2024

A COMPARISON OF LOW-INTENSITY CBT PROGRAMS: EVALUATING THE EFFECTS OF DESIGN ON REBT INTERVENTIONS

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A COMPARISON OF LOW-INTENSITY CBT PROGRAMS: EVALUATING THE EFFECTS OF DESIGN ON REBT INTERVENTIONS

A dissertation submitted in partial fulfillment
of the requirements for the degree of

DOCTOR OF PSYCHOLOGY

to the faculty of

DEPARTMENT OF PSYCHOLOGY

of

ST. JOHN'S COLLEGE OF LIBERAL ARTS AND SCIENCES

at

ST. JOHN'S UNIVERSITY

New York

by

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Date Submitted: _____ Date Approved: _____

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ABSTRACT

A COMPARISON OF LOW-INTENSITY CBT PROGRAMS: EVALUATING THE EFFECTS OF DESIGN ON REBT INTERVENTIONS

Alexey Dantes Breuss

Low-Intensity CBT interventions have become more popular over the years due to the expanding use of the internet and technology. A particular subset of Low-Intensity CBT, phone-based apps, have become more available on app-stores. The research literature on phone-based apps has not kept up in pace in comparison to the development of new applications. This leaves the quality and efficacy of such apps to be left untested. Furthermore, most applications are dominated by a Beck's Cognitive Therapy (CT) approach, with more Dialectical Behavior Therapy (DBT) apps on the horizon. Rational Emotive Behavior Therapy (REBT) has been largely neglected within the app-based domain. Our study takes on the development of an REBT based phone app and takes a look at mental health outcomes from using other established apps in the CT and REBT space. An experimental phone app, REBT Guide to Emotions, was developed for this study. WoeBot was used as a CT app control group and PsyPills was used as an REBT app control group. Participants were asked to utilize one of three phone apps and report on their pre and post mental health measures utilizing the OQ-45.2. Participants in all groups did not see any significant changes in their total OQ scores, while WoeBot did demonstrate an improvement in short-term negative mental

health symptoms. Other research conducted on the apps points to there being a connection between reminders, app engagement, and user outcomes.

ACKNOWLEDGEMENTS

Thank you to my brothers, Jay and Simon. Thank you to my chosen family, who were there for me because of what we bring to each other's lives, and not because they had to be. James, Mike, Kyle, Kyle, Kelvin, Dylan, Alex, Alex, Tony, Pakiza, Lea, Ariel, Thannya, Shelly, Pam, Michelle, Oona, Richard, Don. Thank you to those who supported me along the way. Taylor, Mr. & Mrs. Wong, Tatum, Effie. Taylor, I couldn't have done it without you. Thank you for believing in me, Heather & Kirstie. Thank you for those who mentored me. Dr. DiGiuseppe, Dr. Ortiz, Dr. Johnson, Dr. Terjesen, Dr. Zaheer, Dr. Spink, Dr. Zeltzer, Dr. Gross. Thank you 6N at NYP Weill Cornell. Thank you all those who accepted me. Thanks, Grandma, for being a stable human.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Statement of the Problem

As the importance of mental health care becomes more widely accepted and mental health care, overall, becomes better received by the general population there continue to be barriers to availability, accessibility, understanding, and stigma of receiving such care (Charles, 2013; Knapp, 2006). While mental health care is far from being accepted, the demand is rising from multiple fronts. Providers are scarce worldwide, let alone within major Western cities, especially in countries that stigmatize mental health more than the West (Schierenbeck et al., 2013). To tackle these issues and provide more accessible mental health care to all, many Low-Intensity CBT or Web-Based CBT programs have appeared (Neary & Schueller, 2018).

A few smartphone-based Low-Intensity CBT programs were built as part of the increase in Low-Intensity CBT programs. The quality and focus of many of these mobile applications (apps) have left something to be desired. Few apps were completely free, the quality of the content, theoretical orientation, and user experience portions of the apps decreased drastically when they were free, and many focused only on one aspect of mental health, such as mindfulness or only challenging cognitive distortions. The design of these apps does not address the barriers to mental health care that face people today (Torous et al., 2018).

The higher-quality apps are aesthetically pleasing, encourage user engagement, and are more user-friendly, but they are typically locked behind a subscription. While these apps are meant to help address the availability and accessibility of mental health

care for all, the financial investment needed to design them becomes an inherent barrier to the accessibility of such apps. If the accessibility of mental health is hindered, then an argument can be made that the value of available care is reduced.

The apps that are free to the public also face several issues: they are of lower quality in aesthetics, do not drive as much user engagement, and do not provide the same level of psychoeducation and theoretical adherence. While these apps contribute to the availability and accessibility of mental health care, the quality of their delivery causes difficulty in servicing users (Torous et al., 2018). The adverse effects on user serviceability make it difficult for users to initially engage, stay engaged, and learn from the content.

These barriers to properly serving users impact the desire of users to seek and engage in mental health care apps (Torous et al., 2018). If users are unwilling to engage with these apps, then there cannot be gains in understanding mental health and reducing stigma through exposure. Furthermore, the advances in availability and accessibility become less important if users fail to use these apps.

Another barrier to the success of mental health apps is that most utilize one approach to treatment- Beck's Cognitive Therapy (CT) to address problems that users face. Other therapies underneath the CBT umbrella, such as REBT, DBT, and ACT, have less representation among mental health apps (Donker et al., 2013). While independently searching through the available Low-Intensity CBT programs (including web-based and mobile mental health programs), this author found that most were

based on CT. DBT was the second most frequent significant model represented. Only four ACT were found, and one REBT app was found.

I propose to develop a mental health app with these insights in mind and based on the REBT theoretical framework. I tried to develop a highly user-friendly app based on a framework with little representation in the Low-Intensity CBT field. The addition of this app and testing its effectiveness in delivering mental health care support adds to the existing literature by providing evidence for the effectiveness of different frameworks in Low-Intensity CBT and, second, by providing a greater understanding of what makes a Low-Intensity CBT app more appealing to the user.

Review of Literature

Availability and Access to Mental Health Services

The overall prevalence of mental disorders was about 18.9% in 2017. Only 42.6% of people with any mental diagnoses and 66.7% of people with a serious mental illness received any service in the same year (National Institute of Mental Health, 2018). Several barriers prevent people from accessing mental health services. Those with moderate and severe disorders face structural barriers in acquiring mental health services, such as the lack of financial means, availability of treatment/providers, limited transportation, or other inconveniences (Mojtabai et al., 2010). Physicians report struggling to find outpatient mental health services for their patients more so than other outpatient medical services (Cunningham, 2009; West et al., 2016). There is also a lack of growth of psychiatric providers. In recent years, psychiatric practitioners are shrinking compared to other medical specialties (Bishop et al., 2016). Low-Intensity CBT

is an ideal route for targeting such structural barriers and service delivery around the globe (Schmidt & Wykes, 2012).

