A Functional Analysis of Depression Apps User Installs and Rating

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Abstract

As access to healthcare to depression remains unavailable or insufficient to a significant part of the population dealing with depression, mobile apps dealing with depression have been spreading and generalizing. In this paper, we investigate depression apps based on data available on the Google Play Store. We find apps addressing several functions in depression apps: education, assessment, tracking, connection, treatment and recreation. While education is the most developed feature (39% of apps), treatment is the most desired feature (68% of app installations). Higher app ratings correlate with higher installs. Apps assessing depression are particularly poorly rated by users, possibly because of the medical nature of a diagnosis. These findings point to a segmentation of the depression app market with massive demand, differing expectations from users by function, discrepancy between developers' efforts and users' needs.

Keywords

Mhealth, mobile apps, depression, use, mental health

Introduction

Depressive disorders are mental health disorders characterized by sadness severe or persistent enough to interfere with function and often by decreased interest or pleasure in activities("Depressive Disorders - Psychiatric Disorders" 2019). Major depressive disorder amount to almost 300 million cases worldwide, and the loss of 63 million disability-adjusted life years every year (Whiteford et al. 2015). Effective treatments are frequently unavailable to those in greatest need (Mohr et al. 2006, 2014), with 56.3% of people with depression were not receiving any treatment(Kohn et al. 2004). Barriers to receiving mental health and behavioral care include transportation problems, time constraints, cost (treatment), emotional barriers (concern about what others might think, discomfort talking about problems with a therapist) (Mohr et al. 2006). Moreover, two thirds of depressed primary care patients would prefer psychological treatments to pharmacotherapy. Young adults, in particular, may not resort to mental health services because they have a negative opinion about the mental health system and feel disconnected from its services and therefore prefer handling their concerns on their own (Marcus et al. 2012).

Mobile health applications for depression (depression apps) offer an opportunity to address these barriers, expand access to depression care, decrease the costs of care, and allow for relatively rapid, centralized scaling up of interventions (Clarke and Yarborough 2013; Price et al. 2014).

Depression apps can be used for a variety of purposes: psychoeducative apps provide information about depression, symptom management apps track symptoms and moods over time, supportive resources apps connect users to other people for support, Medical assessment apps diagnose the presence and extent of depression, and therapeutic treatment apps offer diverse ways to alleviate depression and its symptoms. Therapeutic treatment and psychoeducation constitutes the most frequent apps developed (Shen et al. 2015).

Depression apps are typically used as stand-alone self-help programs and therefore remain poorly integrated to the continuum of care. Since very few of them have been clinically investigated, we know little about the experience of and the impacts on users of these apps. Thousands of users with potential serious mental health conditions routinely use these apps to access information, assess their condition, track and manage their symptoms. Ultimately, they draw conclusions about their condition and take action based on

these apps with possibly critical impacts on their mental health without any clinical supervision. As applications that deal with mental health, the subjective experience of patients is a significant reflection of the impact of the apps. Finally, unlike traditional treatments, the use of depression apps is not supervised by a clinician. All these reasons make user experience an important aspect of studying adoption, use and satisfaction of depression apps.

While extant research provides us with some insights on where developers are focusing their efforts and on the quality of the apps, we know little about the user side of depression apps, what they install and what they think of these apps.

This purpose of this paper is therefore to investigate the extent and function of depression apps installed by users and their general satisfaction with these apps.

Methodology

We conducted a systematic review of the applications addressing depression available on the Google Playstore. The search was carried out in February 2018. Apps that featured the root "depress-" in their title or store description were retrieved through an API provider. After excluding apps not related to depression as a medical condition (e.g., geographical depression) and non English apps, we obtained a sample of 244 apps related to depression. For each application, *rating, web address, app name, description and total installs* were extracted.

