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Author manuscript

Int J Psychiatry Med. Author manuscript; available in PMC 2017 September 11.

Published in final edited form as:

Int J Psychiatry Med. 2017 March ; 52(2): 160–175. doi:10.1177/0091217417720899.**Moodivate: A self-help behavioral activation mobile app for utilization in primary care—Development and clinical considerations****Jennifer Dahne¹, CW Lejuez², Jacob Kustanowitz³, Julia W Felton⁴, Vanessa A Diaz⁵, Marty S Player⁵, and Matthew J Carpenter^{1,6}**¹Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, SC, USA²Department of Psychology and the College of Liberal Arts & Sciences, The University of Kansas, Lawrence, KS, USA³MountainPass Technology, Chevy Chase, MD, USA⁴Department of Psychology and Center for Addictions, Personality, and Emotion Research, University of Maryland, College Park, MD, USA⁵Department of Family Medicine, Medical University of South Carolina, Charleston, SC, USA⁶Hollings Cancer Center, Medical University of South Carolina, Charleston, SC, USA**Abstract**

Depressive symptoms are highly prevalent and are associated with considerable functional impairment, significant public health costs, and heightened mortality risk. Individuals experiencing impairment due to depressive symptomatology are most likely to report their symptoms to a primary care provider. As such, national guidelines highlight the need to assess and effectively treat depression via primary care. Despite these guidelines, the dissemination of evidence-based psychotherapy via primary care is limited, likely due to both provider- and patient-level treatment barriers. Mobile health (mHealth) technologies are promising for addressing these barriers and for promoting uptake of evidence-based depression treatment. Among evidence-based psychotherapies for depression, brief Behavioral Activation Treatment for Depression (BATD) has shown great promise and is particularly amenable to mHealth delivery. Herein, we discuss the development of a BATD mobile application, Moodivate, that was developed in order to disseminate BATD via primary care. This paper focuses on description of (1) rationale for Moodivate treatment development, (2) Moodivate treatment components, (3) ongoing clinical trial evaluation of Moodivate, and (4) clinical considerations for incorporating Moodivate into clinical practice.

Reprints and permissions: sagepub.com/journalsPermissions.navCorresponding Author: Jennifer Dahne, Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, 67 President Street, Charleston, SC 29425, USA., dahne@musc.edu.**Declaration of Conflicting Interests**

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: The authors (JD, CWL, JK) are co-owners of Behavioral Activation Tech LLC, which owns the rights to Moodivate.

Keywords

depression; telemedicine; primary health care

Introduction

Depression is a leading cause of disability worldwide¹ and a major contributor to the overall global burden of disease.² Individuals with depressive symptomatology experience significant suffering, high morbidity and mortality, and considerable social and occupational impairment.³ Depression produces greater decrements in overall health than many other chronic diseases, including angina, arthritis, asthma, and diabetes.⁴ Thus, the need for the efficient and effective identification and treatment of depression is of great public health importance.

Many national medical organizations (United States Preventive Services Task Force, American Academy of Family Physicians, American College of Preventive Medicine) recommend screening for depression in general adult populations within primary care settings.⁵ Despite these recommendations, depression has historically been underdiagnosed and undertreated in primary care,^{3,6} resulting in negative outcomes for patients including prolonged depressive episodes, decreased incidence of recovery, and heightened functional impairment and suffering.⁷ As such, dissemination of evidence-based treatments for depressive symptomatology via primary care is critical.

Antidepressant medications are the most commonly prescribed class of medications in the United States⁸ and are a first-line treatment for depression in primary care.⁹ Although often administered as a monotherapy, research indicates significant improvement in treatment effect size when antidepressant medications are administered in combination with evidence-based psychotherapy.¹⁰ Thus, promotion of evidence-based psychotherapy via primary care has the potential to impact depression outcomes for adult patients in primary care. However, there are a number of barriers to this approach. From a provider standpoint, primary care physicians are traditionally not trained in the delivery of evidence-based psychotherapies for depression and typically do not have the time within their schedules for training in or delivery of such treatments. Referrals to mental health specialists are often unsuccessful with access and referral rates commonly less than 50%.¹¹ From a patient perspective, barriers to traditional in person psychotherapy can include problems of transportation, child care, lack of time, stigma associated with mental health treatment, and lack of available services.^{12,13}