Low-Intensity CBT

Low-intensity CBT refers to any form of CBT delivered as a web-based intervention and to any form of CBT delivered on a digital platform or has a program of exercises that uses a fewer sessions than the recommended average (Farrand, 2020). This review focuses on the "web-based" interventions.

The importance of Low-Intensity CBT can be highlighted by the overall prevalence of mental disorders and the number of people not receiving mental health services in the U.S. alone. With these previous statistics in mind: "overall mental illness prevalence was about 18.9% in 2017, only 42.6% of people with any mental illness and 66.7% of people with a serious mental illness received any service in the same year", it is evident that many people do not receive mental health services (National Institute of Mental Health, 2018). There is a strong need for mental health services and a lack of available options for those with a mental disorder.

Due to this gap, researchers and clinicians are motivated to seek alternatives to direct mental health interventions (Hazel et al., 2016). Initial exploration of the effectiveness of web-based CBT showed significant positive results in decreasing depression and anxiety in patients (Powell et al., 2013). As web-based CBT research gained traction, it continued to show its effectiveness in reducing symptoms of many mental disorders and pain management (Sander et al., 2016). Low-Intensity CBT also showed promise as a preventative measure for high anxiety in high-performance

environments (Howell et al., 2018). Additionally, Low-Intensity CBT is effective when translated into different languages (DaPonte et al., 2018).

The limitations of web-based CBT coincide with ease of use, access to technology, and comfort level with technology (Purkayastha et al., 2020; Roque & Boot, 2018). If a person lacks access to the internet or a computer, smartphone, or tablet, then web-based interventions are out of a person's reach. Older generations typically do not adapt to technological devices quickly and might need assistance in navigating them. Reviews indicate that some web-based CBT programs can be hard to navigate, even if the user is tech-savvy. For example, several students in the Purkayastha study had to reach out to the researchers to learn how to properly use MoodGym.

A search of various Low-Intensity CBT programs available online revealed more apps than web-based programs. Of 197 total (overlap included) apps available., 49 programs are available as web-based, 138 on the Android platform, and 159 on Apple iOS. Despite their availability, many apps are not supported by empirical evidence (Neary & Schueller, 2018; Donker et al., 2013). Donket and colleagues screened 5464 abstracts and found only eight papers that provided empirical evidence for the effectiveness of five mental health apps, further documenting the scarcity of research on mental health apps. They did find that these mental health apps can significantly decrease depression, stress, and substance use. However, once again, research on the effectiveness of most apps is nonexistent. While not every web-based app found was checked for supporting literature, it was apparent that more web-based programs had empirical evidence behind them than smartphone, downloadable apps.

To combat the lack of available empirical support for many Low-Intensity CBT programs, a screening review program was developed by a board of certified mental health professionals named PsyberGuide. PsyberGuide's goal is to aggregate credibility data, user experience ratings, and transparency for professionals and users alike. The review data is provided by one of ten reviewers from the field of psychology; all but one holds a doctorate, except one holding an MSW. While this project provides valuable information at a glance, it is hard to understand how to use these metrics to select an effective program.

PsyberGuide's reviews are conducted based on the reviewer's personal evaluation of whether the content aligns with psychological theory and the reviewer's perception of user experience. Therefore, there is no agreed-upon, a priori criteria to judge an app as effective. While I do not argue about the credentials of the PsyberGuide assessment team, compared to empirical research, these metrics may not correlate with effective outcomes. For example, MoodGym, a popular web-based program, has been used in many studies and is based on CT principles (Purkayastha et al., 2020). This program is rated as having 5/5 credibility and 3.31/5 on user experience. Despite this, it is unclear if MoodGym effectively reduces overall psychological distress and depressive symptoms. A meta-analysis of 11 studies showed that MoodGym's effect on general psychological distress was insignificant and that reductions in depressive symptoms might have resulted from publication bias (Twomey & O'Reilly, 2017). Despite significant reductions in depressive symptoms at first follow-up, long-term effects were not

promising, although anxiety symptom reduction post-follow-up was moderately significant.

Due to the discrepancy between the credibility rating and the questionable potential for the use of this program, it makes it hard to determine how credibility and user experience can be utilized to determine whether a Low-Intensity CBT program has lasting positive effects. This fact further highlights the necessity to explore what makes a Low-Intensity CBT program effective. Strict adherence to a theoretical perspective with empirically supporting evidence is insufficient for a program to show efficacy.

If adherence to a theoretical perspective is not enough, then what does a Low-Intensity CBT program have to do to demonstrate that it is effective in improving mental health? The answer may lie in the engagement and usability of the program. When an independent study adapted MoodGym to a mobile device, they discovered the main difference: the user's perception of ease of use made a significant difference, favoring the mobile version (Purkayastha, Addepally, & Bucher, 2020). At this time, there is little to no research comparing web and app-based Low-Intensity CBT programs, and this unique study demonstrated the potential major difference between the two forms of Low-Intensity CBT ease of use.

Combining what we now know, it is apparent that app-based programs can be effective in improving mental health, apps varying their perceived ease of use, and sheer adherence to a theoretical perspective is not enough. There is a need to collect more empirical evidence on mental health apps. Building an app that adheres to a well-researched form of therapy (REBT) will add to the Low-Intensity CBT literature, as REBT

currently does not have a strong representation among Low-Intensity CBT programs. Furthermore, designing the app with user experience in mind and accessing the correlation between said user experience and mental disturbance outcomes can help provide future direction for other Low-Intensity CBT apps that focus on cognitive behavioral principles.

Psychosocial Implications

Increasing the availability and accessibility of mental health programs can have positive lasting impacts on communities and overall perception of mental health. Exposure to quality mental health services and education has the potential to alleviate the issues of lack of understanding and stigma surrounding mental health. If a quality service is introduced and builds a positive reputation, people would be more willing to look into it themselves, subsequently exposing themselves to mental health services and learning that they are beneficial.

Those with mild disorders tend to examine low perceived needs, so they do not want to actively seek services (Mojtabai, et al., 2010). The potential impact of and desire to participate in Low-Intensity CBT was not examined in this population. However, there is potential to increase motivation in those with mild disorders if the ease of use of Low-Intensity CBT is adequate. For example, if the path to receiving mental health services has little resistance, such as downloading an app, it is rational to assume more people would be willing to give it a shot.

