



Development and Preliminary Feasibility Study of a Brief Behavioral Activation Mobile Application (Behavioral Appivation) to be used in Conjunction with Ongoing Therapy

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Depressive symptoms are the most frequently treated psychiatric condition in the United States. Brief behavioral activation treatment for depression (BATD) is a popular, evidence-based psychotherapy with strong research support for the treatment of depression. In this paper, we describe the development and initial pilot feasibility testing of a BATD mobile application (Behavioral Appivation) to be used by patients and therapists in conjunction with BATD therapy. We present information regarding the app development process as well as results from a small open-label feasibility trial of the app utilized in conjunction with individual BATD. We include a case series from the open-label trial highlighting how Behavioral Appivation can be utilized in clinical practice.

DEPRESSIVE symptoms are the most frequently treated psychiatric condition in the United States (Kessler, 2012). Regarding treatment for depressive symptomatology, brief behavioral activation treatment for depression (BATD; Lejuez, Hopko, Acerno, Daughters, & Pagoto, 2011; Lejuez, Hopko, LePage, Hopko, & McNeil, 2001) is a widely used, evidence-based treatment (Sturmey, 2009). BATD is based in behavioral principles of depression suggesting that depression is caused by a lack of reinforcement in the environment for positive, nondepressed behaviors. As such, the goal of BATD is to help the patient reengage in positive, nondepressed activities.

A considerable amount of literature speaks to both the efficacy and effectiveness of BATD for the treatment of depressive symptomatology and comorbid disorders. Across studies, BATD is associated with reductions in depressive symptoms among individuals with elevated depressive symptoms (Gawrysiak, Nicholas, & Hopko, 2009; Reynolds, MacPherson, Tull, Baruch, & Lejuez, 2011) as well as with major depressive disorder (Hopko, Lejuez, Lepage, Hopko, & McNeil, 2003). Moreover, BATD has been used efficaciously with depressed individuals with a range of other comorbidities including substance use (Daughters et al., 2008; MacPherson et al., 2010; Magidson et al., 2011), anxiety/trauma (Gros et al., 2012; Strachan, Gros,

Ruggiero, Lejuez, & Acerno, 2012), and physical health conditions such as cancer (Hopko et al., 2011). BATD has been tested in a variety of patient populations including college students (Gawrysiak et al., 2009; Reynolds et al., 2011), veterans (Egede et al., 2015), Spanish-speaking Latinos (Collado, Calderón, MacPherson, & Lejuez, 2016; Collado, Castillo, Maero, Lejuez, & MacPherson, 2014; Collado, Long, MacPherson, & Lejuez, 2014), and survivors of systematic violence in Kurdistan, Iraq (Bolton et al., 2014). A key strength of BATD, which contributes to its popularity, is that it is simple, straightforward, and as such is easy for clinicians to be trained in and to use with their patients (e.g., Bolton et al., 2014). Contributing to the widespread utilization of BATD, behavioral activation has strong research support as an empirically supported treatment (Sturmey, 2009; www.div12.org) and has been selected as an evidence-based therapy by the UK National Institute for Health and Care Excellence (www.nice.org.uk).

In a traditional delivery of BATD, a therapist would guide the patient through the basic BATD components that include (a) *treatment overview and rationale*: introduction to the BATD model; (b) *identification of life areas, values, and associated activities*: identification of values and goals within a variety of life areas important to the patient, including relationships, education, career, recreation, and health; (c) *daily monitoring and activity planning*: selection of activities that allow the patient to live according to his or her values and incorporation of the activities into the patient's daily schedule—at the end of each week, scheduling additional activities for the following week;

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and (d) *contracts*: identification of a supportive individual to facilitate completion of difficult activities (see Lejuez et al., 2011, for the full BATD treatment manual). Between sessions, patients complete daily monitoring forms on which they record their already occurring activities and their new, value-driven activities. The BATD manual is written for delivery across 8–10 sessions, although it can be delivered in as few as 5 sessions and can extend beyond 10 sessions depending on patient needs and the need to combine it with other therapeutic approaches (Cassar et al., 2016).