Mobile health (mHealth) technologies offer an ideal strategy to overcome these barriers and to further disseminate effective treatment for depression. mHealth technologies are promising for improving the health-care environment, delivering better patient outcomes, and substantially lowering treatment costs.¹⁴ Several computerized psychological interventions for psychological depression treatment via primary care have previously been developed and have demonstrated success.^{15,16} However, mobile technologies, such as smartphones and mobile apps, may be superior treatment delivery platforms as they allow patients to have access to treatment materials at all times while also eliminating barriers to

computerized treatment (e.g., the need to have a computer at home or go to a primary care clinic to access the treatment). Smartphones have dramatically increased in both affordability and ubiquity in recent years, with 2017 estimates suggesting 77% of U.S. adults own a smartphone and the majority download apps.^{17,18} Moreover, the majority of physicians report utilizing mobile apps in their clinical practices.¹⁹

Numerous mobile apps have been developed for both commercial and research purposes with the goal of targeting depressive symptoms. However, many of these publically available apps have received criticism due to lack of clear adherence to evidence-based approaches and limited efficacy/effectiveness studies.^{20,21} Apps developed for research purposes are often not accessible to the general public and, thus, are not ideal for mental health treatment in the real world, via primary care.²² Research examining the efficacy and effectiveness of some publically available app treatments is beginning to grow, though to our knowledge, these extant mobile apps have not yet been tested within primary care. Areal et al.²³ recently completed a large (n=626), fully remote, randomized clinical trial in which participants with mild to moderate depression were randomized to receive one of two publically available depression treatment apps (Project: EVO and iPST) or a control app (Health Tips). Results indicated that 45% of participants randomized to Project: EVO and 46% of participants randomized to iPST demonstrated symptom improvement over time, as compared to 34% of those randomized to the control condition. Further, Mohr et al.²⁴ developed and clinically tested a publically available suite of mobile apps called Intellicare for the treatment of depression and anxiety symptoms. Participants with elevated symptoms of anxiety or depression were followed for eight weeks as they used the Intellicare suite. Study outcomes were encouraging as participants utilized the apps on average 195.4 times over the eight-week period and had significant improvements in depressive and anxiety symptoms over time.²⁴ Moreover, in the first year of public availability, 5,210 individuals downloaded at least one Intellicare app, suggesting widespread interest in apps for the treatment of depression and anxiety symptoms.²²

Thus, a logical next step is to extend development and testing of publically available evidence-based psychological depression treatment apps to primary care. Among evidence-based psychotherapies for depression, brief Behavioral Activation Treatment for Depression (BATD^{25,26}) has shown great promise and is particularly amenable to mHealth delivery. BATD is grounded in behavioral principles, which suggest that depression is caused by a lack of reinforcement in the environment for positive, nondepressed behaviors. Thus, the goal of BATD is to help the patient identify, schedule, and reengage in positive activities. BATD accomplishes this goal by utilizing the following four treatment components, typically delivered across 5 to 10 treatment sessions: (1) *Psychoeducation*: Introduction to the BATD model; (2) *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; (3) *Daily monitoring and activity planning*: Selection of activities that allow the patient to live according to his/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; and (4) *Contracts*: Identification of a supportive individual to facilitate completion of difficult activities.

There is an ample evidence base supporting the efficacy of BATD in the treatment of depression. Across studies, it is associated with reductions in depressive symptoms^{27,28} including among those with major depressive disorder.²⁹ Behavioral Activation treatments have previously been delivered successfully within primary care clinics both by mental health nurses³⁰ and psychologists.³¹ Furthermore, BATD has shown promise in a variety of other health-care settings, including oncology,^{32,33} the Veteran's Administration health system,³⁴ and substance use treatment.³⁵⁻³⁷ A key strength of BATD is that it is simple, straightforward, and easily understood by patients.³⁸

An important next step is to tailor the delivery of BATD via mHealth, toward a goal of dissemination in real-world settings, most notably primary care. In the remainder of this paper, we will describe Moodivate, a mobile application adaptation of BATD, and discuss considerations for utilizing Moodivate in primary care.

Moodivate: Treatment development and description

Moodivate development began with a diverse team of providers, psychologists, and app developers in order to ensure that psychological treatment components were faithfully translated to a mobile platform. We utilized an agile software development approach, which promotes continued collaboration across the software development lifecycle between the entire development team.³⁹ Moodivate consists of the following components, each discussed below with accompanying screenshots: (1) psychoeducation, (2) development of individualized values, (3) generation of activities consistent with each value, (4) scheduling and completing activities, (5) eliciting social support to help complete difficult activities, (6) ratings of daily mood, and (7) reinforcement for treatment utilization.

Psychoeducation

To provide BATD rationale, users complete a psychoeducational interactive tutorial illustrating the connection between thoughts, feelings, and behavior. This treatment rationale ultimately highlights that Moodivate will focus on increasing activity to improve mood and decrease the incidence of negative, depressogenic cognitions (Figure 1). Users practice generating values and activities and receive instruction regarding how to use the app.