Overview of the Present Study

The existing literature on Low-Intensity CBT, specifically internet-based interventions, is indicative that Low-Intensity CBT has the potential to address issues of increasing availability, increasing accessibility, increasing understanding of adaptive thoughts and behaviors, and decreasing mental disorder stigma. Simultaneously, individual app-based programs shown to be more accessible and better perceived by users might lack empirical research backing their efficacy. Developing an app and analyzing its data is a low-risk, high-reward endeavor as it helps supplement the small body of literature on the subject, supports the efficacy of a different theoretic model for use over an app (REBT), and can help alleviate some of the problems mental health services face today.

Given the many people who cannot access mental health services, let alone understand what mental health services can do for them, continuing to add accessible resources would only increase the chances they learn about and receive services. Researching apps can also provide valuable insight into what makes Low-Intensity CBT effective and help developers build future mental health apps with these insights. If we develop an app that appears to be effective, but users do not want to use, we can feel sure about the efficacy of delivery of REBT through an app and can focus on problem-solving the design. If the opposite happens, we can focus on improving the REBT framework and learn from what went well with the app's design. REBT has the potential to display greater effectiveness in a Low-Intensity format due to its universal approach to addressing maladaptive cognitions, that once is taught to the client, can be applied to

various situations. The current gaps in research do not give us sources to draw upon exploring the effects of REBT as a Low-Intensity intervention.

The Present Study

This study was designed to demonstrate the effectiveness of an REBT app as a Low-Intensity intervention and to demonstrate that technical and design aspects of Low-Intensity interventions matter. A unique REBT-based app (DiGiuseppe et al., 2014 & Ellis, 1994) was designed for the use of this study. This REBT-based app, titled *REBT Guide to Emotions*, is based on the REBT framework and guides the user through the framework. Design features of the program may result in participants engaging more and gaining more benefits from what they learn in reducing their mental health problems. This study compared the efficacy of an REBT based Low-Intensity program to a CT app (WoeBot: Fitzpatrick et al., 2017) based control group and a different REBT-based app (PsyPills: David et al., 2019) based control group in reducing mental health symptoms, lowering problems in interpersonal relationships and problems failing to engage in one's social role.

Two of the low-intensity treatments both used an REBT format. The two REBT treatments differed in the technical aspects of how the information is delivered. PsyPills first collects a large amount of emotional data regarding the user's current state then provides the user with a short REBT based reframe. REBT Guide to Emotions guides the user through psychoeducation regarding their emotional state regarding an event and provides the users' ways to reframe their current thoughts regarding said event and emotions. The two REBT approaches differ in their approach to educating and

interacting with patients. The comparison approach (PsyPills) asks the user to provide a rating scale on their emotions, checks their activating event, the thoughts and beliefs surrounding the event, and attempts to provide the user with a single sentence answer to think about to improve their immediate emotional wellbeing. The REBT Guide to Emotions experimental approach collects information regarding the user's triggering event and current emotional experience interweaves appropriate amounts of psychoeducation and interactive learning opportunities, and considers long-term healthy and unhealthy attitudes that could hinder the users' long-term success. The advantage of the experimental REBT app is that it gives ample (more time) time and information for the user to properly absorb the necessary information to teach them about the benefits of adjusting their thinking and approach in their daily lives. The design of the comparison app makes it appear to be most effective when in conjunction with a real, live, in-person REBT, as the terminology and approach used may seem foreign to those who do not understand the REBT model. The experimental model does not assume the user can utilize the appropriate information on their own and provides the necessary education for the user to benefit from it.

HYPOTHESIS

Based on the existing research, I hypothesized that:

- WoeBot will show a pre to post-test improvement in OQ-45.2 scores.
- Participants who receive REBT Guide to Emotions would show a pre to post-test improvement in OQ-45.2 scores.
- Participants who receive PsyPills would show a pre to post-test improvement in OQ-45.2 scores.
- Participants who receive the REBT app programs would demonstrate a greater significant decrease in their scores on a clinical outcome measure (OQ-45.2) compared to participants in the WoeBot control group at post-test.
- Participants who receive the REBT app would show a greater significant decrease in their scores on a clinical outcome measure (OQ-45.2) compared to participants who receive an alternative REBT low-intensity intervention (PsyPills) and the CT low-intensity intervention (WoeBot).
- Participants who report more positive overall user experience on the user experience scale will show a greater significant decrease in their scores on a clinical outcome measure (OQ-45.2) than participants who endorse greater negative perceptions of user experience.

RESEARCH QUESTIONS

- The two comparison apps being used, WoeBot and PsyPills each have their potential strengths and weaknesses. WoeBot is highly user-friendly and guides users slowly through its built-in modules, while PsyPills takes a theoretical solid adherence to the REBT model but uses a great deal of technical language. We do not have enough information about the REBT model in Low-Intensity programs to hypothesize which program would produce greater significant decreases in scores on clinical outcome measures. As part of the study, we would like to compare the effects of each app to each other and determine if one or the other is more effective in reducing clinical outcome measures.