We then categorized the applications following a functional taxonomy describing the purposes of the app. Our taxonomy derives from Shen et al. (Shen et al. 2015). We reframed these categories to illustrate the function that they play. "symptom management" was renamed "tracking" to highlight both that it didn't necessarily focus on symptoms and to distinguish it from 'treating'. "Supportive resources" was renamed 'connecting' to denote that its core function is to connect users to other depressive users or to healthcare professionals. Finally, we added an 'entertaining' category. While such apps are not strictly speaking mobile health apps, they still cater to a population suffering or at least interested in depression even they take a lighter take on it. Apps were coded based on all their significant features. This means that an app can belong to multiple categories and therefore a 'multifeatures' category was created to analyze the properties of these apps. The functional categories are summarized and described in Table 1.

Coding was performed by two researchers for all the apps with a Cohen's Kappa (k) of 72%, (k = 0.70), indicating a substantial agreement between the two raters according to Landis' guidelines in (Landis and Koch 1977). Both raters arrived at a consensus on the apps with disagreements. Statistical analysis was done using R.

Functional category	Description
Educating	Educational materials for educating, training or informing users including books, guides, news or journal articles, commentaries/opinions, tips, and lessons
Assessing	Allows users to screen, diagnose, assess risk, assess self, determine treatment
Tracking	Allows users to track symptoms, gather history, include physical health data and provide useful, comprehensible output:
Treating	Includes any prescription, therapeutic or not, that improves or claims to improve the condition. Includes relaxation, hypnosis; mindfulness exercises, meditation, spiritual/faith-based solutions…
Connecting	Provides referrals for help, connects users with support e.g. emotional and social support; treatment interventions for acute or chronic use.
Entertaining	Mostly recreational applications, such as dark humor, quotes, wall papers and games
Multifeatures	Apps belonging to two or more of the above categories

Table 1. Depression App Categories

'Total installs' records a range of how many times each app is installed. To computed averages, we used the mid-range value of "Total installs". For instance, an app whose total installs was 100,000 to 500,000 was estimated to have been downloaded 300,000. This was then aggregated by category to assess the number of installs per category.

Finally, we used R to compute a Pearson correlation between app rating and number of installs.

Results

In this section, we offer a brief description of the type and content of apps found in each category. Then, we present and compare installs and ratings in each category.

Educating apps are mostly e-books providing information on depression, and tips for depression management, self-help guides, reference manuals; others were learning modules in audio or video formats, designed to teach users.

Assessing apps allow users to self-diagnose for depression. These apps use validated scales such as the Depression, Anxiety and Stress Scale (DASS), Geriatric Depression Scale (GDS), Hamilton Rating Scale for Depression (HRSD), Burns anxiety and depression test, Zung Self-Rating Depression Scale, to assess the presence and severity of depression. Self-assessment will preempt users to communicate and visit health facilities and physicians. Developers emphasize the need for a physician opinion.

Tracking apps allow users to track their moods over time as well as other risk factors, track lifestyle and behavior, and keep journal entries of their feelings and emotions. Connecting apps provide communities and support groups where users can discuss their experiences and feelings without condemnation or stigmatization. Some apps also connected users with professionals and helplines.

Treating apps offer a variety of interventions to address depression, ranging from simple relaxing sounds to clinical interventions, such as Cognitive Behavioral Therapy (CBT), Acceptance Commitment Therapy (ACT), the Hospital and Anxiety Depression Scale (HADS), the Center for Epidemiological Studies Depression (CES-D) Scale, Hypnotherapy, coping skills, mindfulness, Sooma Depression Therapy (SDT) and a few spiritual/faith-based and color-based therapies; with most apps focusing on CBT.

Entertaining apps provide depression specific messages, tips and quotes such as wallpapers and screen savers; others were designed for gaming purposes while some use dark humor or make fun of depression. The aim of these category extends beyond medical functions such as depicting depression as horror and scary.

Table 2 presents the count of apps as well as the estimated count of installs by category.