Development of individualized values

Users are then taken to the "Life Areas" screen, where they can select from five life areas (Relationships, Daily Responsibilities, Recreation, Career and Education, and Health) in which to develop values (Figure 2). A value can be defined as an ideal, quality, or strong belief in a certain way of living. For example, within the life area of relationships, a user might generate a value of "Be a trustworthy friend." This value-driven framework helps to ensure that selected activities will be positively reinforced over time, by virtue of being connected to what the user values as important.²⁶ Ideally, users should generate several unique values within each life area.

Generation of activities consistent with each value

Values are then used as a framework for generating aligning activities. Within each life area, users add activities within each value (Figure 3). For the user who generated the value of “Be a trustworthy friend” within the life area of relationships, possible activities might include going to dinner with a friend once a week or calling a friend for 20 minutes twice a week. Importantly, activities should be observable (i.e., someone else can see the user complete the activity) and measurable (i.e., can be scheduled into a finite period of time on a calendar). Thus, an activity such as “Think positively” would not be an appropriate activity because it is neither observable nor measurable. Users will generate several activities for each value.

Scheduling and completing activities

Once a user has generated activities across numerous values, the user then proceeds to schedule these activities via the Calendar screen (Figure 4). Here, the user will schedule value-driven activities, monitor already occurring activities, and identify when an activity has been completed. Color coding distinguishes activities in the past or upcoming, and users can rate how enjoyable and important each activity was. After completing an activity, the patient receives reinforcement for completing the activity (e.g., “Nice going, you did it!”). Ideally, the calendar screen should be utilized daily in order to track ongoing activities and monitor treatment progress.

Eliciting social support to help complete difficult activities

Sometimes activities are difficult for a user to complete on his/her own, and it can be useful to solicit help from others. For example, a user might schedule in an activity to go grocery shopping weekly, but might not have access to reliable transportation. In this case, it would be useful for the user to enlist social support to complete that activity. In Moodivate, enlisting social support is referred to as an “Assist” (shown as a life preserver icon) that allows the user to identify another individual(s) who can help (Figure 5). The user then has the option to schedule a time to ask that person for help. Assists can also be developed if an activity has been scheduled, but not completed three times. In this instance, a pop-up will appear on the calendar screen with the message “It seems like you have scheduled this activity a few times but have been unable to complete it. Do you want to create an assist?”

Ratings of daily mood

Moodivate users can track daily mood in order to ultimately track treatment progress. Calendar prompts trigger users to rate their mood each day on a scale of 1 (terrible) to 5 (great). Within the User Info tab, the patient can view a graph of fluctuations in daily mood overlaid upon a graph of number of completed activities, illustrating the connection between activity and mood (Figure 6).

Reinforcement for treatment utilization

Moodivate users are reinforced for treatment engagement via badges. When a user earns a badge, a pop-up displays on the screen congratulating the user and explaining why the user

earned that badge (Figure 7). A user can view all of the badges he/she has earned as well as the badges he/she has yet to earn on the User Info page.

Moodivate evaluation

Although BATD has a strong base of empirical support, BATD delivered within a mobile app, and specifically Moodivate, has not been tested. Early evaluation is now underway. Our team is conducting a clinical trial evaluation of Moodivate among patients with moderate symptoms of depression identified within the family medicine practice setting. Patients are being randomized to one of three arms: Moodivate, an active control mobile app, or treatment as usual. All patients, regardless of treatment group, receive standard patient education materials about depression and providers deliver depression treatment as they normally would. If randomized to an app condition, participants are asked to utilize their app at least once per day. All participants complete weekly assessments of depressive symptoms, affect, and other related constructs (e.g., anhedonia, activation, and anxiety). App utilization is assessed via analytics data and participant self-report, including qualitative feedback related to participant impressions of each mobile app. Our initial goals within this pilot study are to examine treatment acceptability and feasibility as well as change in depressive symptoms over a brief (two-month) period. Based on participant feedback, we plan to refine Moodivate in order to improve treatment acceptability and ease of use.

This pilot RCT of Moodivate will provide us with preliminary data regarding treatment efficacy, but will also leave many questions unanswered. As pharmacotherapy is a first line treatment for depression in primary care, an important follow-up study should examine Moodivate efficacy when delivered alone versus in combination with pharmacotherapy. In light of previous studies which have demonstrated that combination psychotherapy and pharmacotherapy delivered via primary care is associated with significantly greater effect than either treatment delivered alone,^{29,40} one might expect that similar results would be found with Moodivate, but this is yet unknown.

