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RAPID COMMUNICATION

Smartphone Applications for Mental Health

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Abstract

Many adolescents and adults do not seek treatment for mental health symptoms. Smartphone applications (apps) may assist individuals with mental health concerns in alleviating symptoms or increasing understanding. This study seeks to characterize apps readily available to smartphone users seeking mental health information and/or support. Ten key terms were searched in the Apple iTunes and Google Play stores: mental health, depression, anxiety, schizophrenia, bipolar, trauma, trauma in schools, post traumatic stress disorder (PTSD), child trauma, and bullying. A content analysis of the first 20 application descriptions retrieved per category was conducted. Out of 300 nonduplicate applications, 208 (70%) were relevant to search topic, mental health or stress. The most common purported purpose for the apps was symptom relief (41%; $n=85$) and general mental health education (18%; $n=37$). The most frequently mentioned approaches to improving mental health were those that may benefit only milder symptoms such as relaxation (21%; $n=43$). Most app descriptions did not include information to substantiate stated effectiveness of the application (59%; $n=123$) and had no mention of privacy or security (89%; $n=185$). Due to uncertainty of the helpfulness of readily available mental health applications, clinicians working with mental health patients should inquire about and provide guidance on application use, and patients should have access to ways to assess the potential utility of these applications. Strategic policy and research developments are likely needed to equip patients with applications for mental health, which are patient centered and evidence based.

Introduction

Smartphone ownership has become increasingly common in the United States[1] and among individuals receiving treatment in community mental health settings.[2] Smartphone applications (apps) may introduce individuals with mental health problems to psychoeducation, symptom monitoring, or treatment options, and these applications may be particularly appealing due to their anonymity, portability, and ease of access and use.[3] Using technology to share helpful mental health resources may also extend reach to underserved populations and fill gaps in the context of limited availability of mental health services.[4]

Before initiating the use of a new technology, potential users consider the information provided about the technology[5]; smartphone app store descriptions and consumer reviews commonly inform decisions about whether to use an app.[5,6] However, few empirical studies have examined the information made available to potential users choosing mental health-related apps.[7] To address this gap, in this article, we use content analysis to help answer: (a) whether apps found appeared relevant to the mental health key term searched for and/or mental health in general, (b) what types of approaches to improving mental health were provided within apps, and (c) whether descriptions included information, which may be important to someone with a mental health concern, such as information about privacy safeguards and evidence of app effectiveness.

Methods

Data selection

In March 2014 we used 10 key terms (i.e., mental health, depression, anxiety, schizophrenia, bipolar, trauma, trauma in schools, post traumatic stress disorder (PTSD), child trauma, and bullying) to search iPhone Apps in the Apple iTunes Store and Android apps through the Google Play Store. These terms were included to capture common mental health diagnoses; trauma was oversampled due to the specific focus of the research team.

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The first 20 apps appearing in each search and their accompanying descriptions were recorded into a database. We chose 20 as most users typically view one page of search results.[8] No other restrictions were placed except for the ''bullying'' search in the Google Play Store as the search resulted in apps related to bully dog breeds. Duplicate apps were excluded.

Data coding

App characteristics were coded based on app name and app store description; none of the apps were downloaded or researched further. A preliminary codebook was developed based on app descriptions. Two coders from the research team separately used the initial codebook for the first six apps. They then revised the codebook based on new codes, with a third author (E.M.) settling any disagreements about code meaning (Supplementary Data; Supplementary Data are available online at www.liebertpub.com/cyber). Further coding was completed by the research team with no new codes emerging after the 35th app.

Apps were first categorized based on relevancy of whether they addressed a mental health topic. Apps that did not directly address the term searched or general mental health or stress were excluded from further analysis. Two independent coders completed the previously described coding for relevancy and reviewed discrepancies until percent agreement for relevancy was 100%. We then used app descriptions to categorize apps based on general characteristics, including the following: audience the app appeared to be designed for, cost, user rating, number of downloads, use of diagnostic language style, and creator or type of group who had developed the app (e.g., commercial, academic like a university, professional like a licensed psychologist). Other general app characteristics are listed in Table 1. In addition, we categorized apps based on characteristics specific to mental health, including the following: mental health diagnoses or symptoms included in the description, mention of confidentiality, or inclusion of a legal disclaimer. We categorized apps according to their ''apparent purposes,'' which were exclusive categories of the main purposes of the apps, inferred from app descriptions (Fig. 1). To understand the main tools offered by the app for mental health improvement, we further categorized approaches for symptom relief (e.g., meditation, hypnosis) used by any of the apps even if symptom relief was not the primary purpose (Table 2). We coded for source of information supporting app use or mental health diagnosis (e.g., research evidence, professional experience). Last, we coded categories of descriptive terms used for depicting qualities of the app (e.g., ease of use, improves health) used in app descriptions. The two independent coders coded all apps and then discussed and resolved any discrepancies by referring to the agreed codebook definitions. The RAND Corporation IRB determined this research was exempt from Human Subjects review.