METHOD

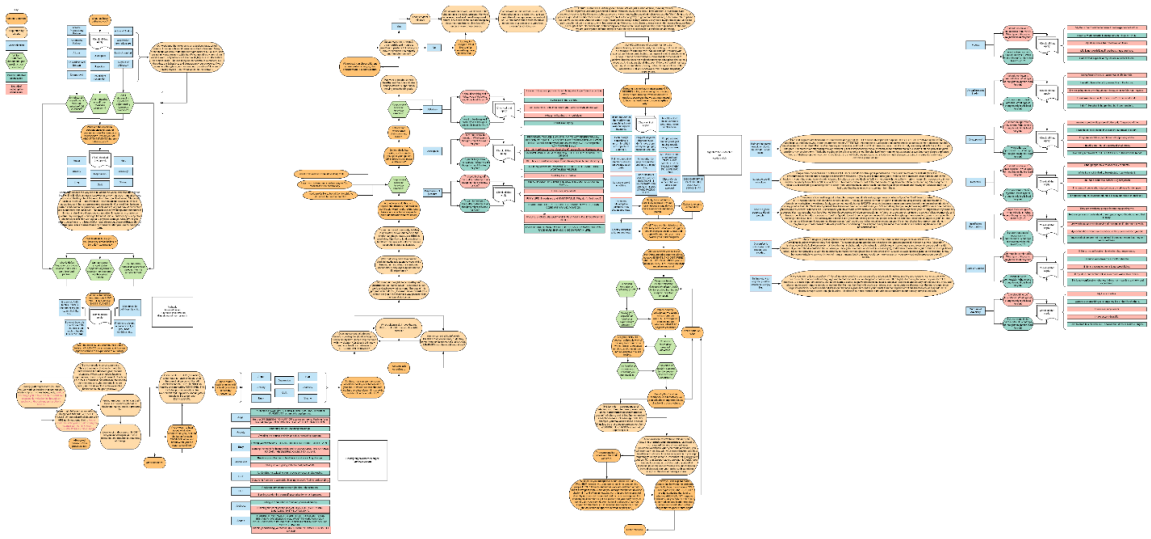
Design

Development of *REBT Guide to Emotions*: After reviewing the literature on Low-Intensity CBT, including web and app-based, a flowchart software was used to build an REBT-based Low-Intensity CBT module (Figure 1). The module was designed with interactivity in mind, and user input guided the narrative and education surrounding solutions to mental health problems. The module was designed to store responses from the user to provide interactive examples later. The design included matching games for users to play to learn about healthy and unhealthy cognitive responses for each emotion (i.e., anger, anxiety, and depression). For example, when presented with a healthy and unhealthy outcome for anger, the user would have to select the healthy outcome for the presented emotion. An REBT expert checked over the REBT module to confirm its theoretical orientation and correct design.

Once the experimental REBT module was built, a coder was recruited to build it in React Native, a language capable of being ported to iOS and Android. Graphic design was determined through the collaboration of the coder and author of the study.

Figure 1.

REBT Guide to Emotions Module Flowchart. Flowchart of the software before the development of the app.



Research design

Testing the app required a control group (WoeBot), based on another CBT approach. In this case, it was CT, an REBT-based app without the same level of psychoeducation and a different user experience as a comparison group (PsyPills), and an experimental group using the REBT Guide to Emotions app. Pre and post-measures of the OQ-45.2 measure and a post-user experience scale measure were distributed to all participants. The OQ-45.2 is divided into three scales. Two of these scales are more stable across time due to requiring more time for changes to be implemented and realized: Interpersonal Relations (IR) and Social Role (SR). The third, Symptom Distress (SD), is more sensitive to short-term changes. A no-treatment control group was not

used to avoid the following: leaving users without mental health support if they needed it and comparing effect sizes between interventions as something often ends up being better than nothing, potentially inflating the results of the study.

Participants

Adult participants were recruited through online advertising. A listing was made and shared on social media platforms like Facebook, Instagram, and Reddit. The advertising contained a direct link to a Qualtrics survey that would have participants fill out a baseline OQ-45.2 measure before being randomly assigned to a group. A sample size of 14 subjects per group was sought after to demonstrate adequate power for the analysis. The desired sample size was calculated using G*Power software while seeking a moderate effect (Faul, Erdfelder, Lang, & Buchner, 2007; Faul, Erdfelder, Buchner, & Lang, 2009).

Once participants were randomly placed into each group, appropriate instructions were given to each participant, including which app to install, a QR code or direct link to the app, how to install the app, and the recommended duration of use. The participants were asked to initially utilize the app for 10 minutes and then utilize the app over the course of the week as they see fit. Participants were not required to utilize the app more frequently than they desired. A week after their initial response, Qualtrics sends the users a follow-up survey link to their preferred email to do a post-test OQ-45.2 measure and a descriptive information survey.

Interventions

The Fully Integrated LI REBT Module. The entire REBT App, titled *REBT Guide to Emotions*, was designed to provide a streamlined REBT experience to the user with appropriate levels of psychoeducation and engaging activity to keep the user invested in the module. The app was designed to teach participants to distinguish between healthy and unhealthy negative emotions, set appropriate goals and accept healthy negative emotions, and distinguish rational beliefs and irrational beliefs (awfulizing, low discomfort tolerance, demands, and global evaluations of human worth), understand that irrational beliefs lead to unhealthy negative emotions, understand that rational beliefs lead to healthy negative emotions, challenge their irrational beliefs, generate appropriate rational beliefs, and adopt lifelong healthy attitudes.

The process combines the user-selected choice of their disturbance(s), psychoeducational segments that explain the rationale behind the REBT model, and interactive learning opportunities through exploratory matching segments (Figure 1). Each interaction the user has with the app is supported by appropriate psychoeducation that explains the rationale for the program. This supporting rationale is placed between interactive parts of the app to maintain a balance of education and user interaction.

Going through the module takes the user through their activating events, beliefs, and consequences and provides insight into how to dispute current beliefs and form new ones. The model is made to serve as a guide that the user can repeat when needed and learn to dispute their irrational beliefs on their own. The app encourages continued practice of the taught principles to develop lifelong healthy attitudes. This app provides

a comprehensive and complete integration of REBT that is meant to educate the user as much as possible in the absence of an actual psychologist.

This program is built in a coding language capable of being ported for use in iOS and Android devices, React Native. The program includes a modern layout and design aspects, tracks user input to provide them with responses based on their input, and introspective exercises that demonstrate how to challenge irrational beliefs. The app contains appropriate references.

The content of this program was reviewed by an expert in the REBT module developed for this experiment to ensure its alignment with the theoretical model of REBT. The apps selected for comparison groups were apps with existing literature.

The standard PsyPills REBT program. The PsyPills program utilizes the REBT ABCDE model to evaluate the user's current activating event and provides a response the user is meant to ponder to help alleviate their current disturbance. The program starts by evaluating the user's current global emotional profile by asking the user to gauge the intensity of 32 emotions on a scale of zero to five. Once the user has rated all of the emotions, they can move on to a report of their levels of functional negative feelings, dysfunctional negative feelings, and positive feelings.

The following prompt asks the user to measure their pulse using the phone camera. The user is instructed to place their finger over the camera and hold it there for 20 seconds while the app measures the user's pulse. A pulse reading is provided to the user. Once a user's pulse is measured the app proceeds to ask the user to fill out Likert Scale items regarding their cognitions in the past two weeks. This is followed by more

Likert items asking the user to rate how frequently they experienced the previously mentioned emotions in the past two weeks. Then, more Likert items about recent experiences. After going through over 100 Likert Scale items the user is then prompted to provide their pulse one more time and then highlight which negatively valenced emotions they are experiencing. The app then utilizes the REBT framework to identify what the user believes "should" be happening and what they are primarily distressed over in the situation. Upon completing all of this information, it leaves the user with a one to two-sentence response about how to reconceptualize the situation healthily.

The user then has the option of doing it all over again or checking if their levels of distress have lowered. If the distress is not lowered the app suggests running through its module more frequently. The app provides optional short readings on the theory behind REBT that are not part of the main module and are not readily accessible by the user. A history tab is also available for users to track their progress.