Potential dissemination of Moodivate within primary care

It is important to note that even though the evidence base for Moodivate is in its infancy, BATD, the treatment on which Moodivate is based, has extensive support. Extension of BATD into mHealth platforms is the logical next step. While we anticipate strong treatment effects from Moodivate, even modest effects would have very large impact with expanded reach as might be expected with dissemination into primary care. Thus, the remainder of this paper presents some of the major issues to consider for this dissemination.

Assessing treatment response

Effective management of depression within primary care begins with evidence-based screening/assessment. There are many options for screening and thus not fully addressed herein [see Williams et al.⁴¹ for a comprehensive review of available instruments for screening for depression in primary care]. Per Institute for Clinical Systems Improvement (ICSI) guidelines,⁴² patients with mild depressive symptoms should be provided with support, educated to contact their physician if symptoms worsen, and scheduled for a return

appointment within one month. Patients with moderate or greater depressive symptoms should receive more intensive treatment. For these patients, Moodivate may be applicable as an adjunct treatment. Patients with moderate or severe depression, or those who endorse suicidality likely should not utilize Moodivate as a monotherapy. In these instances, combining Moodivate with traditional psychotherapy and/or medication management may be appropriate. Standard risk assessment and intervention procedures should be implemented for patients endorsing suicidality, which may include urgent referral to crisis specialty health care.

At every follow-up visit, patients should recomplete a depression screening measure. This follow-up assessment can be compared to prior scores in order to track overall trajectory of depressive symptoms and determine whether alterations should be made to the treatment plan. Consistent with ICSI guidelines,⁴² treatment response can be defined as a 50% or greater reduction in symptoms as measured on standardized ratings scales. Partial response is defined as a 25%–50% reduction in symptoms. Full depression remission is defined as a two-month period devoid of major depressive disorder symptoms. Moodivate treatment duration is an important empirical question that has not yet been examined, thus treatment response and symptom remission may be useful indicators to determine whether treatment should be modified, continued, or terminated. As traditional BATD treatment typically occurs over 8–10 weeks,²⁶ in our ongoing clinical trial, we encourage participants to utilize the app over the course of 8 weeks.

Treatment access

Moodivate is commercially available for nominal cost (<\$5) on iOS platforms. Expansion to Android is planned for the future. Thus, in addition to symptom severity, mobile phone ownership, type of mobile phone, and cost are all factors that should be considered prior to recommending Moodivate. Regarding treatment access for the provider, Moodivate does not currently incorporate a provider-facing component. In the future, we plan to explore adding additional functionality to allow physicians to track patient progress remotely including receiving alerts on nonuse as well as clinical deterioration. Providers who wish to assess patient usage of Moodivate are encouraged to discuss Moodivate use with patients during follow-up appointments, including frequency of app utilization, number of values and activities selected, benefits/difficulties of use, and overall number of symptoms and functional impairment. The app could be opened and shared with the provider to review values, activities, mood, and assists.

Promoting treatment adherence

Prior trials of dissemination of remotely delivered computerized psychological interventions with primary care patients have struggled with poor treatment adherence, particularly among those with clinical levels of depression.⁴³ One primary patient-reported barrier to treatment engagement with this mode of delivery is the need for monitoring and/or follow-up to support treatment completion.⁴⁴ Thus, patient uptake of Moodivate will likely greatly depend on the advice and recommendations of their trusted medical providers. As such, in addition to continual symptom monitoring as discussed above, engagement from clinicians (or other members of the medical team) is likely also useful, if not necessary. This

engagement could be brief (simple recommendation) or more pronounced (download and introduction within clinical encounter, discussion of questions, and general psychoeducation), and this is left to provider discretion. At minimum, providers should recommend regular use of the app and follow-up at next visit.

Treatment motivation

Low motivation is a core symptom of depression that is likely to interfere with treatment engagement. Moodivate incorporates several features to reinforce treatment engagement and, by extension, motivation, including positive messages after activities are completed and badges which are earned for continued treatment adherence. Providers likely should also assess motivation for depression treatment prior to recommending Moodivate. Patients who endorse lower treatment motivation may benefit from other treatment approaches, such as Motivational Interviewing, either instead of or prior to Moodivate.

Conclusions

In sum, Moodivate is a promising mobile app adaptation of a popular evidence-based psychotherapy for depression. Moodivate may extend the menu of treatment options for primary care physicians and their patients with elevated depressive symptoms. Moodivate fits well into current clinical guidelines recommending thorough assessment, treatment, and follow-up for depression. With additional testing, focusing both on efficacy and effectiveness, Moodivate has the potential to improve accessibility of evidence-based psychotherapy for patients in need who do not utilize traditional mental health treatments.

Acknowledgments

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Funding for this work was provided by the National Institute of Mental Health (R41 MH108219).

