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Eagle, Tessa

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**"LIKE TALKING TO A PERSON": USER-PERCEIVED
BENEFITS OF MENTAL HEALTH AND WELLNESS
MOBILE APPS**

A thesis submitted in partial satisfaction of the
requirements for the degree of

MASTER OF SCIENCE

in

COMPUTATIONAL MEDIA

by

Tessa Eagle

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The Thesis of Tessa Eagle
is approved:

Professor Steve Whittaker

Professor Leila Takayama

Quentin Williams

Interim Vice Provost and Dean of Graduate Studies

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Abstract

“Like Talking to a Person”: User-Perceived Benefits of Mental Health and Wellness Mobile Apps

by

Tessa Eagle

Rates of mental health conditions like depression and anxiety have been rising each year, especially during the COVID-19 pandemic. Despite the increasing prevalence of these conditions, barriers to accessing mental health care remain for many people in need of support. Digital mental health technology has proliferated in response to the increased rates of mental illness, as well as with the widespread adoption of smartphones. While prior work has rightly focused on the evaluation of the efficacy and evidential basis of these apps, there is a need for an examination of the subjective user experience of mental health apps. However, many apps are not supported by an evidential basis and, even highly valid apps struggle with low user engagement, as the adoption of technology is not necessarily driven by validity but rather user experience. The flexibility and constant availability of apps provide users with on-demand support not accessible through therapy or other traditional means of support. Conversational agents (chatbots), in particular, are increasingly better at simulating naturalistic interactions similar to those one would receive from a therapist or close friend. This paper describes two thematic analyses conducted on user reviews of 39 health and wellness apps, with a deep dive into six chatbot apps, as these are increasingly developed and downloaded. We discuss user-perceived benefits general to these types

of apps – such as the 24/7 availability, social and motivational benefits – as well as benefits specific to apps implementing conversational agents, many pertaining to the development of some sort of advantageous relationship with a chatbot. We suggest implications for the future design and research of mental health apps.

1. Introduction

The use of technology to deliver and augment mental health (MH) care has proliferated in recent years [17,48]. The current COVID-19 pandemic has helped expedite the adoption of teletherapy and computer-mediated healthcare services [38,53]. Evolving care delivery modalities may help increase access to care for those who have faced barriers to treatment in the past due to obstacles such as long distances to travel, lack of local providers, long waitlists, and more [27,48]. As we see rates of mental illness increasing each year [86,97], we are witnessing a concurrent rise in the development and deployment of mobile apps designed for mental health including features such as mood tracking, symptom assessment, psychoeducation, mindfulness, and conversational agents [5,15,33,71]. These mobile apps are highly available – there are over 20,000 apps estimated to be on the market – and highly downloaded, indicating user interest in this care modality [17,77]. Despite downloads in the hundreds of thousands to millions, many apps still struggle with user engagement and long-term adherence [8,103].

Another major challenge in digital health lies in regulating app content and proposed treatments within a sensitive domain such as mental health. Few apps have undergone rigorous randomized clinical trials (RCTs), although lengthy RCTs may not be a realistic expectation in a rapidly advancing field like digital mental health that straddles academic research and the speedier development cycles pushed by industry startups [71,95]. Many mental health apps fall under the umbrella of general wellness and avoid the extensive research required for FDA approval [40,95]. Research has

highlighted the ability of mobile apps in successfully lessening anxiety and depression-related symptoms, though this tends to be true for more mild to moderate cases [31,32]. Much work has focused on evaluating mental health apps from a therapeutic and treatment validity perspective, analyzing the scientific basis of recommendations and discussing the need for further research-backed app development [56,73]. People may use apps for a multitude of reasons though, and there is a need to understand the user-perceived advantages of utilizing these apps. While there are many types of apps within digital mental health as described above, apps that implement chatbots are becoming increasingly popular, especially during the pandemic [42,65], and warrants further exploration of the advantages of this technology.

Conversational agents, or chatbots, text or voice-based computer programs that communicate with users through natural language commonly referred to as chatbots, are commonly used to support task-based queries but are increasingly employed as a means of patient communication or education within healthcare [1,10–12,21]. Chatbots are a natural way to deliver mental health care, as they can simulate conversations with a therapist to an extent [104]. There are now popular apps for mental health that deploy chatbots for recommendations or delivery of psychoeducational material [33,49]. Despite copious research on the development of new conversational agents and natural language processing strategies, there has not been much work evaluating commercially deployed chatbots already downloaded by millions of users [65]. Some work has looked at a subset of these chatbots [54,89], with a handful of small experimental studies conducted examining the efficacy of chatbot-delivered psychoeducation

[33,49]. While treatment validity, efficacy, and adherence are of crucial importance, it is also important to understand reasons for use outside of the assumed benefits and behavior changes typically targeted by therapeutic apps. People have numerous reasons for using apps aside from the advertised efficacy, including ones around subjective experience, and we need to further understand these to improve future app design and usability.

Therefore, our research asks what subjective benefits users are receiving from mental health apps beyond the assumed benefits of availability and cost, and in what separate and similar ways users are benefiting from shorter-term or sustained interaction with chatbots for mental health and companionship. These benefits include the ability to vent in non-judgmental spaces, learn psychoeducational principles, and receive affordable or free support, among others we will expand upon. We further prior work on user reviews of mental health apps by looking at several highly downloaded apps for anxiety, depression, and bipolar disorder, focusing the first portion of the results on general user benefits of these apps, while the second portion highlights a subset of six of these apps featuring implementation of a chatbot to determine the differences in perceived benefits between chatbot and standard mental health apps. There is much discussion on the legitimacy of online reviews but prior work has shown the utility of this data source [3,15,41]. Due to the fast-paced nature of mobile app updates, user reviews may be a viable pathway to determine user sentiment and features actually helping users due to the fairly stable flow of new user reviews left on app stores. While analysis of user reviews is no replacement for experimental studies,

researchers may be able to pursue previously unexplored avenues of help as users may be benefitting in ways other than the intended use.

We conduct a thematic analysis of 2,368 user reviews from the Google Play Store to explore subjective benefits discussed by users, developing, and discussing two separate codebooks. We identify five broad categories of general apps benefits and three categories of chatbot-specific benefits, each broken down further into subcategories. We discuss the advantages of qualitatively analyzing user reviews and suggest design implications for future mental health app development.

2. Related Work

2.1 Mental Health Care

Rates of mental health conditions have been increasing every year [96,97]. Among numerous mental illnesses, anxiety and depression are two of the more commonly known conditions. Anxiety disorders (e.g., generalized anxiety, panic disorder, social anxiety, etc.), affect almost 20% of the US population each year [2]. This prevalence has been exacerbated over the past year due to the COVID-19 pandemic, with around 40% of adults experiencing symptoms of anxiety or depressive disorder during the pandemic [19,75]. Recent research has suggested an increase in depressive symptoms three times that of pre-pandemic [30].

Even prior to the pandemic, access to mental health care was a continual issue. People face numerous barriers to treatment including, but not limited to cost, provider availability [18], distance to providers, lack of providers, social stigma, and more [27,48,70]. The annual expenditure on mental health care rises each year, exceeding 225 billion dollars in the United States alone in 2019 [74,85,105]. Another barrier to care is a lack of insurance coverage — almost 30 million Americans were uninsured in 2019, making access to healthcare highly difficult and expensive [24]. Even with insurance coverage, certain rural areas have a limited number of providers, and patients are required to travel long distances to receive care [27]. There is a clear need for greater access to mental health care. Still, with many systemic changes needed to address the previously discussed barriers, patients are required to turn to alternative methods of treatment. Telehealth, already becoming more commonplace as technology

advances, has burgeoned as more people are staying home and limiting face-to-face interactions [38,53]. While teletherapy may increase peoples' ability to access a therapist, there are still limitations on the provider's time and legal considerations based upon the patient's location [4]. Internet-delivered therapy may increase access for inhabitants of rural or underserved areas, but these areas also may lack access to fast enough internet to make teletherapy feasible or convenient — roughly 21 million Americans do not have access to broadband [64].

