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A Content Analysis of Popular Smartphone Apps for Smoking Cessation

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Abstract

Background—Smartphone applications (apps) are increasingly available for smoking cessation.

Purpose—This study examined the content of popular apps for smoking cessation for both iPhone and Android operating systems in February 2012.

Methods—A total of 252 smoking-cessation apps were identified for the iPhone and 148 for the Android. Across both operating systems, the most popular apps were identified ($n=47$ for the iPhone and $n=51$ for the Android) and analyzed for their (1) approach to smoking cessation and (2) adherence to an index based on the U.S. Public Health Service's Clinical Practice Guidelines for Treating Tobacco Use and Dependence. Where available, apps were coded for frequency of downloads. The analysis took place in 2012.

Results—Overall, popular apps have low levels of adherence, with an average score of 12.9 of a possible 42 on the Adherence Index. No apps recommended calling a quitline, and only a handful of apps recommended using approved medications (4.1%). Android apps in the sample were downloaded worldwide between 310,800 and 1,248,000 times per month. For both the iPhone and Android, user ratings were positively associated with scores on the Adherence Index. For the iPhone, display order was also positively associated with scores on the Adherence Index.

Conclusions—Apps could be improved by better integration with the Clinical Practice Guidelines and other evidence-based practices.

Introduction

An estimated 11 million smokers in the U.S. own a smartphone.^{1,2} The extent to which smoking-cessation apps are being used on smartphones, and to what effect, is unknown. No studies to date in the peer-reviewed literature have reported on the efficacy of smartphone apps for smoking cessation. Moreover, a content analysis of 47 iPhone apps for smoking cessation indicated that apps have low levels of adherence to key evidence-based practices.³

A number of trends have emerged that have made an updated review of apps warranted. Android has overtaken iPhone and its operating system as the leading smartphone operating system.⁴ Additionally, the number of available smoking-cessation apps on both platforms

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has increased substantially. Finally, the evidence base to support using mobile phones for smoking cessation, specifically text-messaging programs, has grown,^{5,7} with two meta-analyses supporting the use of text-messaging programs.^{5,6}

This study set out to update the previous study³ by expanding the scope of review to include apps for both the iPhone and Android and by expanding the evaluation criteria to reflect the current evidence base. Of interest is the degree to which popular smoking-cessation apps adhere to established best practices for smoking cessation and the extent to which these apps are being used by the public.

Methods

Sample

A list of smartphone apps was collected for both the iPhone and Android, the two leading smartphone operating systems,⁴ on February 11, 2012, using the search terms *quit smoking*, *stop smoking*, and *smoking cessation*. The list of possible apps for the iPhone was obtained using iTunes (version 10.5.2), and for the Android, using Google Play. A total of 400 quit-smoking apps were identified. Because the volume of apps exceeded available resources, a decision was made to limit the analysis to the top 50 most popular English-language apps for each operating system. The final sample consisted of 47 apps for the iPhone and 51 for the Android for a total of 98 apps (Figure 1 provides an overview of sample selection procedures).

The measure of popularity used to define the sample varied across operating systems. For the Android, total worldwide app downloads were used as a proxy for popularity. Total app downloads were available in Google Play for each app starting on November 27, 2011⁸ and are available in ranges (e.g., 1000–5000). Because it was not possible to rank Android apps within the same range of downloads, all apps that were downloaded at least 1000–5000 times were selected in order to obtain a sample of approximately 50 apps. The final Android app sample ($n=51$) represents 98.0% of the downloads of all identified Android quit-smoking apps ($n=148$).

Unlike Google Play, the iTunes App Store does not provide information on app downloads. Instead, the display order of search results on the computer monitor was used as the indicator of popularity, and the first 50 displayed apps were selected. Although display order is primarily a function of downloads, “other undisclosed factors related to popularity” are included in its calculation (Apple Inc. Customer Support, January 2012). Users’ ratings of apps were recorded as a secondary measure of popularity. In both Google Play and the iTunes App Store, consumers who have downloaded an app can rate apps on a 5-point scale, with 1 being the lowest rating and 5 the highest. Average user ratings were recorded for each Android and iPhone app.

Coding of Apps

Apps were coded on each item in the Adherence Index (Table 1). Items were primarily derived from the U.S. Clinical Practice Guideline for Treating Tobacco Use and Dependence.⁹ Two items were added to the original index,⁷ and one item was deleted, for a total of 21 items. One new item assessed whether an app had a texting or alert feature to reflect the current evidence base supporting the use of text messaging for smoking cessation,^{5–7} the only mobile feature studied to date for smoking cessation. The other item assessed whether the app included interactive features, as effective text-messaging and other computer-mediated programs generally have been found to be interactive.^{6,10,11} The deleted item assessed whether the app enhanced motivation in a way that was personalized because coders noted it as duplicative of another item that promoted personalized advice on quitting.