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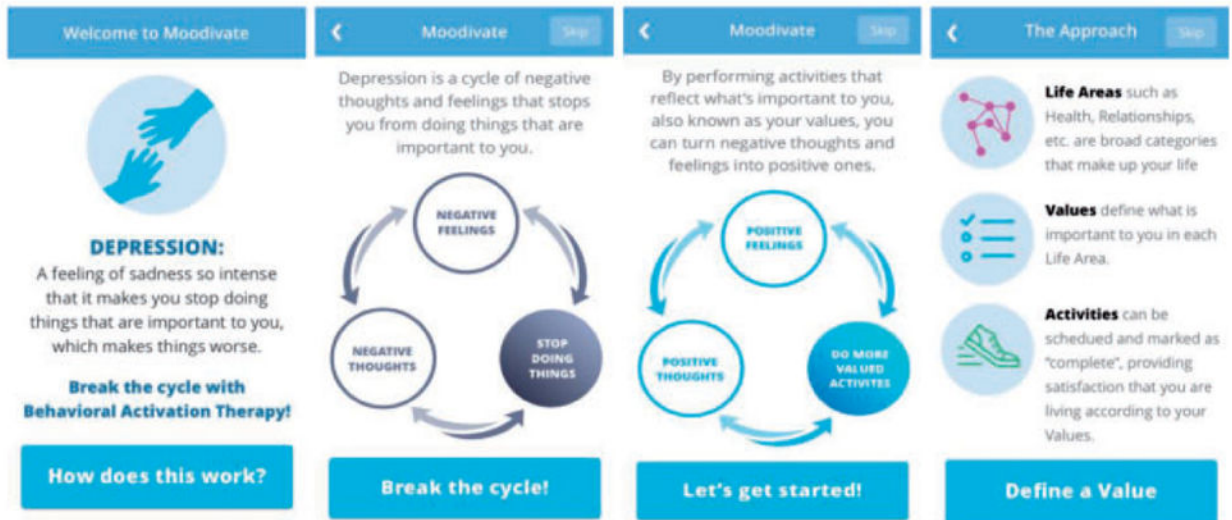


Figure 1.
Moodivate psychoeducation.

