promotes continued use of key factors: resilience and coping skills. Through these new capabilities, the patient can be offered clinical content available anytime and anywhere. Through these new methods, patients can autonomously self-administer clinical contact, and become available to improve their knowledge. If mobile phones are continuously used in this way, this will allow patients the ability to experience clinical contents, situated not only in a therapeutic setting , but also in an everyday context. other benefits include: mobile phones are widespread technologies allowing patients to overcome the digital divide and have increased access to research and treatment access. Interactive feedback with apps can help increase treatment compliance which can transfer skills to everyday life, mobile phones guarantee the availability of contents at any time, can enhance treatment acceptance and can allow quick transfer of data back to the therapist	Despite the critical benefits that mobile phones can have on the patient, treatment and the therapeutic relationship, the real effectiveness of mobile technology impacting psychological welfare is largely dependent on the therapists ability to fully integrate all the mobile phones features into the clinical procedure
Proudfoot, J., Gordon, P., Pavlovic, D.H. (2010).	Journal of Medical Internet Research, 12(5).	Community Attitudes to the Appropriation of Mobile Phones for Monitoring and Managing Depression, Anxiety, and Stress	The aim of this study was to investigate community attitudes toward the appropriation of mobile phones for mental health monitoring and management as groundwork for the development of a digital tool for self-monitoring and self-management of depression, anxiety, and stress	A mixed method approach was used consisting of an online survey, focus group discussions, and interviews. From May to August 2009, 655 unique visitors accessed the online survey of whom 48 were ineligible because they were either under 18 years old or did not live in Australia. Of the 607 eligible respondents, 525 (86.5%) completed the survey. This study explored, community attitudes toward the appropriation of mobile phones for mental health monitoring and self-help. Triangulation of results from the 3 study components suggests that, overall, participants were positive about the idea of conceptualizing mobile phones as a mental health tool but the acceptance was conditional upon a number of key features being included. These included the need for the program to be simple and straightforward to use and the need for its security and privacy to be guaranteed, especially for information sent to the mobile phone. A user name and password were considered to be mandatory. Text message reminders were seen as helpful as long as they were not intrusive, and feedback graphs were deemed to be important.	The simplification and rapid development of digital technology together with the way in which mobile phones are carried on the person and switched on and positive community attitudes make the mobile phone a useful vehicle for enhancing access to evidence-based monitoring and self-help for people with mild to moderate high-prevalence mental health conditions