Table 1. General App Characteristics, $N=208$, n (%)

Additional capabilities[a]	
Sleep problems	22 (11)
Weight loss	6 (3)
Age groups	
Not specified	172 (83)
Adult	21 (10)
Children	16 (8)
Adolescent	8 (4)
Geriatric	2 (1)
Audience[b]	
General	106 (51)
Individuals with mental health problem	69 (33)
Not specified	51 (24)
Mental health professional	31 (15)
Medical professionals-general	18 (9)
Family	18 (9)
Primary care provider	17 (8)
Student in school	12 (6)
Nurses	11 (5)
Student in mental health	10 (5)
Creator[c]	
Commercial	169 (81)
Professional	19 (9)
Academic organization	11 (5)
Lay person experienced in mental health	8 (4)
Interactivity[c]	
Not stated	162 (78)
Interactive	44 (21)
Language style used	
Lay[c]	137 (66)
Diagnostic[c]	68 (33)
Language tone used[c]	
Neutral[d]	127 (61)
Optimistic	70 (34)
Negative	10 (5)
Consumer friendly[c]	
Consumer friendly	175 (84)
Medical language	25 (12)
Number of downloads[e]	
Unknown	1 (0.5)
1+[f]	5 (2.4)
10+	13 (5.8)
100+	39 (19)
1,000+	34 (17)
10,000+	16 (7)
100,000+	5 (2.4)
Cost	
Free	150 (72)
Price	58 (28)
User rating	
0	38 (18)
1–2.5	13 (6)
3–3.5	40 (20)
4–4.5	82 (40)
5	33 (16)
Not available	3 (1)
Presence of testimonials	27 (13)

[a]Exercise, smoking cessation, pain management, workplace support were 2% or less.
[b]Medical professional-trainees, parents, friends, teacher, employers were 3% or less.
[c]Categories are exclusive.
[d]That is, adjectives or descriptions, which were neither positive nor negative.
[e]Only available for Android apps.
[f]''+'' referring to ''or greater.''

Results

Search method results

We retrieved 361 apps (iPhone = 161; Android = 200); 61 were duplicates within or across operating systems and were deleted, so only a single version of apps was reviewed. Of the

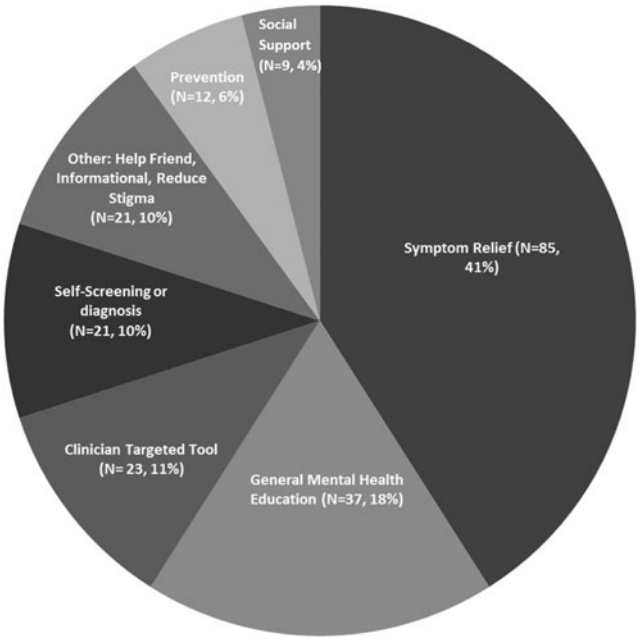

FIG. 1. Apparent purpose of mental health app.

remaining 300, 163 were relevant to the specific search topic, 42 were relevant to general mental health, and 3 were relevant to stress (208 apps total). Forty-seven apps that were relevant to general health and 45 that were not relevant to any of these above categories were excluded. For example, some apps were not relevant due to focusing on general health concerns (e.g., iPharmacy—Drug Guide & Pill Identifier) or other topics related to the word searched, but not related to mental health (e.g., Great Depression Numbers). The search topic with the most not relevant apps was bullying (e.g., The Bullying Bard, The Legend of Spookley the Square Pumpkin).