Control condition, CBT-based app (WoeBot). The control group will utilize an established CT-based Low-Intensity app named WoeBot. WoeBot interacts with users utilizing strictly a chat feature where the WoeBot asks the users questions to which they may select pre-determined responses. The WoeBot checks with users daily and asks them to rate their current mood, engage in gratitude exercises, mindfulness exercises, behavioral activation, and eventually engage in thought challenging exercises.

The decision to not utilize a waitlist control was made due to established literature that some intervention is typically better than no intervention. Comparing the effectiveness of an REBT model to more widely used CBT models will also provide data

on how REBT fares as a Low-Intensity intervention, which adds more to the literature than utilizing a waitlist control group. This also avoids an ethical dilemma where a participant in the study may be reporting near clinical levels of distress but not receiving any intervention.

Procedure

Participants were randomly assigned to one of three groups: one REBT experimental, one REBT comparison, and one CBT control. While a sample representative of the general population is ideal, a convenience sample of those available in social media and internet-based mental health spaces was utilized to reach suitable testing numbers. Participants were recruited by social media posts (including Facebook, Twitter, Instagram, Reddit, etc.). All social media platforms utilized the same link leading the Qualtrics survey that automatically distributed groups randomly at equal intervals. Users will be provided a notice that their information will remain confidential, and their names will not be utilized in the study at any point during its duration or after that. Users do input an email address for follow-up survey delivery. The email addresses stored will be deleted upon completion of the study. Any user data (emails) downloaded from the Qualtrics database is stored on encrypted devices and is discarded after data processing.

Measures

Demographics. Eighteen years or older, likely a convenience sample of higher education individuals in their 20s and 30s. Screen prerequisites for participants include having access to a smartphone and the ability to see.

Outcome Questionnaire (OQ-45.2)

The Outcome Questionnaire (OQ-45.2: Lambert et al., 1996) measures short-term changes in emotional disturbances and functions over a wide variety of disorders. The 45 questions that comprise the questionnaire assess symptoms, interpersonal problems, social functioning, and quality of life. A five-point Likert Scale is used for every item (4=Never, 3=Rarely, 2= Sometimes, 1 = Frequently, 0=Always). The OQ-45.2 consists of three subscales that calculate symptom distress, interpersonal relations, and social role, as well as an additional subscale for risk assessment. The OQ-45.2 also has excellent reliability and strong concurrent and construct validity. The questionnaire is sensitive to change and differences between clinical and non-clinical samples (Lambert et al., 1996).

User Experience Scale

Likert items focusing on aesthetics, ease of use, engagement, recommending to a friend, helpfulness, and frequency of utilizing the app were designed to understand user experience when using Low-Intensity CBT (Appendix 1). The items allow the user to express if they felt somewhat or strongly positive/negative or neutral about the app's features. The user experience questionnaire inquires whether the user utilized the app to check for adherence.

Appendix 1.

User experience questionnaire.

The app was pleasing to look at

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

The app was easy to use

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I would recommend this app to a friend

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

How many times did you open the app?

1	2-3	4-5	6-7	8+

Did you complete a full exercise using the app?

Yes	No

If “Yes”, how many times did you complete an exercise?

1	2-3	4-5	6-7	8+

Data Collection Procedure

Pre-Intervention

Baseline measures were collected using Qualtrics. A pre-intervention OQ-45.2 measurement was collected from each participant before the assigning of a randomized group.

Post-Intervention

Participants will fill out the user experience scale and a second OQ-45.2 one week after starting the utilization of the app.

RESULTS

Statistical Analysis

Data analysis was conducted using IBM SPSS (Version 25). The statistical significance level for all tests was set at a *p*-value of below 0.05. Out of the initial participants, 44 participants completed the post-survey, with one participant not being able to fill out the OQ-45.2 posttest questionnaire fully, and thus their data was unable to be used. The PsyPills group received 14 post-survey responders, REBT Guide to Emotions received 13, and WoeBot received 16. Descriptive data is included in Table 1.

Table 1.

Descriptive Statistics for the Total OQ scores for the Three Treatments Pre and Post Test

RM Factor 1	AppGroup	N	Mean	SD	SE
Pre-OQ	PsyPills	14	66.429	19.078	5.099
	REBT Guide to Emotions	13	62.077	13.985	3.879
	WoeBot	16	64.938	16.683	4.171
Post-OQ	PsyPills	14	64.929	20.716	5.537
	REBT Guide to Emotions	13	62.000	15.583	4.322
	WoeBot	16	57.688	13.763	3.441

A pre to post measure was conducted for the total OQ scores (Table 2). For further analysis, we utilized each scale of the OQ as an independent pre-to-post to measure. Because the study was seeking a main effect for time, we ran tests for pre-to-post tests for each of the three treatment groups and each of the OQ subscales along with the OQ total score. PsyPills and REBT Guide to Emotion did not produce any

significant pre-to-post measures in the OQ total or the three subscales (Table 3, Table 4, Table 5). WoeBot produced a significant pre-to-post score on the OQ total (t = 2.673, p = 0.017, Cohen's d = 0.191) and a significant pre-to-post SD subscale difference (t = 2.498, p = 0.025, Cohen's d = 0.162). WoeBot did not produce significant pre-to-post measures for the IR or SR subscales.

Table 2.

OQ45.2 Pre-to-Post ANOVA Data

Within Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p	η^2	ω^2
OQ 45.2 Pre-to-Post	184.762	1	184.762	3.928	0.054	0.008	0.006
OQ 45.2 Pre-to-Post ✻ AppGroup	214.847	2	107.423	2.284	0.115	0.009	0.005
Residuals	1881.712	40	47.043				

Note. Type III Sum of Squares

Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p	η^2	ω^2
AppGroup	315.870	2	157.935	0.305	0.739	0.014	0.000
Residuals	20705.944	40	517.649				

Note. Type III Sum of Squares

Table 3.

PsyPills Pre-to-Post Independent Measures

Measure 1		Measure 2	t	df	p	Cohen's d
Pre OQ45 Total	-	Post OQ45 Total	0.557	13	0.587	0.149
SD Pre	-	SD Post	1.291	13	0.219	0.345
IR Pre	-	IR Post	-0.924	13	0.373	-0.247
SR Pre	-	SR Post	0.165	13	0.871	0.044

Table 4.

REBT Guide to Emotions Pre-to-Post Independent Measures

Measure 1		Measure 2	t	df	p	Cohen's d
Pre OQ45 Total	-	Post OQ45 Total	0.037	12	0.971	0.010
SD Pre	-	SD Post	-0.048	12	0.962	-0.013
IR Pre	-	IR Post	0.800	12	0.439	0.222
SR Pre	-	SR Post	-0.125	12	0.902	-0.035

Table 5.