Each app was also coded into categories according to the primary approach it used toward smoking cessation. In addition to the four categories previously used (calculator, hypnosis, rationing, and calendar/tracker),³ three additional categories of apps emerged. An “informational” app was one that primarily provided information on quitting smoking. A “lung health tester” app claimed to measure lung health or lung capacity by having the user blow into the microphone of their phone. A “game” app provided a game for quitting smoking. Any app that did not fall into the previous seven categories was categorized as other.

Two researchers independently coded each app on each item of the index in 2012. Each item was coded as 0 indicating “not present at all,” 1 indicating “partially present,” or 2 indicating “fully present.” The maximum possible score on the index for an app was 42 points. The coders were found to be in agreement for the iPhone 76.3% of the time, and for the Android 84.97% of the time. Average inter-rater agreement based on Cohen’s kappa was 0.77 for the Android and 0.52 for the iPhone. If coding scores differed by 1 point, the two scores were averaged. This occurred 15.8% of the time for the iPhone and 8.12% for the Android. If coding scores differed by 2 points, a third reviewer was used to resolve differences. This occurred 7.9% of the time for the iPhone and 7.1% for the Android. Statistical comparisons of means were conducted across operating systems using *t*-tests. Tests of associations between Index Scores and popularity were conducted with Pearson correlations.

Results

An overview of the characteristics of smoking-cessation apps ($n=98$) is presented in Table 1, and details about each app are provided in Appendix A for the iPhone and Appendix B for the Android. The average Adherence Index Score for all apps in the sample was 12.9 ($SD=6.8$) of a possible 42 points. Calculator apps were the most common category, representing 38.8% of all apps, followed by hypnosis apps (17.3%); rationing apps (15.3%); trackers (12.2 %); informational (6.1%); games (3.1%); lung health testers (2.0%); and other (5.1%). Of apps categorized as “other” ($n=5$), four aimed to alter a person’s associations with smoking.

For the Android, the download range of each Android app ($n=51$) was summed. Results indicate that the apps were downloaded between 777,000 and 3,120,000 times worldwide over the 2.5 month period (or between 310,800 and 1,248,000 times per month). Using the midpoint of the download range, apps were downloaded approximately 779,400 times per month.

To understand which guidelines were strongly followed across apps, an analysis was conducted in which only apps that earned an average adherence score of 1.5 or higher for a particular guideline—indicating the feature was “mostly” or “fully” present—were included⁷ (Table 1). This analysis indicated that, on average, 28.1% ($SD=27.0$) of apps strongly followed a given guideline, with no difference between operating systems. Areas of strength for apps included being specific to smoking (94.9%) and having interactive features (71.4 %). On the other hand, less than one fifth of apps offered practical counseling or advice on how to quit/stay quit (19.4%); provided options within the app for gaining social support for quitting (17.3 %); or provided help on managing roadblocks when quitting (15.3%). A minority of apps offered text alerts (12.2%), and none of these used text messages as part of the app. A handful of apps recommended an approved smoking-cessation medication for smoking cessation (4.1%). No apps referred users to a quitline (0.0%).

For both the iPhone and Android, apps with higher Adherence Index scores were more likely to receive positive user ratings (Android: $r=0.32$, $p<0.05$; iPhone $r=0.29$, $p<0.10$). For the iPhone, Adherence Index scores were also positively associated with display order ($r=0.39$, $p<0.01$), indicating that apps that were displayed first were more likely to have higher Adherence Index scores. No relationship was observed for the Android between scores on the Adherence Index and downloads.

Discussion

Overall, apps were found to have low levels of adherence to items on the Adherence Index. Although apps were found to have some strengths, including being specific to smoking and being interactive, several basic evidence-based practices were missing from the vast majority of apps. Omissions included referrals to a quitline (no apps) and recommending approved medications (4.1% of apps). The presence of these gaps supports earlier findings³ and represents areas for improvements.

Emerging evidence indicates that quit-smoking text-messaging programs on mobile phones can increase quit rates.⁵⁻⁷ It is noteworthy that few apps were found to include text alerts, and no apps included text messaging, the most tested and proven application of mobile phones for smoking cessation.⁵⁻⁷ Options for smokers to gain social support for quitting improved since the last analysis.³ Whereas this was previously limited to e-mail, several apps now had community bulletin boards and/or links to social media such as Facebook and Twitter. The authors view apps' increased integration with social media as a positive development, but future research will need to evaluate its value for smoking cessation.

Approximately 779,400 English-language, quit-smoking Android apps were downloaded per month worldwide. If it is assumed that app downloads were primarily to U.S. phones,¹² and U.S. comparisons are made, these downloads appear to be occurring with a higher prevalence than some other more mainstream forms of smoking-cessation help-seeking. A recent study reported that in the U.S., the national quitline (1-800-QUIT-NOW) received approximately 100,000 calls per month, and an associated leading website received approximately 200,000 unique visitors per month.¹³ Regardless of the comparative frequency of help-seeking, Android downloads, especially when taken together with presumably similar levels of iPhone downloads, indicate that substantial numbers of smartphone users are looking for smoking-cessation help with smartphone apps. Given the demand, providing effective smoking-cessation apps represents an important public health opportunity to reach smokers and help them quit smoking.