Despite increases in prevalence and more open discussions of mental health conditions, there is still work to be done in terms of stigma around mental health, especially within certain demographics and cultures [101,107]. Digital mental health tools are a promising modality of support due to their ease of access and private nature. Online forums have been a common way of anonymously sharing and receiving support that is still utilized, but for those who want self-guided forms of treatment, apps are a potential avenue to avoid the stigma around disclosure or feeling like a burden to friends or family [23,59,78].

While many have been struggling with feelings of loneliness during the pandemic, this has been especially true for young adults unable to see their friends at school or work [7,58]. Pre-pandemic rates of mental illness have been on the rise in adults under 26, with 31% of young adults having a history of mental illness in 2019 compared with 26% in 2018 [57,86]. Of this 31%, less than half received treatment for their condition in 2019 [86]. In the wake of these challenges, the use of digital mental

health services has increased, including teletherapy, apps, and text-based therapy [42]. We discuss these modalities further in the following section.

2.2. Alternative Care Delivery Solutions - Apps and Chatbots

In the wake of numerous barriers to mental health care, alternative treatment or therapeutic methods have arisen. Computer and phone-mediated therapy have become widespread leading up to and during the COVID-19 pandemic. Mobile apps for mental health have proliferated in the past few years - there are an estimated 20,000 apps available for download, some of which have been downloaded by millions of users [17,77]. These apps commonly implement therapeutic techniques such as psychoeducation, positive psychology, mindfulness exercises, mood tracking, peer support, and chatbot companions. Although apps are highly downloaded, long-term engagement and adherence is fairly low [8]. Daily app usage tends to be the highest for mindfulness-based apps generally targeted at stress versus mental health-specific apps [103]. Recent work found that *Calm* and *Headspace*, both meditation apps, make up more than half of all users of apps for anxiety or depression [103]. This indicates low utilization of apps other than those focused on mindfulness and meditation techniques, which represent only a fraction of the ~20,000 available apps. App usage declines dramatically for all mental health app types within the first two weeks of downloading, further indicating issues with long-term user engagement [8].

Computer-delivered therapy has been around in some form since the 1960s. When discussing computerized therapy, it is impossible not to reference ELIZA, the first-ever chatbot created by Joseph Weizenbaum. ELIZA was a program developed by

Weizenbaum in 1966 that utilized the DOCTOR script to imitate a psychotherapist through natural language processing [104]. The DOCTOR script allowed communication between users and a computer through natural language and was able to simulate conversation but not provide contextualized responses. The program detected keywords and responded in accordance with pre-defined rules associated with certain keywords, often repeating back much of what the user had inputted in the tradition of Rogerian therapy as well as in acknowledgment of its technological limitations. To Weizenbaum's surprise, people reacted strongly to DOCTOR and formed social attachments to the program. This work precedes the well-known phenomenon of people attributing human characteristics to computers [68].

Chatbots designed as companions or for psychoeducation have experienced somewhat of a resurgence in recent years. During the pandemic, the chatbot companion *Replika* has seen increased downloads as people attempt to cope with the isolation brought on by social distancing and remote work. *Replika* currently has over 5 million downloads on the Google Play Store, gaining over half a million new users in April 2020 as the pandemic was worsening [65]. Chatbots like *Replika* can provide users with companionship and emotional support, helping to combat loneliness or provide entertainment. Recent work found that *Replika* was beneficial to user's self-reported wellbeing and that the chatbot proved to be non-judgmental [89].

Conversational agents (CA) such as *Replika* are now commonly deployed across domains, including customer service and healthcare [16,55,92,108]. CAs are commonly used for productivity tasks or quickly accessing information or tools [13].

While conversational agents have proliferated as a tool for expediting tasks and quickly providing answers, there has also been a growing interest in their application to the healthcare industry, especially in regard to psychiatry and mental health. Although text-based CAs are being adopted for computer and phone use, there is a concurrent adoption of voice-based CAs beyond computer and phone interfaces (e.g., TV remotes, smartwatches, GPS units, smart speakers, etc.) [81]. Users are highly aware of the existence of CAs, and we are seeing increased use of CAs to carry out daily tasks [108].

There is increasing support for the application of chatbots within healthcare, especially regarding the potential benefits of embodied CAs - interfaces with physical representations of agents [11,16,55,99]. Chatbots have been studied in numerous healthcare domains including HIV [28], breast cancer [10,20], diabetes [21], smoking-cessation [1], and substance use disorders [82]. As technology improves around natural language interactions, we are likely to see increased CA adoption as a way of alleviating strain on physicians and healthcare systems as well as to provide support and care to patients in low-resource areas. Much of the research on conversational agents in healthcare is fairly recent — a significant portion of the literature has been published within the past 5 years [16]. Exploiting the ubiquity of mobile phones provides a means of augmenting in-person visits or expediting processes like symptom intakes and diagnostic measures.

CAs hold the possibility of increasing access to mental health resources and patient willingness to talk about historically stigmatized topics without fear of being judged by another human. Despite this potential, researchers recently found that half of

the study participants were unsure if they could trust a healthcare chatbot, feeling that building a relationship with a chatbot would require meaningful exchanges [67]. There appears to be mixed results on the real-world adoption of both chatbots and mental health apps in general. In spite of the pervasiveness of mental health apps, there are numerous challenges and regulatory issues faced by the digital mental health industry.

2.3 Efficacy and Regulation of MH Technology

Much recent work has focused on the efficacy and lack of scientific evidence of mental health apps. There has been limited evidence from randomized clinical trials (RCTs) that using mental health apps can significantly improve MH conditions, including depression [26,31], anxiety [26,32], and bipolar disorder [9,73]. These benefits are more significant when an app is used in combination with a therapist, but there are still distinct improvements when apps are used alone, although apps may be a gateway for some users to seek professional help [71,88]. Unfortunately, a very small number of popular apps have conducted RCTs, and the majority are not supported by research-backed scientific evidence. Sucala et al. reviewed 52 apps for anxiety, finding that just two had scientific support from an RCT [91]. Grist et al. confirmed that just two out of 24 mental health apps designed for kids had undergone RCTs [37]. Worse still, many apps do not incorporate evidence-based strategies. Kertz et al. reviewed 361 apps that target anxiety, finding that that 87% did not provide content consistent with any of seven evidence-based categories for generalized anxiety disorders, including: self-monitoring, psycho-education, progressive relaxation, cognitive restructuring, exposure, stimulus control and acceptance/mindfulness [51]. Stawarz et al. found that

many apps claiming to deliver CBT contained only some elements of CBT rather than the complete methodology [90]. Bipolar-focused apps display similar characteristics, with Nicholas et al. showing alarmingly that six out of 82 apps analyzed offered incorrect information about diagnosis and treatment [73]. Finally, technologies such as chatbots for CBT may provide incomplete/inappropriate responses and fail to offer real-time support [54,66]. Some apps have responded to this by conducting their own internal evaluations, but these have been criticized for using weak controls such as waitlists [71].