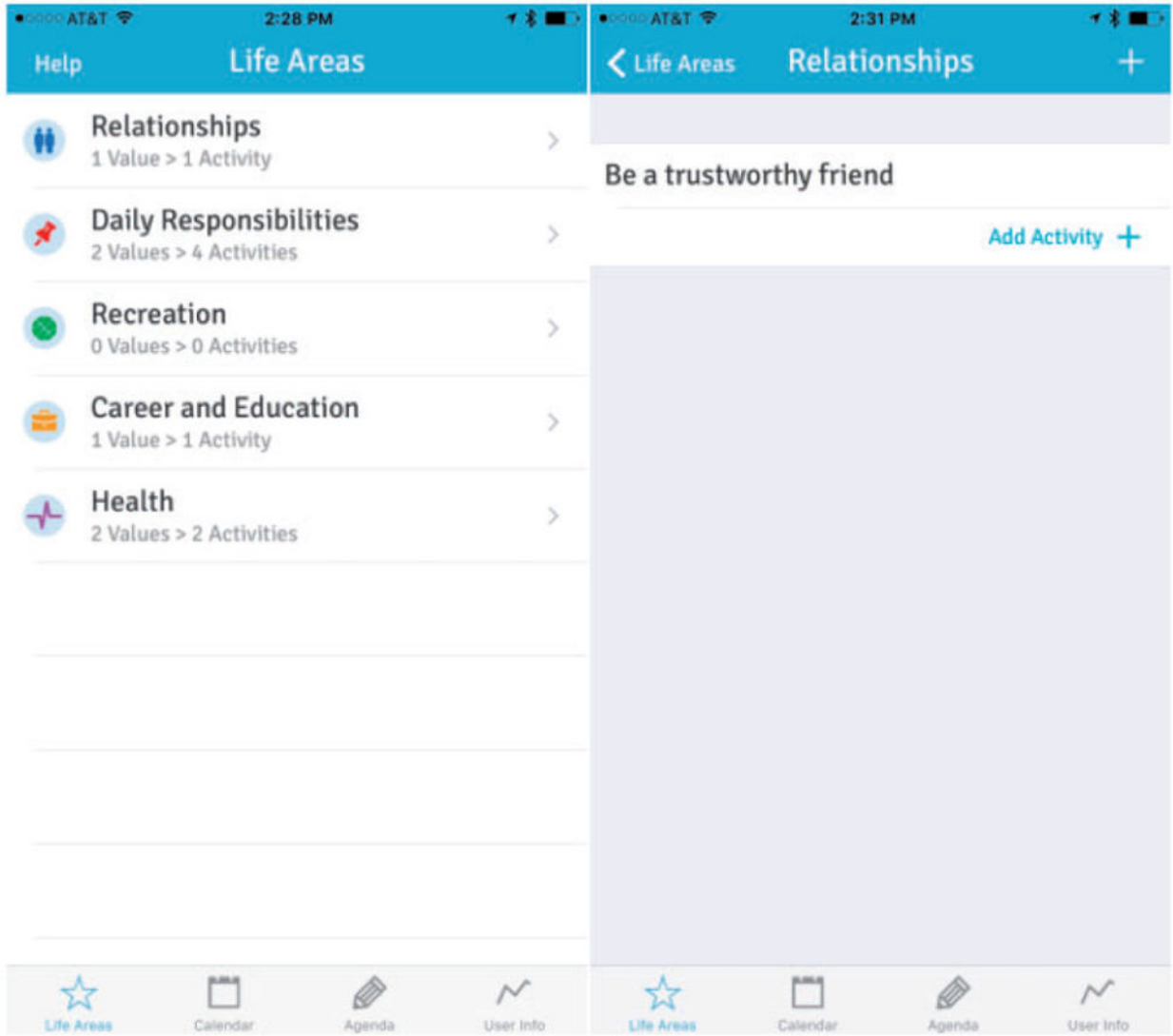


Figure 2.
Life areas and values.

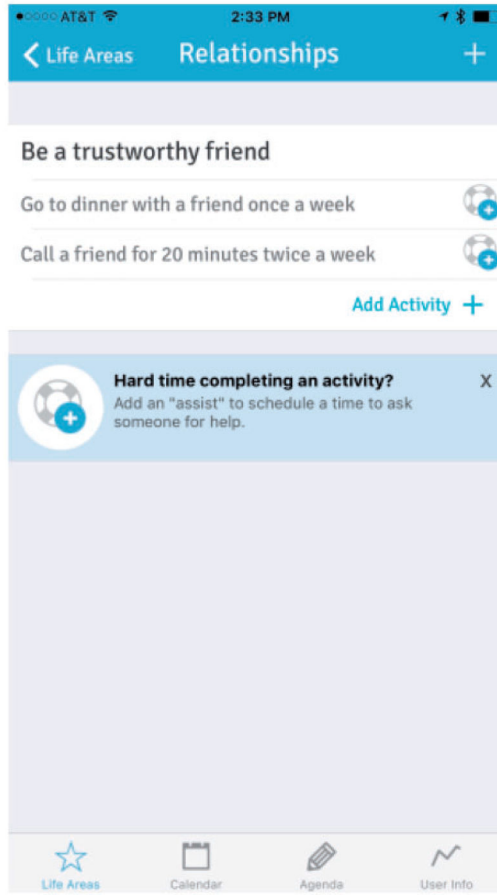


Figure 3.
Activities.