WoeBot Pre-to-Post Independent Measures

Measure 1		Measure 2	t	df	p	Cohen's d
Pre OQ45 Total	-	Post OQ45 Total	2.673	15	0.017	0.668
SD Pre	-	SD Post	2.498	15	0.025	0.624
IR Pre	-	IR Post	1.393	15	0.184	0.348
SR Pre	-	SR Post	1.460	15	0.165	0.365

A repeated measures ANOVA was applied to the data focusing on the Pre and Post OQ-45.2 measures as the within-group variable and another between-group variable that included three levels representing the three app groups as the between-subjects variable (Table 2). The analysis did not indicate a significant effect for time, the Pre to Post measures, on the OQ-45.2 with the utilization of any app, with the results approaching significance [F(1, 40) = 3.928, p = .054]. The interaction of time and app-based treatment was F(2, 40) = 2.284, p =.115, and was not significant. However, we believe that the p-value of .054 would have been significant if the sample size was larger. This is why we performed post hoc within-group t-tests on the pre to posttest measures of the OQ for each of the three treatments.

A Bayesian repeated measures ANOVA was conducted in addition (Table 6.) The results of the Bayesian ANOVA were all below a BF_{01} of 10, indicating a lack of a strong effect. The pre-OQ-45.2 scores of participants who did not complete a post score were also compared to the pre scores of those who did complete the follow up measure. No statistical differences were found (t = -0.433, p = 0.667, Cohen's d = 0.266).

Table 6.

Bayesian Repeated Measures ANOVA

Model Comparison					
Models	**P(M)**	**P(M|data)**	**BF_M**	**BF_{01}**	**error %**
OQ-45.2 Pre to Post	0.200	0.352	2.175	1.000	
Null model (incl. subject and random slopes)	0.200	0.249	1.327	1.414	1.537
OQ-45.2 Pre to Post + AppGroup	0.200	0.162	0.772	2.177	3.178

Model Comparison					
Models	**P(M)**	**P(M|data)**	**BF_M**	**BF_{01}**	**error %**
OQ-45.2 Pre to Post + AppGroup + OQ-45.2 Pre to Post ✻ AppGroup	0.200	0.133	0.615	2.642	3.842
AppGroup	0.200	0.103	0.462	3.405	2.881

Note. All models include subject, and random slopes for all repeated measures factors.

Analysis of Effects					
Effects	**P(incl)**	**P(excl)**	**P(incl|data)**	**P(excl|data)**	**BF_{excl}**
OQ-45.2 Pre to Post	0.600	0.400	0.647	0.353	0.817
AppGroup	0.600	0.400	0.399	0.601	2.263
OQ-45.2 Pre to Post ✻ AppGroup	0.200	0.800	0.133	0.867	1.625

Analysis of Descriptive Data

The REBT comparison app, PsyPills, received mostly negative reviews for aspects of user experience (Table 7). When prompted to answer if the app was pleasing to look at: 28.6% of participants strongly disagreed, 28.6% somewhat disagreed, 28.6% of people were neutral, 14.3% somewhat agreed, and 0% strongly agreed. When prompted to answer if the app was easy to use, 50% of participants reported they strongly disagreed, 14.3% somewhat disagreed, 7% were neutral, 21.4% somewhat agreed, and 7.1% strongly agreed. When prompted to answer if participants would recommend the app to a friend, 57.1% strongly disagreed, 21.4% somewhat disagreed, 14.3% were neutral, 0% somewhat agreed, and 7.1% agreed. When prompted if the app was useful,

35.7% of participants strongly disagreed, 28.6% somewhat disagreed, 14.3% were neutral, 21.4% somewhat agreed, and 0% strongly agreed.

Table 7.

PsyPills Qualitative Data

PsyPills	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree or Disagree**	**Somewhat Agree**	**Strongly Agree**
The app was pleasing to look at	28.6%	28.6%	28.6%	14.3%	0%
The app was easy to use	50%	14.3%	7.1%	21.4%	7.1%
I would recommend this app to a friend	57.1%	21.4%	14.3%	0%	7.1%
This app was helpful	35.7%	28.6%	14.3%	21.4%	0%
	1	**2 to 3**	**4 to 5**	**6 to 7**	**8+**
Times Opened	8 (57.1%)	1 (7.1%)	3 (21.4%)	1 (7.1%)	0
	Yes	**No**			
Times completed full module	10 (71.4%)	4 (28.6%)			
	1	**2 to 3**	**4 to 5**	**6 to 7**	**8+**
If Yes, how many times did you complete the exercise?	6 (60%)	2 (20%)	1 (10%)	1 (10%)	0

The experimental REBT app, REBT Guide to Emotions, received mostly positive reviews on aspects of user experience (Table 8). When prompted to answer if the app was pleasing to look at: 0% of participants strongly disagreed, 7.7% somewhat disagreed, 15.4% of people were neutral, 69.2% somewhat agreed, and 7.7% strongly agreed. When prompted to answer if the app was easy to use: 0% of participants reported they strongly disagreed, 7.7% somewhat disagreed, 0% were neutral, 23.1% of participants somewhat agreed, and 69.2% strongly agreed. When asked if participants would recommend the app to a friend: 0% strongly disagreed, 0% somewhat disagreed, 30.8% were neutral, 53.8% somewhat agreed, and 15.4% agreed. When prompted if the

app was useful: 0% of participants strongly disagreed, 0% somewhat disagreed, 23.1% were neutral, 46.2% somewhat agreed, and 30.8% strongly agreed.

Table 8.

REBT Guide to Emotions Qualitative Data

REBT Guide to Emotions	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree or Disagree**	**Somewhat Agree**	**Strongly Agree**
The app was pleasing to look at	0%	7.7%	15.4%	69.2%	7.7%
The app was easy to use	0%	7.7%	0%	23.1%	69.2%
I would recommend this app to a friend	0%	0%	30.8%	53.8%	15.4%
This app was helpful	0%	0%	23.1%	46.2%	30.8%
	1	**2 to 3**	**4 to 5**	**6 to 7**	**8+**
Times Opened	3 (23.1%)	10 (76.9%)	0	0	0
	Yes	**No**			
Times completed full module	11 (84.6%)	2 (15.4%)			
	1	**2 to 3**	**4 to 5**	**6 to 7**	**8+**
If Yes, how many times did you complete the exercise?	8 (72.7%)	3 (27.3%)	0	0	0

The control CBT app, WoeBot, received mostly positive reviews in regards to user experience as well (Table 9). When prompted to answer if the app was pleasing to look at: 0% of participants strongly disagreed, 5.9%% somewhat disagreed, 11.8% of people were neutral, 47.1% somewhat agreed, and 35.3% strongly agreed. When prompted to answer if the app was easy to use, 0% of participants reported they strongly disagreed, 5.9% somewhat disagreed, 5.9% were neutral, 47.1% of participants somewhat agreed, and 41.2% strongly agreed. When prompted to answer if participants would recommend the app to a friend, 0% strongly disagreed, 11.8% somewhat disagreed, 23.5% were neutral, 29.4% somewhat agreed, and 35.3% agreed. When

prompted if the app was useful, 0% of participants strongly disagreed, 17.6% somewhat disagreed, 17.6% were neutral, 41.2% somewhat agreed, and 23.5% strongly agreed.