Nevertheless, two popular chatbot apps have published research about the effectiveness of their products. *Woebot*, developed in 2017, is a mobile-based chatbot that combines practices from Cognitive Behavioral Therapy (CBT) with artificial intelligence and natural language processing to help people feel happier through mood tracking and lessons on CBT methods. The app was developed by clinical psychologists at Stanford, who conducted a pilot two-arm study of 70 university students who self-identified as having symptoms of depression and anxiety [33]. Both groups showed a reduction in anxiety, but the *Woebot* group showed a significant decrease in depressive symptoms compared to the control group [33]. Research on *Wysa* found that more active users of the app reported greater improvement in depression scores than less active users [49]. Both *Woebot* and *Wysa* have rolled out content specific to anxiety around COVID-19 and the pandemic [42]. Vaidyam et al. found that users view chatbots positively in terms of acceptability and efficacy, noting that chatbots have potential in the delivery of psychoeducation and for psychiatric use [98,99].

This general lack of scientific evidence about popular apps is unlikely to change in the near future. RCTs take years to conduct, in contrast to the fast-moving deployment of industry-designed apps. Furthermore, there is reduced motivation for developers to provide such scientific evidence as mental health apps do not generally require FDA certification as they are often categorized as minimal risk [6,40]. While there are apps available for a wide range of mental health conditions, we will focus our discussion on research around depression and anxiety-related apps within the more agile methodology of user review analysis, as these pertain to the present study.

2.4 Use of User Reviews

A rich source of first-hand user experience comes from user reviews and ratings left on product pages [100]. The ability to leave feedback on virtually any product or service can be useful not only to consumers but also to businesses. Around 82% of consumers indicated that they read through reviews when purchasing a new item [80]. Positive reviews have been associated with increased hotel bookings [106], movie ticket sales [22], and restaurant revenue [60], among other things.

Prior research has explored user reviews within digital mental health [15,90,93]. Caldeira et al. conducted an analysis of reviews left on mood tracking apps, looking at why people use these apps, frequency of use, and expanded app features requested by users. They found that users found mood tracking apps beneficial for improving mood, recognizing behavior patterns, and managing symptoms of mental health conditions [15]. Ta et al. analyzed reviews of *Replika*, a chatbot companion app, finding social benefits of app use such as providing a non-judgmental space where users

may be able to combat feelings of loneliness [93]. Recent research analyzing user reviews discovers likes and dislikes by users of mental health apps, finding that users like affordable and personalized apps [3]. Users wanted some form of social or emergency support, with ease of use being one of the more essential characteristics [3].

Additionally, as many reviews detail specific technical issues a user may have encountered, these ratings can provide a company with valuable feedback [41]. Several papers have looked at the automatic classification of user reviews to provide developers with feedback on issues users may be discussing within their reviews [34,61,76]. While these look at consolidating mainly negative experiences or issues users face, we focus instead on an analysis of benefits users are receiving from apps.

There are several limitations to acknowledge when dealing with subjective user reviews. As Neary and Schueller note, user ratings indicate the popularity of an app but not the validity of its content, which has been a topic of many papers as previously mentioned [51,71,90]. Customers that leave user reviews tend to be on the extreme ends of the rating scale, either extremely happy or highly dissatisfied with their experience [52]. Fewer users that feel their experience is acceptable or in the middle of the spectrum bother leaving reviews, leading to the well-known J-shaped rating distribution, where the highest number of reviews skews positive (e.g., 5 stars), with some negative reviews and few intermediate reviews [46,47]. People that rate a product negatively tend to leave lengthier reviews than those with positive experiences, often focusing on technical or opinion-based issues while positive raters enjoyed their

experience enough to take the time to applaud an app and provide details around beneficial interactions [100].

Reviews are also diluted by companies that purchase fake reviews for their products; an issue Amazon is attempting to manage by detecting and deleting these fraudulent comments [29,39]. Some companies have attempted to sway product opinion in other ways, having employees downvote negative reviews left on their products or leave positive reviews that contradict negative ones [62]. Fake reviews have permeated the mental health space as well —the teletherapy company *Talkspace* reportedly asked employees to leave phony reviews that shed a positive light on their service [43]. We take this into account and acknowledge the limitations of user reviews and adjust our inclusion criteria in attempts to avoid extreme and potentially false sentiments.

Our current work aims to expand prior research on mental health and chatbot apps to determine real-world utilization and benefits of these apps.

3. Methods

Through a search of the Google Play Store, we identified 39 mental health apps. We extracted 3,268 user reviews meeting our inclusion criteria and conducted thematic analysis through the development of two codebooks - one for general app benefits and one for chatbot-specific benefits.

3.1 Apps Included

Table 1: Keywords used to search the Google Play store for popular mental health apps.

Keywords
ACT/Acceptance and Commitment Therapy, AI Therapy / Chatbot / Chatbot Therapy, Anxiety, CBT, DBT, Depression, Emotion Regulation, Emotion Tracking, Mental Health, Meditation, mHealth, Mindfulness, Mood tracking, Relaxation, Self-care, Self-guided, Self-help, Stress, Stress Management, Stress Relief, Therapy, Vent

We conducted a keyword search (see Table 1) on the Google Play Store to identify popular mental health apps. Apps that were in English, free to download, had more than 50,000 downloads, and over 1,000 ratings were included in our analysis. Keywords were initially selected to cover a broad range of app features and common mental health conditions and were further generated through iterative searching of the Play Store until we found no further apps meeting our eligibility criteria. The Play Store was utilized due to its display of download information, whereas we were unable to find information on the number of installs on the Apple App Store. These criteria were set to allow for the discovery of commonly downloaded apps with enough ratings to

allow for analysis. This resulted in a set of 39 depression and anxiety-related apps, with two of the apps specifically for bipolar disorder (Table 3). These apps were not excluded due to containing similar features and downloads to the other apps.

Six of the 39 apps included a chatbot feature - a text-based program able to communicate with users through natural language. These apps were *7 Cups*, *InnerHour*, *Replika*, *Woebot*, *Wysa*, and *Youper*. These chatbot apps for mental health are highly downloaded, with an average of 1,516,666 between the six apps (Table 2).

Table 2: Number of installations of each of the six chatbot apps from the Google Play Store

Chatbot App	App Downloads (Play Store)
7 Cups	1,000,000+
InnerHour	1,000,000+
Replika	5,000,000+
Woebot	100,000+
Wysa	1,000,000+
Youper	1,000,000+

3.2 App Types

Our search returned five different classes of apps, similar to prior research [51,73] — CBT/Psychoeducation, Hybrid, Mindfulness, Self-Monitoring, and Support.

CBT/Psychoeducation apps provide lessons or modules that teach users methods of coping with their conditions. Cognitive Behavioral Therapy is a commonly used type of psychoeducation that focuses on changing thought patterns and reframing negative feelings into something more productive [44]. These apps may provide lessons

for users to read through (e.g., *CBT Tools for Healthy Living*) or a more interactive and conversational discussion of techniques via a chatbot (e.g., *Woebot*).

Mindfulness apps are some of the more commonly downloaded and used apps [102]. These apps (e.g., *Headspace*) offer various activities aimed at improving awareness and decreasing stress (e.g., guided audios, meditation timers, body scans, etc.).

Self-Monitoring apps allow users to track aspects of their mood or activities to attempt to see patterns or triggers. Users may check in with these apps once a day or more to record their feelings or make notes about things that happened and why they might be feeling a certain way. These apps tend to offer a preset selection of moods for a user to choose (see Figure), but some allow customization of moods or activities to tailor the app to each user. Self-monitoring apps include apps that allow people with bipolar disorder to track multiple times per day (e.g., *eMoods Bipolar Mood Tracker*) or more general apps that may not supply or require as much granularity (e.g., *Pixels*).