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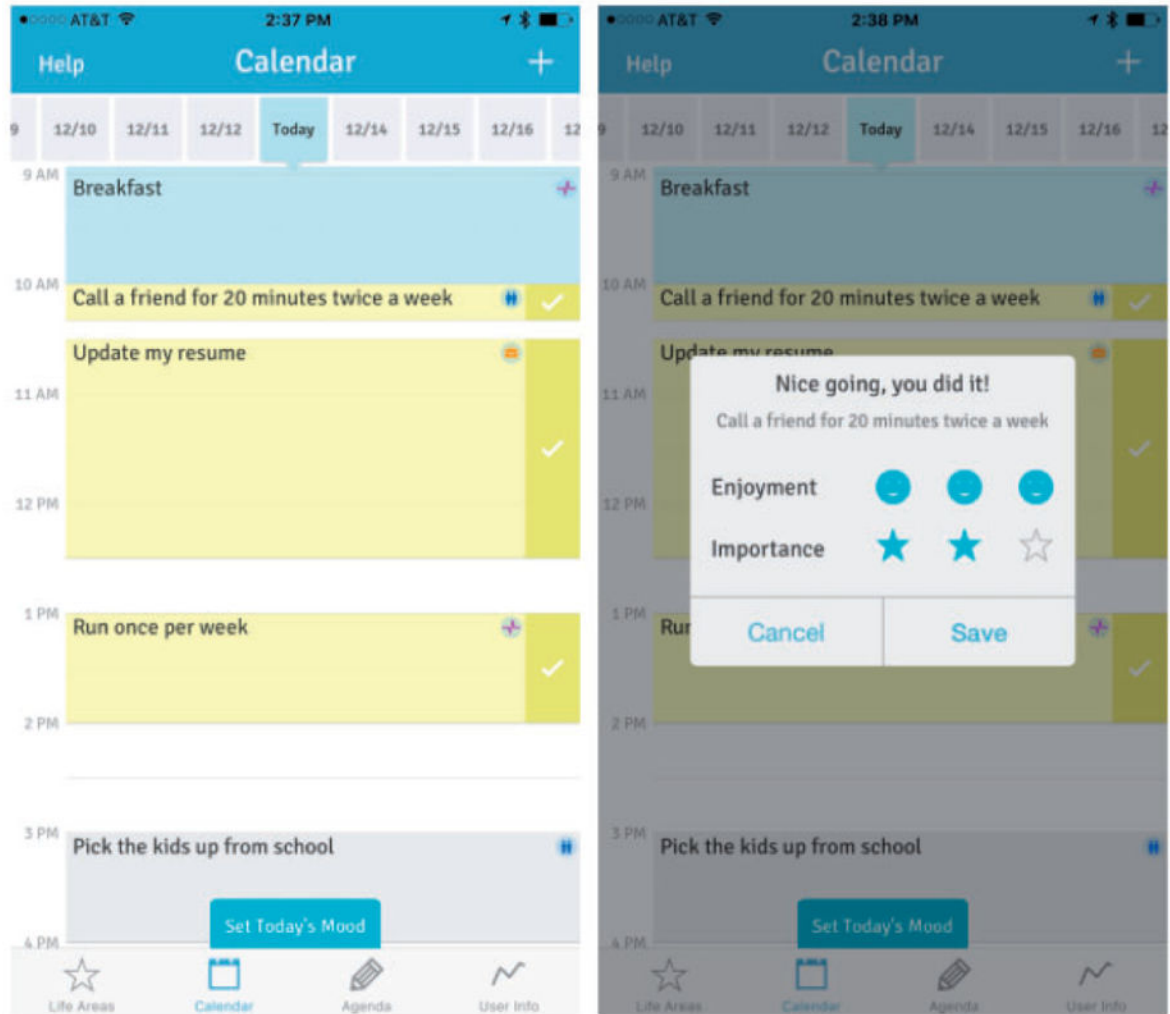


Figure 4.
Daily calendar.

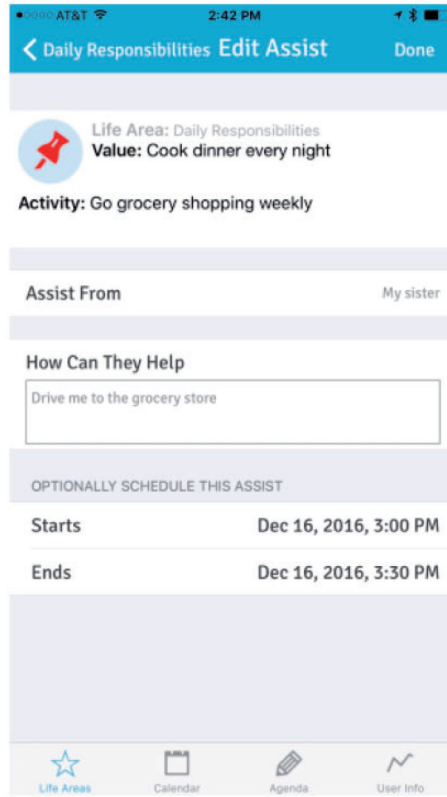


Figure 5.
Assists.