Table 9.

WoeBot Qualitative Data

WoeBot	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree or Disagree**	**Somewhat Agree**	**Strongly Agree**
The app was pleasing to look at	0%	5.9%	11.8%	47.1%	35.3%
The app was easy to use	0%	5.9%	5.9%	47.1%	41.2%
I would recommend this app to a friend	0%	11.8%	23.5%	29.4%	35.3%
This app was helpful	0%	17.6%	17.6%	41.2%	23.5%
	1	**2 to 3**	**4 to 5**	**6 to 7**	**8+**
Times Opened	4 (23.5%)	4 (23.5%)	8 (47.1%)	1 (5.9%)	0
	Yes	**No**			
Times completed full module	14 (82.4%)	3 (17.6%)			
	1	**2 to 3**	**4 to 5**	**6 to 7**	**8+**
If Yes, how many times did you complete the exercise?	4 (28.6%)	5 (35.7%)	3 (21.4%)	2 (14.3%)	0

Statistical analysis of user experience data was performed alongside graphing said data for greater visual clarity (Figure 2). PsyPills' was found to be significantly different from REBT Guide to Emotions and WoeBot the first four Likert items on the user experience questionnaire with all differences having a p value of <0.001 (the app was pleasing to look at, the app was easy to use, I would recommend this app to a friend, and this app was helpful). REBT Guide to Emotions and WoeBot did not significantly differ from each other on the four aforementioned items. The apps did not show significant differences on app usage data outside of REBT Guide to Emotions and WoeBot being significantly different on how many times users completed a full exercise.

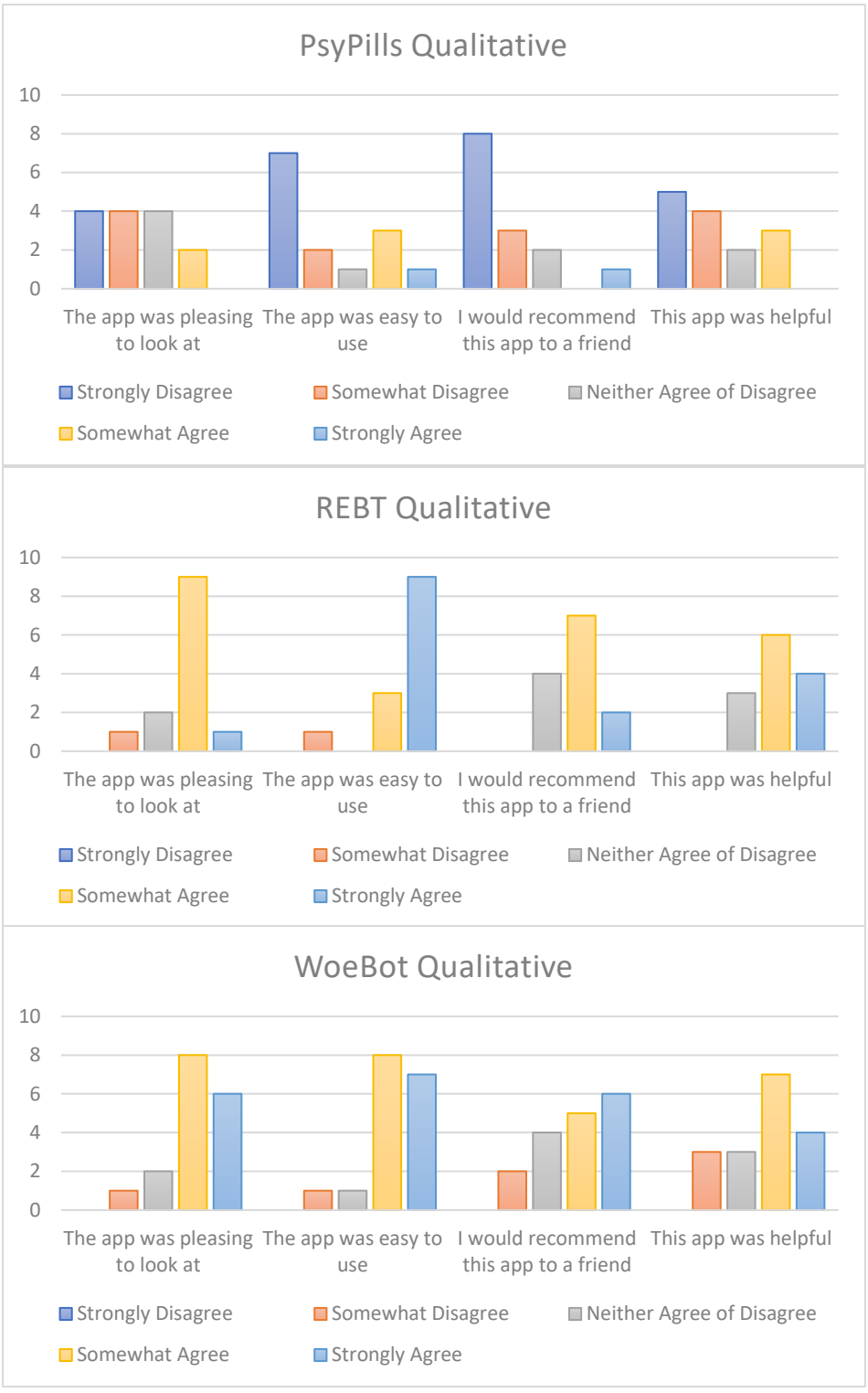


Figure 2.

Visual Descriptive Data. App group descriptive data graphed for visual clarity.

The usage rate data that was collected was correlated in SPSS to the difference in Pre to Post Test OQ-45.2 outcomes and OQ-45.2 scale outcomes. WoeBot came close to having one significant correlation between app usage and changes in the SR scale outcomes at $p = 0.051$. No other correlation was statistically significant, indicating that frequency of use did not influence outcomes. Statical differences in usage data indicate there to be no differences between app usage outside of the number of times a module was completed between REBT Guide to Emotions and WoeBot. It is important to note that part of the WoeBot app design prompts users to reengage for a new module every day and has shorter modules than the REBT Guide to Emotions app.