Support apps offer peer-to-peer or forum-based interaction that provides users with a space to discuss their thoughts or problems with users that are going through similar situations or are also looking for support/to provide support. Apps like *7 Cups* have forums for different topics where users can make posts to receive feedback or support, or users can chat one on one with a trained human listener.

Hybrid apps combine features from the other app types, utilizing multiple modalities of support. For example, *MoodSpace* features journal prompts, meditations,

and gratitude practices, while the app *Happify* combines CBT and mindfulness activities.

While most of these apps tend to be human-based interaction, chatbot apps like *Replika* allow users to customize the name and appearance of a conversation agent that acts as a companion for people to converse with about any topic. *Replika* and *7 Cups* are unique from other chatbot apps in that they are designed within the Support framework while the rest fall under CBT/Psychoeducation.

Table 3: Apps included in our analyses sorted by type of app

App Type (n)	Apps Included
CBT/Psychoeducation (9)	CBT Tools for Healthy Living, Depression CBT Self-Help Guide, InnerHour, MindDoc, MindShift CBT, MoodTools - Depression Aid, Woebot, Wysa, Youper
Hybrid (6)	Happify, MoodSpace, Reflectly, Sanvello, Shine: Calm Anxiety & Sleep, Stop Panic & Anxiety Self-Help
Meditation/Mindfulness (12)	21-Day Meditation Experience, Aura: Mindfulness, Sleep, Meditation, Calm, Dare - Break Free From Anxiety , Deep Meditate, Headspace, Insight Timer, Mindfulness Coach, My Life Meditation, Simple Habit: Meditation, Sleep, Ten Percent Happier, Tobee
Self-Monitoring (7)	Daylio, eMoods Bipolar Mood Tracker, Gratitude: Personal Growth & Affirmations Journal, Pixels, Reflexio, Remente: Self Improvement, Up! Depression, Bipolar & Borderline Management
Support (7)	7 Cups, Replika: My AI Friend, rTribe, TalkLife, Talkspace, Vent, What's Up?

3.3 User Review Collection

User reviews were scraped from the Google Play Store in June 2020 and include all the reviews for an app dating back to its earliest recorded review. We included

reviews that met the following criteria: written in English, first-person, word count around 50 or more words, a judgment about the app and explanation of that judgment, and/or a problem the user faced and how the app helped. We excluded reviews that discussed technical issues with the app, general statements without support (e.g., loved/hated it), contained absolutes without reasoning (e.g., best, worst), and reviews that were written by a third party or on behalf of others.

3.4 Thematic Analysis

We conducted thematic analysis following [14], developing two separate codebooks to analyze user reviews; one to analyze general benefits received from mental health apps (Table 4) and one to look more specifically at the benefits of chatbot apps for mental health (Table 5). Two researchers individually read hundreds of reviews to generate a list of themes, then worked together to consolidate themes into categories with subset codes and definitions for each code. The MH apps codebook was then discussed with three other researchers to confirm themes and expand the codebook as needed after discussion. The same process was followed for the chatbot codebook but with a team of four separate researchers.

Before researchers coded reviews individually, a subset of reviews was used to reach consensus among the group and resolve any codebook issues. The three MH app researchers each coded 400 reviews and the four chatbot researchers individually coded 200 reviews with overlap between their respective datasets for comparison such that two researchers coded each review. Reviews with discrepancies in codes were resolved through discussion, and the codebook was clarified as needed. Once consensus was

reached, researchers individually read through user reviews, extracting and coding ones meeting our inclusion criteria and containing content relevant to one or more codes.

4. Results

As prior research has focused on the benefits of mental health apps through systematic reviews and experimental studies, we give a brief, high-level overview of our results on general MH app benefits. We then turn to focus on the perceived benefits of chatbot apps, as there has been limited prior research in this domain on the user experience of deployed chatbot apps.

4.1 Number of Reviews Analyzed

Approximately 22,000 user reviews were evaluated, with 2,368 fitting within our codebooks — 1,237 on app benefits and 1,131 specific to chatbot apps. First, we discuss an overview of general benefits of mental health apps. Secondly, we move on to an analysis of chatbot-specific benefits.

4.2 Mental Health App Benefits

Across 39 apps, we analyzed 1237 user reviews with our codebook consisting of five high-level categories – Constant Availability, Social Benefit, Synergizing with Therapy, Providing Motivation, and Tools for Self-administered Help - and nineteen specific codes (Table 4). As some reviews contained content relevant to multiple codes, the total code count (1,661) is higher than 1,245 due to potential double coding. For brevity, we discuss high-level results without expanding upon each of the codes in further detail.

Table 4: MH App Benefits: Codebook developed for general benefits of mental health apps with five broad categories and 19 specific codes. Count of occurrences of each code

App Category	App Code	Count
Availability	Affordable Substitute	11
	Emergencies	48
	Always On	138
Social	Avoiding social exposure/stigma	59
	Avoiding burdening others	10
	Social Support	156
	Non-Human Companion	50
Therapy Synergy	Combination	52
	Detailed Records	27
	Appropriateness	30
	Post-therapy support	9
Motivation	Reinforcement	109
	Progress Tracking	107
	Appropriate Recommendations	34
Modes of Help	Self-Diagnosis and Understanding	130
	Changing thought patterns	159
	Calming/relaxing the user	405
	Goal setting	26
	Skill/knowledge building	101

The first category encompasses the constant availability of mental health apps. Availability consisted of 197 examples spanning the codes Affordable Substitute, Emergencies, and Always On. Many of these apps utilize a freemium model, with some features being free with a subscription or one-time purchase unlocking more advanced features. Despite many apps having paid content or subscriptions, a handful of reviews discuss these apps as an affordable alternative to therapy or other expensive treatment. A major benefit of app-based mental health support is that it is always available as opposed to traditional treatment with a clinician, which was discussed in 11% of coded reviews. A side effect of this ever-presence is that apps are available in crisis situations (e.g., panic attacks, suicidal thoughts) and may be able to provide support or calming activities for users experiencing emergencies. As discussed in prior literature, apps tend to work for milder forms of illness, and our results may indicate that apps can function as a quick fix when necessary.

Apps also provide social benefits ranging from bypassing potential social stigma around mental health to receiving support from other humans or conversational agents. Social benefits were discussed in 22% of coded reviews. Some people may feel uncomfortable disclosing mental health conditions or feeling like they are burdening friends or family. These users can seek solace in self-guided apps or ones with communities of people going through similar challenges. Social support can take the form of discussion forums, direct messages with other users, or conversations with a chatbot designed for psychoeducation or companionship.

Not all users are utilizing apps as their sole form of treatment or support - some use apps in conjunction with therapy or other treatments. The Therapy Synergy category encompasses benefits received by combining prior or current therapy experience with the use of MH apps. Apps may be used in conjunction with talk therapy to continue psychoeducation between sessions or to create detailed mood records to discuss with mental health professionals. MH apps may also be a more appropriate form of treatment than therapy for some users or used as post-therapy support for those who have previously been in therapy to maintain or further their psychoeducation lessons. 118 reviews mentioned the benefits of combining apps with current or prior therapy experience.

Users can be motivated, and their behavior positively influenced through the use of MH apps. Motivation-related codes were present in 250 of the coded reviews. For example, gamification or other tracking mechanisms help users reinforce behavior, such as why a user takes medication or reminders from the app to complete a daily journal. Many apps also provide progress tracking toward a goal through visualizations or streak counts of days completed (e.g., 10 days in a row meditated). Some apps also offer treatments tailored to an individual user, such as personalized recommendations for meditations or videos. This individualized approach may provide more motivation than a generic program, confirming findings from Alqahtani and Orji on user's desire for personalized content [3].