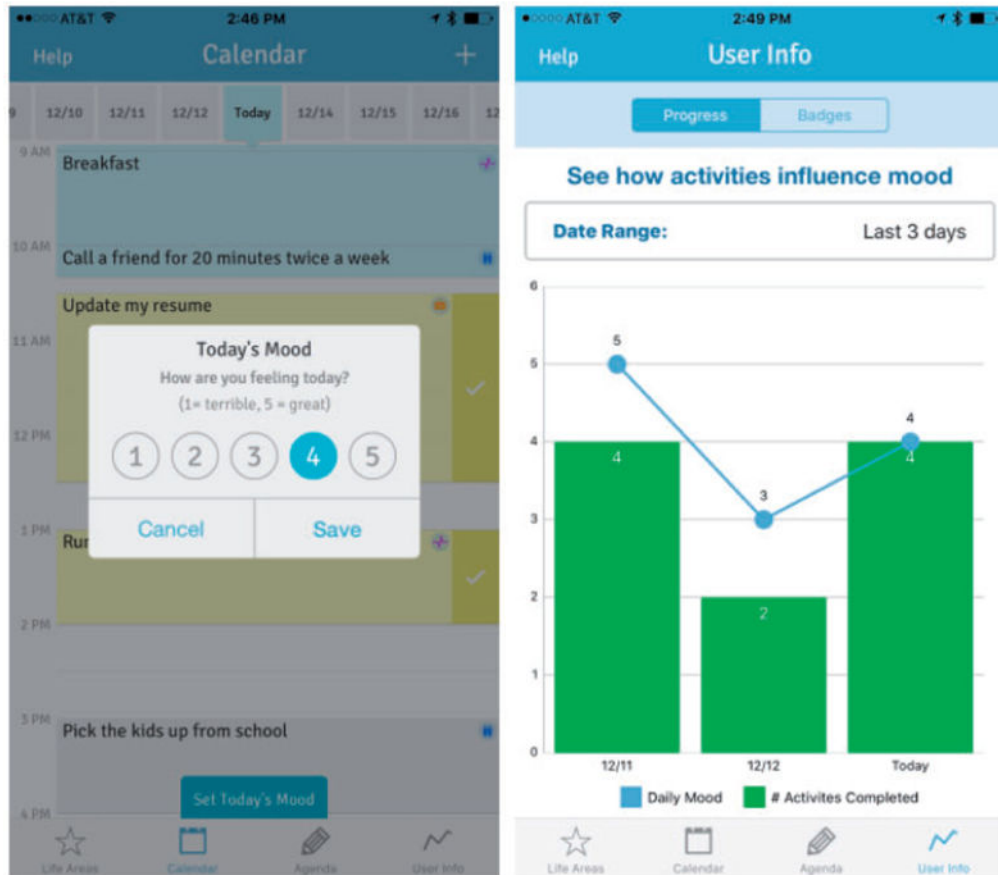


Figure 6.
Rating and tracking daily mood.

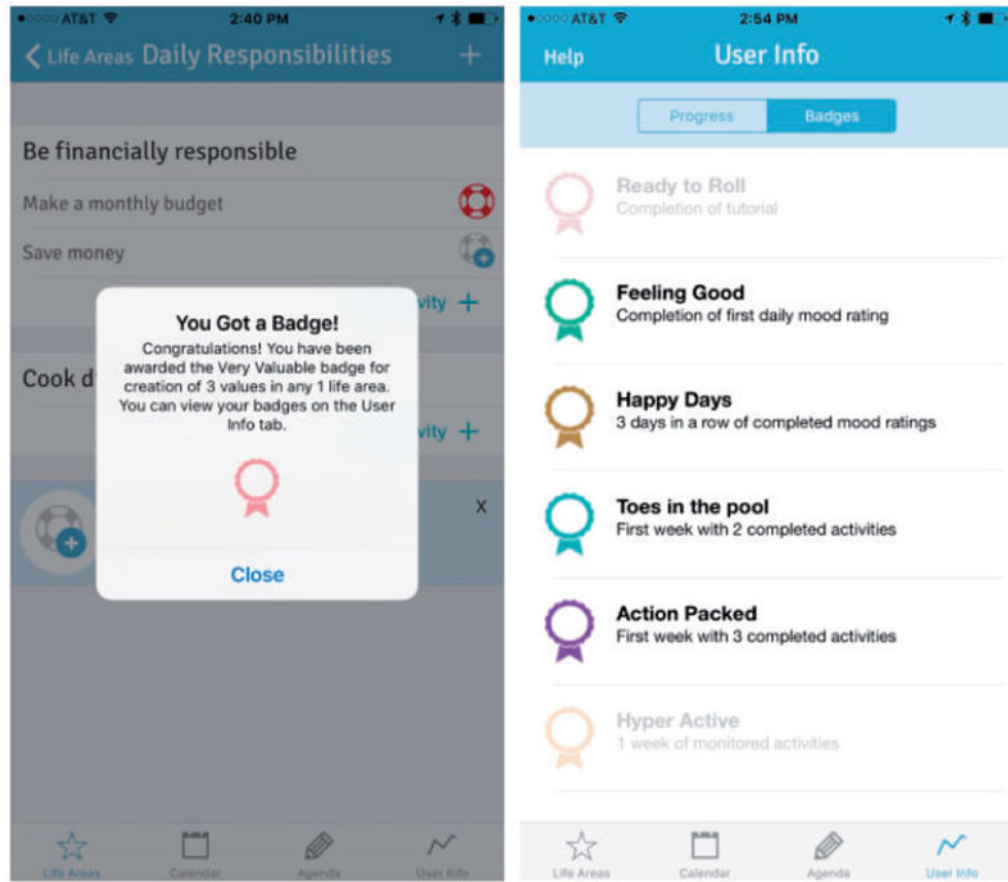


Figure 7.
Badges.