Application characteristics

General application characteristics are listed in Table 1. Mental health-specific characteristics are listed in Table 2. Although specific keywords were searched, there was overlap between diagnoses or symptoms mentioned in app descriptions. Of the few apps mentioning privacy, these included features such as offering adding password protection, ensuring anonymity if publicly posting content, or affirming the app was not sending or collecting user information. Few applications offered legal disclaimers such as not intending to replace a professional diagnosis or treatment, no guarantee of accuracy, and absolution from liability for damages or inability to use the app.

Apparent purposes

The most common apparent purpose of the apps was for symptom relief (41%; $n=85$) (Fig. 1). App descriptions provided information on how the app could improve mood, relieve stress, or decrease anxiety using self-help methods. Some apps clarified they did not replace professional treatment, although one implied it supersedes professional therapy.

TABLE 2. MENTAL HEALTH-SPECIFIC CHARACTERISTICS OF APP, $N=208$, n (%)

Mental health diagnosis or symptom mentioned[a]	
Depression	61 (29)
Anxiety	50 (24)
General mental health	44 (21)
Stress	34 (16)
Posttraumatic stress disorder	28 (13)
Bipolar	23 (11)
Bullying	24 (11)
Sleep disorder	20 (10)
Schizophrenia	19 (9)
Panic disorder	13 (6)
Obsessive compulsive disorder	11 (5)
No specific symptom or diagnosis mentioned	11 (5)
General trauma	9 (4)
Child trauma	8 (4)
ADHD	8 (4)
Source of information supporting app use or mental health diagnosis	
Not stated	123 (59)
Research evidence	48 (23)
Professional experience	23 (11)
Personal experiences or stories	18 (9)
National guidelines	8 (4)
DSM criteria	7 (3)
Approaches to improving mental health used by the app[b]	
Relaxation	43 (21)
Stress management	36 (17)
Symptom tracking	1 (15)
Calming audio	28 (13)
Interpersonal support	25 (12)
Diary or journaling	22 (10)
Connect with mental health resource	19 (9)
Support group	18 (9)
Hypnosis	15 (7)
Meditation	15 (7)
Other therapy[c]	14 (7)
Mood tracking with provider	11 (5)
Cognitive behavioral therapy	10 (5)
Crisis management	10 (5)
Medication management	10 (5)
Validated diagnostic screens	10 (5)
Presence of a legal disclaimer	26 (12)
Mention of confidentiality	
No mention of privacy or security	185 (89)
Assures privacy or security	19 (9)

All categories are not mutually exclusive except for mention of confidentiality.

[a]Categories of impulsivity, memory, personality disorder, postpartum depression, dementia, amnesia, self-injury, autism, somatoform disorder, eating disorder, learning disorder, substance abuse, and trauma in schools were each 1% or less.

[b]Categories of prediction tool, points or games, brainwave frequencies, mindfulness, conflict resolution, religious support, and heart rate tracking were each 4% or less.

[c]Other type of therapy not mentioned in another category.

> ''a free app that enables you to log your moods daily. You can then analyze your behavior patterns and get advice on how to be a happier bunny. Who needs therapy?''

Approaches to improving mental health

Approaches used by the app are listed in Table 2. Among apps whose primary purpose was symptom relief, the most

FIG. 2. Descriptor categories used to characterize mental health app.

common approaches were relaxation (49%; $n=42/85$), stress management (40%; $n=34/85$), calming audio (33%; $n=28/85$), and symptom tracking (22%; $n=19/58$). Examples of support for these approaches provided ranged from less-specific statements such as,

> ''We ask you questions based on research and best practices to make sure you get the advice and tools that are right for you,''

to stronger statements such as,

> ''The diagnostic validity of the PHQ-9 is fully evidence based,''

with links to research studies.

Categories of descriptors used

The most common descriptors used for the app were that it was easy to use (37%; $n=78$), ''special'' denoting use of superlatives (e.g., best, wonderful) (22%; $n=45$), educational (17%; $n=35$), would increase insight (16%; $n=33$), or was effective (15%; $n=31$) (Fig. 2). Many apps were described as not needing substantial effort by the user to get effective results, or providing a simple way to understand a complex mental health problem. Some described opportunities to learn new skills and increase empowerment for users themselves:

> ''With our application, your worries are controllable now. Learn to reduce stress and depression and relax your body and mind.''