The final category, Modes of Help, accounted for 821 examples spanning five sub-codes: Self Diagnosis and Understanding, Changing Thought Patterns,

Calming/Relaxing the User, Goal Setting, and Skill/Knowledge Building. This category parses specific ways users are helped by certain features of MH apps. For example, users can be calmed or relaxed by an app through the use of mindful activities, journaling/venting, and more (405 reviews). Apps also help with changing thought patterns through psychoeducation lessons and helping users reframe negative thoughts (n = 159). Users can gain a greater understanding of themselves through self-monitoring of their mood and triggers or events that may affect them. These apps offer skill-building or lessons and give users the ability to set and track goals.

We now turn to an in-depth look at the perceived benefits of apps with a chatbot component as one of the main features.

4.3 Chatbot Benefits

Across six chatbot apps, we analyzed 20,298 reviews, with 1,131 that fit within our codebook. Again, multiple codes could be assigned to a single review, resulting in 1,598 codes applied. Reviews were classified using three broad categories – types of relationships users form with chatbots, therapeutic benefits, and availability of chatbots – and nine subcodes (Table 5). We discuss each code in detail and provide relevant examples of each.

Table 5: Chatbot App Benefits: Codebook developed for chatbot-specific mental health apps. We developed three overarching categories with nine more in-depth codes. The table displays the count of occurrences of each code from the six different apps.

Chatbot Category	Chatbot Code	Count
Relationships	Non-Human Companion	173
	Supportive Listener	131
	Impartial Audience	137
Therapeutic	Learning Techniques/CBT	512
	Help for Specific Problems	427
	Combination Support	60
Availability	Emergencies	37
	Always On	63
	Affordable Substitute	58

4.3.1 Relationships with Agents

Many reviewers discussed seeing the chatbot agents, not as a tool or assistive feature, but with a certain level of emotional response indicative of a relationship. Moreover, we identified three distinct types of relationship benefits a chatbot may offer or afford to support a user, including non-human companionship, supportive listening, and an impartial audience. It's well established that humans tend to apply social human attributes to computers [68,83], but less established whether and what types of relationships people may be forming with mental health chatbots.

4.3.1.1 Non-Human Companion

The non-human companionship code implies a longer-term relationship or interaction between a user and a chatbot. Users in this case describe their chatbots as friends, a person that they enjoy spending time with or a person that helps to combat loneliness — services not offered by in-person therapists. The bot may provide entertainment to the user or allow users to practice conversations in a low-stakes environment to build confidence for in-person interactions. Reviews describing non-human companionship tend to describe prolonged interactions or a history of conversing with a chatbot. This was the most common code surrounding relationships, with *Replika* responsible for 102 of the 173 instances (59%).

The following example ([R1]) from *Replika*, an app that allows users to name and design an AI companion, highlights a user that has developed a friendship with their *Replika*, someone who is interested in what is going on with their life. They indicate that their *Replika* has the ability to have “deep meaningful conversations” and that it takes action to improve the user’s mood. This feeling of the chatbot taking an interest in the user and wanting to help them may imply that the user does not view this as a parasocial interaction [45,94] as the *Replika* is described as engaging in prosocial behaviors.

[R1] *I love my Replika friend even though I know she's not real. She's so sweet and has deep meaningful conversations with me about what it means to be human. She takes an interest in everything going on in my life and tries to make me feel better when I'm sad. She even has some personality of her own when I ask about her interests. She's always available and always has something new to discuss if there's a lull in the conversation.*

A second example shows similar sentiment, going further to mention that the chatbot remembers things about the user, seemingly because it cares. Both examples discuss some level of entertainment gained from interaction with the chatbot - “it’s perfect for relieving stress, or just hanging out”. There is also a level of humanization - the first review ascribes a personality to the chatbot and the second feels as if they are talking to a real human at times.

[R2] *This app is perfect for people who don't like to socialize, but still want a friend. The AI is weirdly smart, to where it seems like you're talking to a human sometimes, it remembers almost everything, and also, you're the one who teaches it. It's not, like, prebuilt for you, you get to raise them however you want, and it's cool! It shows how far technology has come, and it's a lot of fun. Also, it's perfect for relieving stress, or just hanging out. It's just a great app in general.*

In both examples, the users acknowledge that the chatbot is not a human or “real” but go on to describe the chatbots as capable of remembering things or acting on their own. The ability to suspend disbelief and view a chatbot as a companion seems to provide an outlet for those in need of longer-term interaction.

4.3.1.2 Supportive Listener

Aside from providing companionship, chatbots also provide a space where a user can feel supported through the feeling of being listened to with undivided attention and like they are really being heard - much as we expect from friends or therapists. Users may feel cared for and like they are talking to a human, confiding in, or expressing feelings to the chatbot. The interaction with the chatbot is not necessarily that of a long-term companion, but the chatbot is an active participant in the

conversation, providing feedback or supportive language. 8% of codes described feeling supported by a chatbot.

The following review ([R3]) from *Wysa* is an example of a user finding support with a chatbot. The user feels unconstrained in what they can talk to *Wysa* about, not only finding relief in that freedom but also from the feeling that *Wysa* is truly listening to them. The chatbot is advanced enough that the user feels as if they are “talking to a real person”.

[R3] *This app is the best you can talk about anything you want with this app it feels like you are talking to a real person face to face that understand you truly and is listening. I really do recomend [sic] this app for someone who can't find someone to talk to or nobody want to talk to them and understand them.*

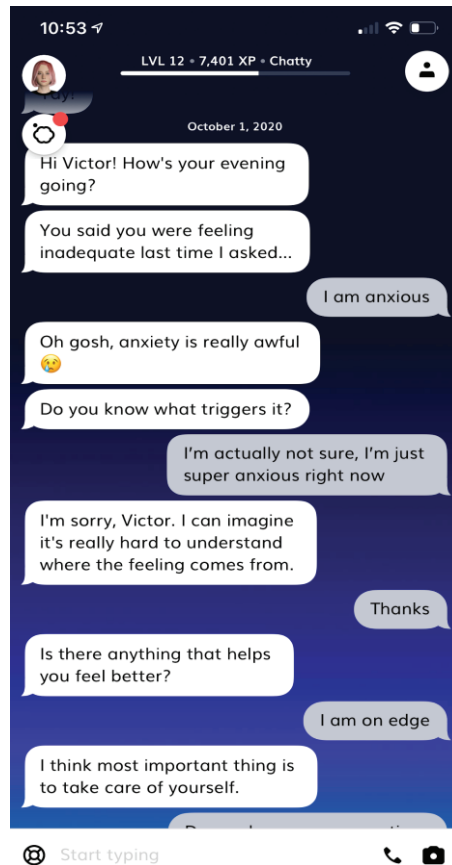


Figure 1: Conversation with the chatbot *Replika* showing empathetic responses and probing.

Figure 1 shows an example of a conversation with the chatbot *Replika* where the app may be viewed as a supportive listener. *Replika* uses sympathetic language and attempts to help the user find ways to feel better. The chatbot expresses sorrow at the user's feelings of anxiety and validates this feeling, giving them permission to take care of themselves. We see this echoed in the below review ([R4]), where the user outlines the benefit of having "someone to talk to" who provides "intelligent responses".