DISCUSSION

The study results do not allow us to reject any of our null hypotheses. Overall, when looking for a general effect size on the OQ-45.2 or any of the subscales, the results of the repeated measures ANOVA do not allow us to assume that there is a significant effect for app usage and improvements on the OQ-45.2 or its subscales or that there are any statistical differences between the app groups. However, when isolated, the WoeBot control group did display significant reductions in both the overall OQ score and the SD scale reduction. Because there were no significant reductions in the IR or SR scales, the majority of the reduction in total OQ-45.2 scores is likely coming from the impact of SD scale symptom reduction within the WoeBot group. WoeBot demonstrated a decrease in SD scores with a t value of 2.489 and p value of 0.025, both IR and SR scales were not significant in their change.

To obtain better insights into the results, we can look at other studies of individual apps. PsyPills has research that shows-in reminders to be discussed. This brings about into question whether these Low-Intensity CBT apps are being tested properly or if larger sample sizes are needed to see positive effects. Alternatively, the study could highlight that REBT-based Low-Intensity interventions could be better suited for specific needs, such as increasing functional negative emotions and helping individuals channel their negative experiences into positive outcomes. Tested that is beyond the scope of the current study.

There are potential differences between the two REBT apps of this study, PsyPills, and REBT Guide to Emotions and the WoeBot app that could have led the WoeBot group to see significant outcomes. WoeBot has built-in daily reminders to check in an attempt to learn a quick skill, whether mindfulness or a breathing intervention, WoeBot invites users back to learn and provides them with recall cues from previous skills. This is in line with the PsyPills study that noted that adding reminders to utilize the app increased the app's efficacy (David & David, 2019). This is also in line with how actual therapy functions, where weekly visits with a therapist often provide clients with reminders and recall cues for previously discussed topics. Engagement is likely a driving force in producing better outcomes.

While the correlation between WoeBot app use frequency and SR outcomes was not statistically significant, it was awfully close at $p = 0.51$. A slightly larger sample size could have very well hit significance leading us to explore how social role facets interact with frequency of use. Of course, correlations could go either way, so frequent use may be a facet of a person who has a well-established social role.

WoeBot has the potential to be more digestible as it takes time to introduce interventions to the user. Both the REBT apps are more involved. PsyPills requires the users to input large amounts of data each time, and the REBT Guide to Emotion app attempts to encapsulate the general gist of the entirety of REBT in a single run through. There is the potential for both REBT apps to require too much individual engagement in order to drive a result. This does not always have to be a limitation, but in a setting where information is readily available and users are used to acquiring digestible chunks

of data at a time, the REBT apps may not provide a path of least resistance toward the necessary information. This does not have to be a net negative and may not be a problem that we necessarily want to address every time, but consider that individual learners may not have the motivation to sustain their attention for long enough to obtain benefits.

It is important to note that WoeBot has the advantage of a larger team of individuals working on being able to devise a more effective app. WoeBot reported raising $90 million dollars in their Series B Funding round in July 2021, and thus have much more resources available to construct a more effective app. PsyPills and REBT Guide to Emotions do not have access to the same level of resources to be able to devise and adapt its application at a faster pace.

There is also the exploration of the descriptive data collected. PsyPills received the worst user ratings, while WoeBot and REBT Guide to Emotions received more positive user ratings. If larger sample sizes in the future can demonstrate that the apps can have positive effects on average, then design options become important for the spread of use for each app. WoeBot and REBT Guide to Emotions both had users reporting that on average, they would recommend the app to a friend. Interpersonal influence has the potential to help more people engage in healthy behaviors. Furthermore, if Low-Intensity CBT programs are overall helpful enough to the users, they are more likely to bring in other users to explore the benefits.

Many participants reported negative perceptions of the user experience of utilizing the PsyPills app, such as not knowing if it was helpful and not wanting to recommend it to a friend. This may lead users to trust the information contained in the app less, less desire to use/rely on the app, and provide other potential users with poor reviews, further discouraging use. A longer-term study of utilization, potentially coupled with download data for the apps, could be helpful in determining if this is accurate.

The user experience data provided for REBT Guide to Emotions and WoeBot were much more positive than PsyPills. This may lead these apps to be utilized more frequently or shared more frequently, thus incurring a greater reach of audience. When looking at utilization data of REBT Guide to Emotions vs WoeBot we can only conclude that people went through a full WoeBot module more often than a full REBT Guide to Emotions module.

The limitations of this study include several factors. Lacking demographic knowledge of participants may protect their identities and provide a path of least resistance for sharing their honest ratings, given the anonymity of the surveys. The lack of demographic data does not help us determine if populations who may be more sensitive to the IR and SR scale would see greater benefit from using these apps. Younger individuals, such as college students, may have greater capacity for change in those factors. Older individuals may be more stable in these factors, thus leaving less room for change. Furthermore, the sample size did contain several clinically significant measures of distress in participants, but the sample size cannot be confirmed as a clinically distressed sample size. While there is a benefit to seeing if the general

population would benefit from the utilization of app-based interventions, it would also be of benefit to isolate specific clinical samples to determine the use of app-based interventions as clinical tools. The study did focus on the mass distribution of services in its objective, and future direction could focus on clinical samples. Furthermore, education level could be correlated with the capacity of an individual to benefit from text based mental health interventions.

Another potential limiting factor was that not all participants responded to the follow-up survey in a timely manner. Some took longer than one week to report back on their post-survey, potentially skewing the results to include greater periods of app utilization, reduction in the effectiveness of the apps, or greater time available for change. If certain groups happened to correlate with less responsive post survey timing, they could have reported higher use due to the greater availability of time.

CONCLUSION

This study highlighted that Low-Intensity app-based interventions are approaching being able to help populations and that Low-Intensity app-based interventions need more refinement and research before they can be trusted as independent interventions. This study highlights the lack of concreteness within the mental health app space, as comparison studies of the PsyPills app were not as promising in their design or outcome data. WoeBot, which has a larger support and research base, did demonstrate a positive effect on the reduction of immediate distressing symptoms, as indicated by the OQ-45.2 SD scale. REBT Guide to Emotions would require more data to be able to be seen as a positive standalone measure.

The study could not determine the effects of users' experience on mental health outcomes or see any potential correlations. The plan for further research is to leave the automated study to run for a longer period to see if there are differences, we can ascertain from a larger sample size, utilization during the entire year, and greater volumes of descriptive data. Another future direction could explore the use of REBT-based interventions alongside the use of individual REBT therapy to see if the app-based interventions could scaffold or accelerate improvement in symptoms.

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