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Rizvi, S.L., Dimeff, L.A., Skutch, J., Carroll, D., Linehan, M.M. (2011)	Behavior Therapy, 42	A pilot study of the DBT coach: an interactive mobile phone application for individuals with borderline personality disorder and substance use disorder.	The primary goal of this research was to develop and test the feasibility of the DBT Coach, a software application for a smartphone, designed specifically to enhance generalization of a specific DBT skill (opposite action) among individuals with BPD-SUD.	a quasiexperimental study was conducted in which 22 individuals who were enrolled in DBT treatment programs received a smartphone with the DBTCoach for 10 to 14 days and were instructed to use it as needed. Participants used the DBTCoach an average of nearly 15 times and gave high ratings of helpfulness and usability. Results indicate that both emotion intensity and urges to use substances significantly decreased within each coaching session. Furthermore, over the trial period, participants reported a decrease in depression and general distress.	Mobile technology offering in vivo skills coaching may be a useful tool for reducing urges to use substances and engage in other maladaptive behavior by directly teaching and coaching in alternative, adaptive coping behavior
Shafran, R. S., Clark, D.M., Fairburn, C.G., Arntz, A., Barlowe, D.H., Ehlers, A., Freeston, M., Garety, P.A., Hollon, S.D., Ost, L.G., Salkovskis, P.M., Williams, J.M.G., & Wilson, G.T. (2009).	Behaviour Research and Therapy, 47	Mind the gap: Improving the dissemination of CBT	The aim of this paper is to identify the barriers to the dissemination of evidence-based psychological treatments and then propose ways of overcoming them, hence potentially bridging the gap between research findings and clinical practice.	Empirically supported psychological treatments have been developed for a range of psychiatric disorders but there is evidence that patients are not receiving them in routine clinical care. Furthermore, even when patients do receive these treatments there is evidence that they are often not well delivered.	69% of 2,300 psychologists in the United States use CBT only part time or in combination with other therapies to treat depression and anxiety.
Smith, A. (2012)	PEW Internet and American Life Project	46% of American adults are smartphone owners	Pew research center's results on smartphone user statistics and ownership demographics	Nearly every major demographic group—men and women younger and middle-aged adults, urban and rural residents, the wealthy and the less well-off—experienced a notable uptick in smartphone penetration over the last year, and overall adoption levels are at 60% or more within several cohorts, such as college graduates, 18-35 year olds and those with an annual household income of $75,000 or more. smartphone ownership decreases dramatically with age even among adults with similar levels of education. However, younger adults with a high school diploma or less are significantly more likely to own a smartphone than even those seniors who have attended college.	Smartphone users now outnumber users of more basic mobile phones within the national adult population
Stewart, R.E., & Chambless, D.L. (2007). https://doi.org/10.1002/jclp.20347	Journal of Clinical Psychology, 63(3), 267-281.	Does Psychotherapy Research Inform Treatment Decisions in Private Practice?	Focused on how psychotherapy research informs treatment decisions in private practice; particularly to what extent are practicing psychologists considering research evidence when they make treatment decisions	Psychologists in independent practice (N 591) were surveyed regarding their approach to treatment decisions, specifically the use of research on empirically supported treatments (ESTs) to inform practice. All participants received a case study of a patient with panic disorder, and half were randomly assigned to receive a research summary on evidence based treatments for panic disorder (cognitive–behavioral therapy and pharmacotherapy). Practitioners reported that they rely primarily on clinical experiences to inform treatment decisions, although they often consult EST literature. Those who received the research summary were significantly more likely to report they would use an EST.	These results indicate that providing information about ESTs can impact practice

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Author/Year	Journal/Vol.	Title	Purpose	Summary/Key Findings/Methods/Demographics	Comments
Stuhlmiller, C., Tolchard, B. (2009)	Journal of psychosocial nursing and mental health services 47(7), 32-39	Computer-assisted cbt for depression and anxiety: increasing accessibility to evidence-based mental health treatment	The authors describe outcome studies of computer-assisted CBT (cCBT) while outlining the current technologies available. The article also discuss concerns and resistance associated with computer computerized therapy, and considers the role of nurses in using cCBT.	The article identifies four key points: (1) Cognitive-behavioral therapy (CBT) as the number one non-pharmacological intervention for most all mental disorders (particularly depression and anxiety), (2) Can be effectively delivered via computer technologies, is a proven, evidence-based treatment that cuts down therapist time, increases access to treatment, and is cost effective (3) Numerous cCBT software technologies, both free and for purchase, are available and can be readily used in clinical practice and (4) cCBT is mandated frontline treatment in the United Kingdom and could gain widespread implementation in the United States if funding and reimbursement issues are overcome.	The widespread use of cCBT might lead to reduced demands on primary and secondary services and reduce medication use and chronicity. Furthermore, the article argues nurses trained in cCBT could make a significant contribution toward reducing the burden of disease by providing evidence based treatment
Tolin, D.F. (2010).	Clinical Psychology Review, 30	Is cognitive–behavioral therapy more effective than other therapies? A meta-analytic review	The aim of the present quantitative review was to determine whether CBT yields superior outcomes to alternative forms of sychotherapy, and to examine the relationship between differential outcome and study-specific variables	a computerized literature search through September 2007 and references from previous reviews, English-language articles were selected that described randomized controlled trials of CBT vs. another form of psychotherapy. Of these, only those in which the CBT and alternative therapy condition were judged to be bona fide treatments, rather than "intent-to-fail" conditions, were retained for analysis (28 articles representing 26 studies, N=1981). Four raters identified post-treatment and follow-up effect size estimates, as well as study-specific variables including (but not limited to) type of CBT and other psychotherapy, sample diagnosis, type of outcome measure used, and age group. Studies were rated for methodological adequacy including (but not limited to) the use of reliable and valid measures and independent evaluators. Researcher allegiance was determined by contacting the principal investigators of the source articles. CBT was superior to psychodynamic therapy, although not interpersonal or supportive therapies, at post-treatment and at follow-up. Methodological strength of studies was not associated with larger or smaller differences between CBT and other therapies.	The superiority of CBT over alternative therapies was evident only among patients with anxiety or depressive disorders. These results argue against previous claims of treatment equivalence and suggest that CBT should be considered a first-line psychosocial treatment of choice, at least for patients with anxiety and depressive disorders