Testimonials were often used to provide evidence for effectiveness:

> ''I cannot sleep without this application and I have tried, believe me.''

Other apps described the permanency of symptoms and advised not to wait for symptoms to become more severe before attempting to address them by using the app. Apps mentioned multiple health benefits and help in achieving life goals.

Discussion

This study was a content analysis of descriptions available for the first 20 applications retrieved when 10 common mental health terms were searched in the Apple iTunes and Google Play stores. Most users considering downloading a new smartphone app, do so during an app store search,[6] and are likely to only view the first page of results.[8] Understanding what users view during this consideration phase[9] (i.e., app store descriptions) may inform whether users with mental health symptoms access helpful resources at a time they are motivated to seek help. Although app store ranking algorithms are not public, number of downloads, keywords in app titles, visuals, and strategic asking for ratings are believed to influence rankings.[10] We found, however, that only 70% of apps produced by our search were relevant to mental health, echoing prior results of low relevancy.[7]

Most apps resulting from our search were for symptom relief, containing approaches to improving mental health that may benefit only milder symptoms. Although low-intensity mindfulness and acceptance-based interventions,[11] as well as relaxation and audio interventions,[12] and self-monitoring[13] may alleviate some symptoms of depression and anxiety, effects likely depend on symptom severity and without clinician support, app users may be unaware of when to seek professional help.

Relatively few app store descriptions emphasized confidentiality; this may be concerning as confidentiality is important to individuals with mental health disorders, and a lack of acknowledgment of confidentiality and privacy is a commonly cited barrier to seeking professional mental healthcare.[14–17] This sentiment may extend to technology interventions—adolescents asked for their perspective on design of a mental health app ranked safety highly—including password protection and user control over privacy with the option of being anonymous as a prerequisite before use.[18]

Mental health application descriptions rarely cited research evidence to support using the approaches included in the application. Although user ratings were high on average and apps were described as easy to use and effective, most did not cite evidence other than user testimonials. There is limited evidence for the efficacy of mental health apps,[19–21] and few of those studied are available for consumer download. Few applications provided detailed information about the app creator, and of those that did, few were created by an academic or professional organization (e.g., clinical mental health provider), raising questions about credibility of the sources.[7]

Some app store descriptions gave an unrealistic appraisal of expectations about the course of mental illness. Commonly, testimonials would describe the app as easy to use and offer superlatives regarding immediate effectiveness. Mental health disorders can have a differential trajectory for various individuals and are often chronic,[22] making it unlikely an app would be able to meet these claims.[23] This may lead to dissatisfaction with use of the app due to unrealistic expectations and deter a user from seeking further care.[24]

Our findings must be considered within the context of study limitations. We used search terms, including diagnoses and more general language, and we were limited by what was included in app store descriptions, but did not have the resources to download and test all available apps. This prevented confirmation of whether the app actually applied the advertised approaches or possibly offered further research evidence or privacy considerations within the app itself (e.g., data encryption). Although we held regular meetings to review coding strategy and discuss any discrepancies, we were not able to calculate interrater scores for each data point. This

analysis would be enhanced by an empirical examination of relationships between app characteristics such as comparing user ratings with audience. Due to our specific and small sample size and the risk of a false negative finding, we would recommend repeating this analysis using a larger sample of apps. Future research involving downloading and testing apps would provide further information.

Implications

Despite these limitations, this review offers several clinical and policy implications. Clinicians should be aware patients may be using mental health applications to supplement or even replace traditional treatment. The categories provided in this review may help clinicians inquire about app use, evaluate whether the app applies evidence-based principles, and provide patients with realistic expectations about expected app benefits depending on their diagnosis and symptom severity. Clinicians can use other clinicians' reviews[25] of currently available apps to determine whether there are some they may recommend to patients due to being evidence based or applying evidence-based treatments in an app format. Current technologies exist even for interested clinicians to develop simple apps themselves without preexisting programming knowledge.[26]

Second, patients should consider using evidence-based tools, such as the DISCERN scale,[27] or consumer-informed websites[28] to assist with evaluating new health technology quality. Last, connecting mental health app users with quality applications will likely require further evidence-based studies[20] and public policy changes. Despite this and the difficulty with applying regulatory measures for app quality,[7] the app marketplace continues to grow.[29] Users and developers may benefit from further guidance on using reliable quality assessment ratings as opposed to star ratings alone,[30] so they can evaluate and design more useful applications for mental health which are patient centered and evidence based.

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