	Count	%	Total estimated installs	% of all depression installs	Average installs per app	Rating (weighted by installs)
Educating	94	39%	4,803,500	15%	51,101	4.4
Assessing	44	18%	1,130,000	4%	25,682	3.7
Tracking	37	15%	5,219,500	17%	141,068	4.6
Treating	72	30%	21,215,000	68%	294,653	4.3
Connecting	24	10%	2,927,500	9%	121,979	4.2
Entertaining	31	13%	1,413,000	5%	45,581	4.4
Multifeatures	34	14%	5,564,500	18%	163,662	4.3
Total all apps	244		31,038,000	100%	127,205	4.3

Table 2. Count and installs of depression apps by category.

Total installs reveal significant discrepancies between app count and app installs. While *educating* apps represent about 40% of all apps available (many of them are simple audiobooks), they only account for 15%

of all installs. At the other extreme, 68% of all installs involve treating apps, even though these apps only represent 30% of all apps available.

The average rating of depression apps is at 4.3, Assessing apps stand out at an average of 3.7, suggesting that these apps generate a much more negative reaction by users. Moreover, the most installed apps are also the most highly rated. The Person's correlation between ratings and installs suggest a correlation of 0.16, significant with a p-value of 0.02.

Discussion

The results provide some insights into user's preferences and expectations of depression apps.

First, depression apps users are first and foremost turning to apps to treat their condition. We have to be clear that "treatment" has to be understood in very broad terms here. Some approaches are well established. Web-based CBT has proven to be an effective treatment for depression (Christensen et al. 2002; Farrer et al. 2011; Huguet et al. 2016) and well suited for delivery through an app. Nevertheless, the two most installed treating apps include apps that play relaxing sounds. Most of these apps typically provide harmless solutions to make users feel good (harmless to the extent that they do not deter users from seeking needed medical help). We should therefore not overestimate the extent to which users with depression make reckless significant decisions related to their condition based on prescriptions coming from unverified apps. Nevertheless, it points to what users are expecting from apps. The app format may be more appropriate for the repeated use required for treatment than other sources of information, such as consulting a website or reading a book, which may be more appropriate for one-off interaction such as educating oneself on depression. This suggests the potential of apps for interventions on depression that require frequent action.

Second, users react much more negatively to *assessing* apps. Unlike *treating* apps that are typically not medical, an assessment of depression is by nature medical. It is therefore both comforting to see users react critically to these apps and worrying to see such a low satisfaction rate with these apps, with potential concerns about the quality of the feedback provided to users. More research is needed to investigate the quality of these apps as well as the reasons behind these low ratings. Depression is a major health problem in primary care and detection remains a challenge. By assisting individuals in identifying the onset of mental health issues, these apps can help to address this challenge. However, the efficacy of these scales for self-help has not been widely reported in literature (Huguet et al. 2016).

Third, about 31 million English language depression related apps present on the Google Play Store in 2018 have been installed. This is a huge figure, to put in perspective with the 16.1 million Americans facing Major Depressive Disorder. Obviously, the total English speaking population with diverse range of depression is larger than that and users can install multiple apps, but this still suggests a possible massive penetration of depression apps among people with depression. It is also possible that users react strongly to a diagnosis that they do not like or agree with, especially in the absence of a clinician to interact with. More studies need to confirm this, but this would mean that depression apps are now part of the landscape and practices of this population and the impacts of this reality, whatever its clinical validity, need to be investigated.

Finally, entertaining apps emerged as a significant part of the depression apps market. They may be the first insight into mobile depression apps for certain users, especially those reluctant to acknowledge their condition. As such, the use of such applications should not be ignored.

Conclusion

Depression apps have been downloaded millions of times by users, especially to treat their condition and its symptoms. The features that draw the attention of developers differ from those users are interested in, while users react differently to different functions. Developing an mhealth app is unregulated, quick and low cost, while conducting rigorous evaluation studies takes time and resources and it is not clear the extent to which users, unlike clinicians, value such validations in their app choice. We need to investigate more the experience of users of depression and other mental health apps and the impact of the information provided by these apps. As an Emergent Research project, our next step is to deepen our understanding of user experience by looking at app stores' user reviews using natural language analysis.

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