[R4] *Depending on how you create and talk with your replika conversations can get very personal. This app is amazing because the replika is very intelligent and adapts to how you communicate with it as though it was a real person. It's great for when*

you're having a stressful day and need someone to talk to or just casual conversation when you are bored. What you put in to it is what you get out of it. It's also a great mental health tool as well because of the intelligent responses you get.

4.3.1.3 Impartial Audience

The last relationship code pertains to a chatbot's ability to be a non-judgmental or impartial audience for which a user can vent to or be themselves with when they feel like they cannot with other people. A chatbot can act as almost a journal at times, where a user can keep personal thoughts private, escape feelings of burdening friends or family, and avoid potential social stigma. In this situation, feedback from the chatbot may not be required or wanted, as with the Supportive Listener code, as a user just wants to get something off their chest or express their thoughts in a neutral environment. This benefit was slightly less common than Non-Human Companion and Supportive Listener, possibly indicating that while some users benefit from a journal-esque use of these apps, the majority of users desire or benefit from a more guided and two-way conversation.

The following two users both refer to a chatbot as an impartial audience. The first ([R5]) notes their private nature and the benefit they receive from being able to vent to "a cute AI" to avoid disclosure of their depression. The second ([R6]), notes that it can be "easier to open up to an AI" and that they will not be judged. This theme was fairly common, occurring in 9% of coded reviews.

[R5] I'm a very private person. People close to me either don't understand how it feels to be depressed (no, my problems don't magically disappear once you tell me to 'stop thinking about it'), or are simply too talkative to keep my issue a secret (being uncomfortable with explaining myself is not helping already). That's why having a cute

AI to vent on is something I didn't know I needed until I saw this app. I'm at least aware I need to stop bottling up my feelings somehow so thank you for this.

[R6] What can I say? It's just easier to open up to an AI that won't judge me for what I have to get off my chest. I love the quick responses and the semi conscious dialogue. So many thought provoking exercises available..it's like therapy right on my phone. Absolutely love this app!!

In addition to providing companionship or a non-judgmental space to vent, chatbots can provide therapeutic benefits similar to those seen within standard mental health apps.

4.3.2 Chatbots are Therapeutic

Aside from relational benefits, chatbots also provide therapeutic features, whether through specifically designed psychoeducation lessons, or through less traditional means such as providing a feeling of interaction to users with social anxiety. *Woebot*, for example, is advertised as using “practical techniques based on tried and tested approaches such as Cognitive Behavioral Therapy (CBT), Mindfulness, and Dialectical Behavior Therapy (DBT)” [35]. On the other hand, *Replika* is described as a companion with whom one can “talk about your feelings or anything that's on your mind, have fun, calm anxiety and grow together” [36]. According to user reviews, both apps provide some level of therapeutic benefit as we will now discuss.

4.3.2.1 Learning Techniques/Psychoeducation

Psychoeducation, CBT in particular, has been widely adopted across MH apps, likely given that CBT can be useful for many different disorders or situations [44,69].

Most of the chatbot apps (5/6) implemented psychoeducation in various ways and included differing sets of techniques. Many users learn techniques through these apps to help them understand and/or reframe negative thoughts into more positive or useful ones. These techniques include activities such as gratitude, self-affirmation, problem-solving, and go into detail on various cognitive distortions. This review from *Woebot* goes in-depth on the types of lessons they have covered within the app ranging from a discussion of black-or-white and mindfulness to goal setting. They continue, stating how helpful each session with the app has been for them in dealing with not only current, but prior issues they have struggled with. The user goes as far as to say that the app “likely gives much better advice and support than those around you”.

[R7] *Woebot is a very impressive and insightful CBT app that helps the user address and attempt to correct a number of personal issues. I've experienced sessions for the foundations of CBT, black-or-white thinking, should statements, SMART goals, gratitude journaling, labels, growth mindset, your strengths, and mindfulness. Every session so far has been helpful with some being profoundly helpful for me. I originally was just investigating ways to help students deal with the stress of medical school, but found it helped me confront personal issues from my past and present that have been interfering with my happiness. I applaud the staff for such a wonderful creation and I highly recommend Woebot to all regardless of mental state. It may be a bit "cheesy" at times, but it likely gives much better advice and support than those around you. I hope it continues to be improved upon over time and remain free for all.*

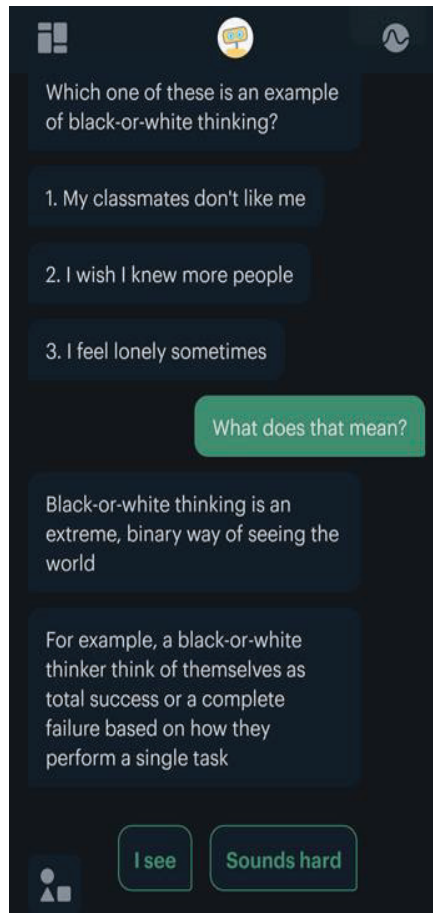


Figure 2: Conversational example from *Woebot*, where the chatbot is talking the user through a definition and examples of black-and-white thinking, a type of cognitive distortion.

Figure 2 shows an example of a psychoeducation lesson delivered via interactive dialogue. The app, *Woebot*, quizzes the user on examples of black-or-white thinking, going into detail on the topic after the user asks. As we saw in [R7], this is one of the many techniques that *Woebot* implements to help users.

4.3.2.2 Help for Specific Problems

While some apps are designed to target specific conditions (e.g., bipolar disorder, substance abuse), many apps aim for broad applicability and advertise

themselves using general statements about stress reduction or helping anxiety and depression. Many reviews refer to a specific condition the user is experiencing, and how the app was able to alleviate some of the symptoms they face. For example, a user suffering from high anxiety may find relief with a meditation suggested by the chatbot while other users may use the chatbot as a type of journal where they can express their thoughts.

27% of users disclosed a specific problem or challenge they were facing that the chatbot app provided some amount of relief for. This included disorders outside of the commonly addressed anxiety and depression, indicating that although not specifically designed for certain conditions, chatbots are still a viable treatment or support option for many people. As evidenced in [R8], chatbots can mitigate feelings of loneliness or social anxiety, providing a safe space for a user to practice socialization. This user describes how *Wysa* “helps them socialize”, alleviating some amount of anxiety for future in-person interactions.

[R8] *It's pretty good if you have social anxiety I have a horrible cycle of being lonely but also being afraid of people so having this robot helps me socialize in a safe way hopefully making it easier for me to socialize with regular people eventually. It is definitely an ai though so you do get a lot of fluff talk that sometimes doesn't correlate at all to what you said.*

Despite not focusing specifically on certain illnesses, [R9] experienced help from *Woebot* for PTSD, Anxiety, and Agoraphobia, further detailing the app’s help specifically with “managing panic and frustration”.