Although BATD is a simple, straightforward psychotherapy for depression, the traditional delivery of BATD is hampered by some practical issues for some patients, primarily associated with utilization of paper forms. In BATD, at every therapy session, the patient is provided with a week's worth of daily monitoring forms to complete between sessions and is instructed to complete one monitoring form per day. As the treatment progresses, monitoring forms are used both to schedule in new value-driven activities as well as to monitor already occurring activities. This reliance on paper forms may make it difficult for some patients to complete between-session exercises and may similarly make it difficult for some therapists to draw associations between completed activities and mood. Addressing limitations associated with utilization of paper forms has the potential to improve treatment efficiency and efficacy.

A growing literature base suggests that mobile applications (apps) may be useful adjuncts for increasing the dissemination of evidence-based psychotherapies and therapist fidelity to evidence-based treatments (e.g., Donker et al., 2013; Reger et al., 2013; Rizvi, Dimeff, Skutch, Carroll, & Linehan, 2011). Moreover, a recent meta-analysis examining the effects of mobile technology utilization on psychotherapy outcomes found that patients who utilized mobile technology (including apps) as either a supplement to treatment or as a substitute for direct therapist contact experienced superior outcomes as compared with patients who did not receive mobile technology (Lindhiem, Bennett, Rosen, & Silk, 2015). Supporting the utilization of mobile technologies in psychotherapy, over recent years mobile technologies broadly and mobile phones more specifically have dramatically increased in both affordability and ubiquity, with estimates suggesting that there are over 3.2 billion unique mobile users worldwide (Steinhubl, Muse, & Topol, 2013). A mobile app adjunct to traditional BATD psychotherapy would offer a fitting solution for addressing the above limitations associated with utilization of paper forms in BATD. Specifically, a mobile app adjunct to BATD has the potential to (a) provide the therapist with real-time data on patient treatment adherence and functioning; (b) make sessions more efficient as the therapist can review patient progress via a website prior to sessions, a feature which may be particularly useful for

settings in which therapy sessions are delivered briefly (i.e., < 30 minutes); and (c) decrease motivational and organizational burden on the patient by eliminating the need for paper monitoring forms and delivering treatment materials via a smartphone, which may be preferable for some patients.

In order to potentially improve the feasibility of BATD, our team developed a mobile app version of BATD (Behavioral Appivation) to be used in conjunction with ongoing therapy. In the remainder of this paper, we (a) describe the development of Behavioral Appivation, (b) present preliminary data from a small open-label trial suggesting the feasibility of Behavioral Appivation for the treatment of depressive symptomatology, and (c) highlight case examples illustrating utilization of Behavioral Appivation.

Development and Description of Behavioral Appivation

We assembled a diverse team with unique insights and skill sets to develop Behavioral Appivation. Our team consisted of an original developer of BATD, a doctoral trainee who used the treatment frequently in research and clinical settings, and a small business focused on mobile app development. Our primary goals for app development were to (a) faithfully translate all treatment materials from BATD into a mobile application format and (b) utilize technology to potentially improve the feasibility of BATD.

Behavioral Appivation consists of a patient mobile application, available via the iTunes app store, and a therapist Web site, accessible at www.behavioralappivation.com. Consistent with BATD, we incorporated the following components into the Behavioral Appivation patient mobile app:

1. Daily monitoring. Patients complete daily monitoring via a Calendar screen (Fig. 1). This screen was developed to serve the same purpose as the daily monitoring form (Form 1) in the original BATD manual, which is to facilitate monitoring of already occurring activities and rating of enjoyment and importance for each completed activity.
2. Life areas, values, and activities. We translated the Life Areas, Values, and Activities (LAVA) Inventory (Form 2 in the BATD manual) into an app version, which patients can access via the Life Areas icon at the bottom of each screen within the app. Similar to the paper LAVA Inventory, the purpose of this component is to facilitate development of values and activities across five different life areas (relationships, daily responsibilities, recreation, career and education, and health; Fig. 2).
3. Scheduling value-driven activities. The cornerstone of BATD is incorporation of enjoyable and

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