This study updates and expands an earlier review³ and updates the assessment criteria to reflect current evidence.^{5-7,10,11} Limitations include that it does not provide insight into how apps are being used after being downloaded, whether they are being used alone or in combination with other types of help, who is downloading the apps (and in what parts of the world), and whether the apps are effective. Additionally, the Adherence Index is built around the assumption that the recommendations in the Clinical Practice Guidelines that were developed for a clinical setting will be effective in the context of a mobile app. However, the possibility exists that the recommendations may not be effective in the context of an app. Further research is required to test this assumption. Additionally, the findings of the study are generalizable only to *popular* quit-smoking apps, and apps may exist that are more evidence based than those included in the study sample. Finally, because of differences between available information in the iPhone and Android app stores, the measure of popularity is only partially comparable across operating systems.

The results of the current study indicate that as a whole, despite the recent expansion of smartphone platforms and increase in the availability of apps for cessation, popular apps still lack many elements that are generally recommended for quitting smoking. Smartphone apps could be improved through better integration with the Clinical Practice Guidelines⁹ and other evidence-based practices. If such apps are proven effective, the high prevalence with which these are downloaded could indicate that mobile apps represent a useful smoking-cessation strategy at the population level.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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The Lorien Abroms/George Washington University has licensed Text2Quit to Voxiva Inc. Text2Quit is a text-messaging program for smoking cessation.

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Figure 1.
Procedure for selection of sample of smoking-cessation apps

Table 1Overview of Popular iPhone and Android Apps, % (*n*) unless otherwise indicated

	All (N=98) ^a	iPhone (n=47)	Android (n=51)
Average Adherence Score (SD)	12.9 (6.8)	14.2 (8.2)	11.7 (5.1)
Average Price, \$ (SD)	1.30 (4.29)	2.46 (5.90)	0.23 (0.91) *
Average User Rating (SD)	3.4 (0.9)	3.2 (1.0)	3.7 (0.8) *
Type of App			
Calculator	38.8 (38)	34.0 (16)	43.1 (22)
Hypnosis	17.3 (17) ^a	25.5 (12)	9.8 (5)
Rationing	15.3 (15)	17.0 (8)	13.7 (7)
Tracker	12.2 (12)	10.6 (5)	13.7 (7)
Informational	6.1 (6)	6.4 (3)	5.9 (3)
Game	3.1 (3)	2.1 (1)	3.9 (2)
Lung Health Tester	2.0 (2)	2.1 (1)	2.0 (1)
Other	5.1 (5)	2.1 (1)	7.8 (4)
Total Downloads			
1,000–5,000	n/a	n/a	43.1 (22) ^b
5,000–10,000			21.6 (11)
10,000–50,000			19.6 (10)
50,000–100,000			7.8 (4)
100,000–500,000			7.8 (4)
Adherence to guideline^c			
Specific to smoking	94.9 (96)	97.9 (46)	98.0 (50)
Interactive	71.4 (70)	63.8 (30)	78.4 (40)
Advise every user to quit: personalized	67.3 (66)	59.6 (28)	74.5 (38)
Ask for tobacco use status	65.3 (64)	53.2 (25)	78 (39)
Enhance motivation: rewards	50.0 (48)	48.9 (23)	49.0 (25)
Assess willingness to quit	39.8 (39)	42.6 (20)	37.3 (19)
Enhance motivation: risks	31.6 (31)	36.2 (17)	27.5 (14)
Advise every user to quit	23.5 (23)	34.0 (16)	13.7 (7)

	All (N=98) ^a	iPhone (n=47)	Android (n=51)
Advise every user to quit: clear	23.5 (23)	27.7 (13)	19.6 (10)
Advise every user to quit: strong	23.5 (23)	25.5 (12)	21.6 (11)
Assist with a quit plan: overall	20.4 (20)	29.8 (14)	11.8 (6)
Assist with a quit plan: practical counseling	19.4 (19)	29.8 (14)	9.8 (5)
Assist with a quit plan: intra-treatment social support	17.3 (17)	17.0 (8)	17.6 (9)
Enhance motivation: roadblocks	15.3 (15)	21.3 (10)	9.8 (5)
Text Alerts	12.2 (12)	12.8 (6)	11.8 (6)
Recommend counseling and medicines	5.1 (5)	10.6 (5)	0 (0)
Assist with a quit plan: recommend approved medicines	4.1 (4)	8.5 (4)	0 (0)
Refer to recommended treatment	4.1 (4)	8.5 (4)	0 (0)
Assist with a quit plan: supplementary information	2.0 (2)	2.1 (1)	2.0 (1)
Arrange for follow-up	0.0 (0)	0.0 (0)	0 (0)
Connect to a quitline	0.0 (0)	0.0 (0)	0 (0)

Note: Boldface indicates significance.

^aTwo hypnosis apps were present on both the iPhone and Android operating systems.

^bDownloads are reported for the period between November 27, 2011 and February 11, 2012.

^cAdherence is defined as a score of ≥ 1.5 .

* $p < 0.01$ for comparison between Android and iPhone

n/a, not applicable