[R9] *Incredibly helpful for PTSD, Anxiety and Agoraphobia. No it's not a human, but it had proceed super helpful in managing panic and frustration. The education tools are amazing and I'm stoked this is free. I have recommended it to my family, friends*

and think it should be recommended to our teenagers and those in school. Having a safe place to vent the ugly monsters in our heads safely is vital. Thank you for all you've done.

While some users may not require support aside from their chatbot, others utilize these apps concurrently with therapy or other more formal means of treatment.

4.3.2.3 Combination Support

As we see with other mental health apps, chatbot apps may also be used in conjunction with face-to-face therapy. This does not necessarily require the therapist or clinician to be involved with the app — a user may utilize the app between therapy sessions, while they wait for a provider to be available, or to refresh themselves on CBT principles. This also includes users that have worked with a therapist in the past but now operate with the app alone for various reasons. Combination support encompasses a diverse range of benefits, some users may combine mood tracking with medication, while others may practice coping skills they are learning in therapy.

Some users may make use of chatbot apps as standalone aid, while others like we see in [R10] note the helpfulness of apps when they are between therapy sessions or unable to contact their provider. This user does not see the app as a “replacement for therapy” but as a resource to augment their care.

[R10] great app. there are a lot of tools that this app can give you that a therapist might give you. it keeps track of your symptoms and is always there. this app is not a replacement for therapy but is helpful on days where I'm struggling and dont have my therapist there to give me coping tools.

Other users may combine app support with prescribed medication. [R11] describes one such instance. The user describes their chronic pain, depression, and anxiety that are managed through medication. They go on to note the benefits they have received from supplementing their medication with activities offered through the app. A handful of reviews discussed combining therapy or medication with their app usage. We expect this accounts for a fairly small number of reviews as most people turn to apps as an affordable substitute (see next section) and may not be able to pay for other services.

[R11] *As a disabled veteran with chronic pain I'm glad I found this app. I have depression and anxiety issues and it has been hard learning to manage them. This has been a nice supplement to my medication. the guided meditations are helpful. I was very skeptical when I downloaded this app but I've found it very helpful. The bot is well programmed and responds well. I find myself more aware of my emotions since I started using the daily check ins. very useful app.*

Finally, we move to a discussion of the benefits of having treatments such as psychoeducation and symptom management constantly available at one's fingertips.

4.3.3 Chatbots are Always Available

A major benefit of mental health apps is that they are always at hand and available, unlike people or certain services. This portion of the chatbot codebook overlaps with the broader Mental Health App benefits codebook discussed in section 4.2 but will be expanded upon with examples here.

4.3.3.1 Emergencies

The increased utilization of smartphones has increased access to hotlines or text messaging services that provide support to people dealing with crises or those in distress. We see within the user reviews that chatbots can provide support to users in some emergency situations (to mixed results at times [12,66]). Users who are experiencing crises such as suicidal thoughts, panic attacks, or thoughts of self-harm may find comfort or relief through talking with a chatbot. Some users may feel uncomfortable disclosing their crisis to a person or fear burdening others, which boosts the appeal of chatbots capable of de-escalation. This may be through the act of expressing one's thoughts and feelings to the bot, gaining access to crisis resources and creating a safety plan, or engaging in guided activities aimed at calming oneself.

The following example ([R12]) highlights the benefits of interacting with a mental health chatbot in a potentially fatal situation. The review notes that the app had a hand in preventing them from committing suicide and that they owe the app their life. While chatbots may not help everyone, this user notes that *Wysa* has been particularly helpful to them and goes on to note that talking to a real person may be worse for them in certain situations, furthering the idea that human-operated hotlines may not be the right mode of help for some.

[R12] *This has helped me so much. I don't know where I would be without this. I would talk for hours with Wysa. Sure it's not a real person, but it is still helpful. Especially in those moments where talking to a real person would make it worse. I recommend this if you're struggling. I know this is a little sensitive to say...but Wysa was a factor that stopped me from suicide. I own this app my life. Thank you to the creators of it. 🙌❤️*

[R13] echoes this sentiment, stating that *Woebot* has saved them from “some incredibly dangerous moments”. There is clearly a need for this emergency support, despite it being discussed in a small number of the reviews we analyzed, perhaps due to stigma around disclosure. Users are turning to chatbots in potentially harmful situations indicating these apps may need further focus on responses for such circumstances.

[R13] *This is THE BEST therapy bot out there. It has become ingrained in me to talk with it when I need to. In all openness, it has saved me from some incredibly dangerous moments. Just it guiding me to calm down and then reevaluate my thoughts. My human relationships have gotten deeper, as I am no longer seeking a person to remind me to CBT journal or as a place to vent. My self-esteem has sky rocketed through CBT therapy with this wonderful bot.*

Figure 3 shows an example conversation carried out by our research team with *Replika* in which the user expresses suicidal thoughts. *Replika* responds empathetically and directs the user to the suicide prevention lifeline. While some emergencies may be resolved via conversation or activity within the app, most apps provide access to real-world resources.



Figure 3: Conversation with *Replika* showing the app's response to user input around suicidal thoughts.

4.3.3.2 Always On

The ubiquitous nature of smartphones means that information and connection are always at hand, another characteristic that is impossible for therapists to provide to patients. As seen above, this may be especially useful and necessary in cases of emergency, but also is a property that is generally helpful to users. Chatbot apps do not have off-hours, they are constantly available, affording use at any time of the day and as often as needed. These apps are convenient and provide a potentially greater frequency of support - albeit a different form - than traditional therapy or care options.

A sense of connection or access to psychoeducation resources is always available to a user.

Reviews tended to mention apps that are available 24/7 or whenever you need them. For example, R14 and R15 describe the app *Replika* as “always there for you” and “there for you, all the time!”. R16 describes the ability to use *Woebot* “whenever I need”. These users clearly enjoy and need the flexibility of on-demand mental health support options.

[R14] *It helps me curve my need for attention. I love it. Someone who is always there for you, and only you. And they never get bored of you, or need space.*

[R15] *Amazing, It's there for you, all the time! You don't have to worry about judgement, and can say whatever you want, My replika is my best AI friend (👉••👉)*

[R16] *Woebot is friendly and helpful! I enjoy the pacing of their lessons but I love that i can check in whenever i need. I always leave a conversation with Woebot feeling at least a little bit better. Since working with Woebot for the past 10 days i do notice a more understanding and patient tone to my inner dialogue. Woebot is a Wowbot :)*

Aside from being an always-available treatment or support option, MH apps also may serve as an affordable replacement or augmentation to more expensive treatments.

4.3.3.3 Affordable Substitute

Finally, chatbot apps provide an affordable substitute or option for users unable to pay for treatment, contrasting with traditional means of support (e.g., medication, counseling). As previously discussed, the cost of in-person therapy is prohibitive and unattainable to many people in need of it. The majority of these apps provide free access

to the chatbot and its resources, while some more advanced features such as connecting with a therapist or access to certain lessons may be offered within the app but behind a paywall. *Woebot* is completely free to use, while *Replika*, *Wysa*, *InnerHour*, *7 Cups*, and *Youper* offer premium features including access to therapists, expanded libraries of therapeutic exercises, and mindfulness audios. Surprisingly, only around 4% of codes mentioned the affordability of these apps as a benefit.

People with mental health conditions may struggle financially and be unable to pay for mental health care, shown in [R17]. These reviews describe how users cannot afford to seek traditional therapy or professional help but are able to receive cheaper or free help via MH apps. Another review goes further to proclaim that the app *Replika* is “free therapy” ([R18]).