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Author/Year	Journal/Vol.	Title	Purpose	Summary/Key Findings/Methods/Demographics	Comments
Watts, S., Mackenzie, A., Thomas, C., Griskaitis, A., Mewton, L., Williams, A., & Andrews, G. (2013)	BMC Psychiatry 13(49)	CBT for depression: a pilot RCT comparing mobile phone vs. computer	This paper reports the results of a pilot randomized controlled trial comparing the delivery modality (mobile phone/tablet or fixed computer) of a cognitive behavioral therapy intervention for the treatment of depression. The aim was to establish whether a previously validated computerized program (The Sadness Program) remained efficacious when delivered via a mobile application.	35 participants were recruited with Major Depression (80% female) and randomly allocated to access the program using a mobile app (on either a mobile phone or iPad) or a computer. Participants completed 6 lessons, weekly homework assignments, and received weekly email contact from a clinical psychologist or psychiatrist until completion of lesson 2. After lesson 2 email contact was only provided in response to participant request, or in response to a deterioration in psychological distress scores. The primary outcome measure was the Patient Health Questionnaire 9 (PHQ-9). Of the 35 participants recruited, 68.6% completed 6 lessons and 65.7% completed the 3-months follow up. Both the Mobile and Computer Groups were associated with statistically significantly benefits in the PHQ-9 at post-test. At 3 months follow up, the reduction seen for both groups remained significant. Results provide preliminary support for the efficacy of a CBT program delivered using a mobile phone	Results provide evidence to indicate that delivering a CBT program using a mobile application, can result in clinically significant improvements in outcomes for patients with depression. Mobile based interventions can be easily implemented and can be made widely available to the community at large.

Table C3

Selected Media Sources: Literature Table

Website/ Author	Full Link	Date Retrieved	Title	Summary
Abi Research-Technology Market Intelligence	https://www.abiresearch.com/press/android-will-account-for-58-of-smartphone-app-down	1/13/14	Android Will Account for 58% of Smartphone App Downloads in 2013, with iOS Commanding a Market Share of 75% in Tablet Apps	Provides information on the annual volume of smartphone app downloads from various iOS platforms
Association for Behavioral and Cognitive Therapies	http://www.abct.org/Information/?m=mInformation&fa=_WhatIsCBTpublic	3/10/14	About psychological treatment: What is cognitive behavioral therapy (CBT)?	Provides brief definition on cognitive behavioral treatment as a psychological treatment
Heggersteun-Business Insider	http://www.businessinsider.com/smartphone-and-tablet-penetration-2013-10#ixzz3dwPy07M7	6/20/15	One in every 5 people in the world own a smartphone, one in every 17 own a tablet [CHART].	
Julie S-Headlines and Global News	http://www.hngn.com/articles/12201/20130912/tablet-shipments-will-overrun-pcs-q4-2013-idc-forcast.htm	1/21/14	Tablet shipments will overrun PCs in Q4 of 2013:IDC Forecast	The marketing research firm forecasts that all types of smart and interactive devices such as tablets, smart phones and also PCs will have a growth of 10.6% in 2013. However that growth rate will fall to 3.1 percent by 2017 because of the emerging less expensive smartphones and tablets. Smartphone shipments will increase to 1.7 billion by 2017 and tablets will increase to 406.8 million. On the other hand, PCs will fall to 123.1 million but laptops will grow to 796.6 million in the same year

(continued)