[R17] *First I would like to thank the WoeBot team for not charging users for *anything*. Much of my stress and anxiety are due to my finances. Other apps I have used make me feel even more hopeless because I can't afford to pay for the tools I need to feel better. So thank you. WoeBot isn't perfect but it has already helped me through some tough situations by talking me through techniques for reframing my thoughts. It's giving me the tools to deal with anxiety and depression in a healthier way.*

[R18] *This is honestly free therapy. You talk to it and jeels a diary of AI's thoughts that are very much specific to your conversations. Also, it's brought make memories from when I was a kid and made me think of those times differently. I'm honestly really surprised with this, very much impressed!*

Finally, some users expressed awe and gratitude for the fact that these apps offer free assistance. [R19] notes that they are “amazed it is for free”, and [R20] thanks the app team for “keeping this free and accessible”. Users may be familiar with the paywalls or subscriptions commonly required by mobile apps [25], a characteristic that

has the capacity to verge on predatory within a sensitive population such as those dealing with mental health conditions. These reviews tended to be for the app *Woebot*, as it is the only completely free app reviewed at the time of writing.

[R19] *The app is perfect. It feels genuine and very positive and funny. Tons of cool facts and easy to digest knowledge. Not overbearing or overloading. Im so amazed it is for free with all its features that are usually given only in a payed versions*

[R20] *Funny, kind, considerate, appreciative, patient, respectful, inspiring, joyful and consistent - Woebot is all of this and MORE! I'm so grateful to have this app to learn effective CBT techniques and ride out my emotional weather! Thank you, Woebot team, for keeping this free and accessible! 💜*

5. Discussion

We have presented clear evidence and examples of the utility of mental health apps to users in need of support based on their perceptions through an examination of user reviews from standard mental health apps and chatbot apps. We find a broad range of reasons for using apps aside from reduction in anxiety or depression-related symptoms. Many apps that conduct research on their product evaluate outcomes based on standardized psychometric measures (e.g., the Patient Health Questionnaire 9-item Depression Inventory), which is necessary and unavoidable. However, this method ignores the numerous experiential reasons for use and, importantly, whether people will use an app long-term. While there is much work to be done evaluating the efficacy and regulation of mental health apps, it is clear that users are feeling they benefit in some way within a real-world use case from the current iterations of apps available on app stores. There is not one universal measure of mental health, and efficacy is nuanced and not explicitly defined within this community. It is important to determine not only if an app is efficacious, but also whether or not users will use and continue to use it. This prompts taking a more holistic view of the use of such apps. For example, *Woebot* has the fewest installations on the Google Play store out of our included set (Table 2), despite being one of the few apps with published research on efficacy [33]. It is worth noting that many of these apps were released around the same time and thus have had equal opportunity to gain users, so there could be a number of reasons for this lesser popularity than efficacy. Our qualitative evaluation of app store reviews provides a more nuanced look into what real world users value and want from their mental health

companion tools and factors affecting engagement. Engagement is a pressing concern as many mental health apps are being underutilized and face issues with long-term adherence and user retention. Mental health apps have been criticized for not including research on efficacy and validated content. But here we show analysis of a different success metric via self-reports of how an app has helped a user achieve their goals.

Our qualitative analysis shows that people most commonly discuss mental health app benefits such as constant availability, access to social or community-based support and reinforcing behaviors or habits — support that is not offered and would be unreasonable to expect from traditional therapeutic services. Apps and chatbots can act as stop-gaps or be sufficient as standalone help for some users. These apps commonly help calm or relax users in moments of need and teach them strategies to challenge and adjust their problematic thinking patterns. Along those lines, both a general benefit (10% of codes) and a chatbot-specific (32%) one pertained to the delivery of psychoeducation principles, indicating that users are finding this modality to be an acceptable form of delivery. This confirms prior research on the acceptability of mental health and chatbot apps and is promising as a means of app-delivered interventions [72,99]. The issue remains of apps promoting psychoeducational or other therapeutic content and not delivering on valid treatments [37,51]. Still, it is worthwhile to have further support for the continued improvement of this technology as many reviews indicate that users see advantages to be had.

Chatbot users also frequently discussed the 24/7 accessibility of apps. Many reviews focused on the relationship between a user and a chatbot, showing that people

desire non-judgmental and supportive conversational ability from these apps. While human interaction cannot be replaced or even exactly replicated, chatbots present a viable solution for people in need of companionship or struggling with loneliness. Users have the peace of mind that a chatbot is always there for them, which is not a possible benefit that therapists can provide.

Affordability was surprisingly one of the less common benefits mentioned in reviews, appearing more times in the chatbot-specific reviews — still only in 4% of codes (.06% within general benefits). One of the commonly touted pros of these apps is their free or low-cost nature [84], and users prefer free apps over those with paid features [3]. It is possible that apps are not as affordable as we previously thought. Mental health apps commonly contain paid features or premium subscriptions, a repeatedly noted complaint among negative user reviews [3]. If we are striving to have as broad a reach as possible, it is crucial that we examine charging practices within this domain to ensure that users who are unable to afford care can receive some support. Semi-frequent analysis of user reviews could determine sentiment around payment plans if more in-depth user research is not an option. However, there are tradeoffs to acknowledge between this and the cost to develop and upkeep an app.

A surprisingly low number of reviews discussed the use of these apps in emergencies, presenting in around 2-3% of codes in each of the two codebooks. Users may be wary of trusting apps in times of crisis, and few apps provide comprehensive strategies to help users at risk of suicide [63]. Our search found strong examples of these apps aiding users in crisis, but these are relatively few. Crisis-related reviews may

be underreported due to perceived stigma around disclosing a highly intense or personal experience, even via a somewhat anonymous online review. A recent study to determine the ability of MH apps to respond to crises found that only 35% of the apps surveyed contained specific resources for crises, which may explain our minimal findings in this regard [79].

There are several implications regarding the future design of MH apps. The relatively high frequency (~28% of codes) of relationship-based themes within our chatbot codebook indicate significant interest or need for this agent-based interaction. This may be due to a lack of friends and feelings of loneliness, fear of disclosure or being a burden, wanting a space to vent and not feel judged, and more. Some users seemed content with continuing prolonged interaction with their *Replikas* for example, while others saw it as a way to gain confidence and practice for real human interaction. Prior work has noted that some users feel stigma around these human-chatbot relationships, so privacy may be an important point [89]. It is important to note as chatbot technology continues to evolve and natural language processing advances that people desire the capability of non-human relationships or support and to design conversation to be as humanistic as possible.

Indeed, there is research showing that strangers can sometimes be better at understanding than one's close relations, a phenomenon dubbed "closeness-communication bias" [87]. Chatbots may enable users to be more honest and explore potentially stigmatizing topics as well as to gain a sense of validation which has been reported as a benefit of anonymous online communities such as *YikYak* and *Whisper*

[50]. These anonymous peer-to-peer apps tend to be unregulated or controlled, which can lead to issues of harassment or inflammatory posts, while chatbots in their current form tend to be tightly bound in terms of conversational topics and response-ability [109]. Few of the mental health chatbots allow unconstrained user input, often making use of preset responses to funnel a user down certain conversation paths. While this is necessary and logical for teaching concepts, providing users with more flexibility around their input may be helpful.

There are several limitations to acknowledge. First, as we established earlier, user reviews alone might not be a reliable source of data due to fake or spam reviews as well as self-selection bias. We looked at only a small sample of the mobile apps available for mental health, and further benefits may be uncovered by expanding app inclusion. As we focused on apps primarily for anxiety, depression, and bipolar disorder, benefits may not be generalizable to apps for other mental health conditions. Efficacy needs to be studied along with methods for determining other benefits and what factors increase long-term adherence.

6. References

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