Website/ Author	Full Link	Date Retrieved	Title	Summary
Mobile thinking	http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/e#appusers	3/12/14	Global mobile statistics 2013 Section E: Mobile apps, app stores, pricing and failure rates	Provides newly updates stats on the usage of mobile apps, amount of downloads, number of individuals using apps, and associated revenues.
Murray, A.C- Information Week	http://www.informationweek.com/interop/app-development-its-new-mobile-priority/d/d-id/1112948	1/21/14	App Development: IT's New Mobile Priority	Statistics on mobile applications: Android and iOS are the target platforms of choice. Android phone tops the list; this platform is being targeted by 78% of respondents that have or are planning to develop apps. 73% are targeting the iPad and iPhone. While 68% are looking at Android tablets, that's a 15% increase over 2012, the largest jump of any platform. Windows Phone 7.x and 8 comes in at 28%. BlackBerry 10 OS registers an anemic 10%. Native apps were the preferred app to develop
Perez, S.- Techcrunch	http://techcrunch.com/2014/06/02/itunes-app-store-now-has-1-2-million-apps-has-seen-75-billion-downloads-to-date			
Pew Internet (2013a) Maeve Duggan	http://www.pewinternet.org/2013/09/19/cell-phone-activities-2013/	1/21/14	Cell phone activities 2013	Provides results from a national representative survey on the most popular activities people perform on their cell phones. Findings in this report are based on data from telephone interviews conducted by Princeton Survey Research Associates International from April 17 to May 19, 2013, among a sample of 2,252 adults ages 18 and older. Top 3 activities: (1) texting, (2) access internet, (3) send or receive email. Downloading apps was 4th with 50% engaging in this
Pew Internet (2013b)	http://www.pewinternet.org/fact-sheets/mobile-technology-fact-sheet/	1/21/14	Mobile technology fact sheet	Highlights of the Pew Internet Project's research related to mobile technology As of May 2013: 67% of cell owners find themselves checking their phone for messages, alerts, or calls even when they don't notice their phone ringing or vibrating, 34% of cell internet users go online mostly using their phones, and not using some other device such as a desktop or laptop computer. Of note, no information on apps were provided.
Smith, S.- eHow	http://www.ehow.com/info_8656054_smartphone-app.html#ixzz1sGnC8CXy	12/6/13	What is a smartphone app?	Provides definition of smartphone apps, devices, & platforms. Information on the variations of apps available as well as how these apps are accessed is also provided
Statista (a)	http://www.statista.com/statistics/201182/forecast-of-smartphone-users-in-the-use/	11/7/2013; I think this has been replaced with Statista c	Number of smartphone users in the U.S. from 2010 to 2016 (in millions).	Forecasts the anticipated number of smartphone users in the U.S. from 2013 to 2017, based on figures from 2010 to 2012. The source estimates that there will be more than 193 million smartphone users in the U.S. by the year 2016
Statista (b)	http://www.statista.com/statistics/377977/tablet-users-worldwide-forecast		Number of tablet users worldwide from 2013 to 2018 (in billions).	For 2016 the worldwide number of tablet users is forecasted to rise to around 1.2 billion.
Statista (c)	http://www.statista.com/statistics/269025/worldwide-mobile-app-revenue-forecast/		Worldwide mobile app revenues from 2011 to 2017 (in billion U.S. dollars).	This statistic presents information on the projected revenues of mobile app stores worldwide from 2011 to 2013 with forecast until 2017. In 2012, the global mobile app revenues amounted to 18.56 billion US dollars and are expected to grow to 76.52 billion US dollars in 2017

APPENDIX D

IRB Approval

Pepperdine University
24255 Pacific Coast Highway
Malibu, CA 90263
TEL: 310-506-4000

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: February 09, 2016

Protocol Investigator Name: Natasha Beck

Protocol #: 15-12-144

Project Title: Mobile Apps for Cognitive Restructuring: A Review and Comparative Analysis

School: Graduate School of Education and Psychology

Dear Natasha Beck:

Thank you for submitting your application for exempt review to Pepperdine University's Institutional Review Board (IRB). We appreciate the work you have done on your proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations 45 CFR 46.101 that govern the protections of human subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an amendment to the IRB. Since your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite the best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete written explanation of the event and your written response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at community.pepperdine.edu/irb.

Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. Should you have additional questions or require clarification of the contents of this letter, please contact the IRB Office. On behalf of the IRB, I wish you success in this scholarly pursuit.

Sincerely,

Judy Ho, Ph.D., IRB Chairperson

cc: Dr. Lee Kats, Vice Provost for Research and Strategic Initiatives