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REVISÃO
REVIEW

A review of smartphone apps for smoking cessation available in Portuguese

Revisão dos aplicativos de *smartphones* para cessação do tabagismo disponíveis em língua portuguesa

Revisión de aplicaciones de *smartphones* para dejar de fumar en portugués

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Abstract

Smartphone apps are being developed as a complement to smoking cessation treatment. The current study aimed to analyze the content of available apps in Portuguese in two operational systems, Android and iOS. Fifty-one apps were found in iTunes and 600 in Google Play. Content evaluation included apps that focused on smoking cessation, with a total of 12 apps in iOS and 3 in Android. Each app was categorized according to its approach to smoking cessation and scored according to level of adherence to the Treating Tobacco Use and Dependence *smoking cessation treatment guideline. Nine apps were classified as calendars, 8 as information tools, 6 as calculators, 3 as cigarette trackers, and 1 as hypnosis. The apps showed low level of adherence to the guideline, with a mean score of 12.8. We recommend that the available apps be revised and that future apps be developed using evidence-based practices for smoking cessation.*

Smoking; Smoking Cessation; Smartphone; Mobile Applications

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Introduction

Smoking causes approximately 6 million deaths per year around the world [1]. According to estimates, one-third to one-half of all smokers die from tobacco-related diseases, while smokers live an average of 10 years less than non-smokers [2]. Offering different treatment modalities to smokers is one of the measures recommended by the World Health Organization (WHO) to reduce the impact of smoking in the world [1].

Brazilian Unified National Health System (SUS) offers free coverage for smoking cessation treatment through the Brazilian National Tobacco Control Program (PNCT). The Program aims to reduce smoking prevalence and the resulting tobacco-related morbidity and mortality [3]. Treatment is provided by health professionals trained in primary healthcare units according to the Brazilian National Cancer Institute's guideline entitled *Management and Treatment of Smokers* [4], a publication based on the U.S. guideline *Treating Tobacco Use and Dependence – 2008 Update* [5]. This guideline uses pharmacological and cognitive-behavioral approaches as evidence-based methods for smoking cessation treatment.

Although major strides have been made to guarantee access to treatment for smokers, a large share of smokers still fail to receive evidence-based treatment. According to data from the *National Health Survey*, 51% of Brazilian smokers attempted to quit smoking in the year prior to the survey, but only 8% received some form of evidence-based treatment [6]. Several factors may help explain the challenges encountered in the implementation of the PNCT and low access by smokers, such as the treatment's cost and the limited number of professionals trained to execute the program [7]. Even services that offer treatment tend to have long waiting lists, since each treatment group has the capacity to treat 10 patients on average for a period of one year [3]. Thus, the use of alternative smoking cessation strategies may be relevant to the Brazilian context.

International researchers have used complementary smoking cessation strategies, such as telephone hotlines [8], printed self-help materials [9], cellphone text messages and apps [10], and online interventions [11]. Such strategies represent a viable alternative to traditional treatments, due to their great reach potential, although they present lower efficacy than the traditional treatments [12].

Among the complementary strategies, smartphone apps, short message services (SMS), and websites have similar characteristics. Since they are generally automated, they can offer education, referral, and counseling to various users simultaneously, 24 hours a day, seven days a week. These strategies can also be updated faster than traditional approaches, based on new research findings [13].

Another factor that explains the potential of these strategies for public health is the rapid growth in the number of smartphones and computers with Internet access. An estimated 46.7 million Brazilians had access to smartphones in the country in 2015; in 2014 the number was 39.7 million. In 2014, Android (89.1%) was the most widely used operational system in Brazil, followed by iOS (5.2%) and Windows Phone (3.8%) [14]. About 67% of the Brazilian population uses Internet. Approximately 110 million Brazilians have Facebook accounts [15]. Most Brazilian web users still prefer to access Internet through computers rather than by smartphones or tablets, but the trend is for smartphones to overtake computers in the coming years.

Despite the growth in technology access and use in Brazil, the information on smoking available on the web still suffers from problems related to quality. According to a review that evaluated the content of sites on smoking available in Portuguese, the sites failed to provide systematic support to help smokers, besides showing limited coverage of the topics recommended by smoking cessation guidelines [16]. A systematic review recently published in the Cochrane database evaluated evidence on the efficacy of smoking cessation interventions based on mobile technologies (SMS, Internet combined with SMS and video) and found that cellphone-mediated interventions show positive effects promising results in short and long-term abstinence (6 months) [17].

Abroms et al. [18,19] aimed to evaluate the content of English-language smartphone apps for smoking cessation; like the resources available on the Internet, they found that cellphone apps generally showed low quality and limited adherence to treatment guideline, besides rarely using evidence-based practices. However, the finding only applies to apps available in English. To date, there is no similar studies on apps available in Portuguese. Based on the above-mentioned studies and considering the potential benefits for public health, the current study aimed to evaluate the content and functionalities of smoking cessation applications available in Portuguese for Android and iOS in April 2015.

Methods

Sample and procedures

The search terms [in Portuguese] were *"how to stop smoking"*, *"quit smoking"*, *"stop smoking"*, *"smoking"*, and *"cigarette"*. These terms were chosen based on the consensus among the authors and on a keyword search tool survey in Google Adwords (https://adwords.google.com/) on December 4, 2014. The tool allows estimating which keywords are used most in Google, which is used by 96.7% of Internet users in Brazil [20].

The list of iPhone apps was obtained by means of a search in iTunes Apple Store (version 12.0.1) and of Android apps in Google Play Store. Identification of the Google Play Store apps used an automated search with a script [21]. The iTunes store search used an iPhone 6 with iOS version 8.1.3.

The searches yielded 51 apps in the iTunes store and 600 in Google Play Store. Content evaluation included both free and paid apps that focused on smoking cessation and were available in Portuguese. The apps that required a fee were purchased. Those that were not available for download in Brazil and duplicate finds were excluded. Apps made by the same developer and that had free and paid versions were analyzed separately since they presented different characteristics and/or functions. Figure 1 shows the apps selection process with the exclusion criteria.

The final sample consisted of 12 apps in iOS and 3 in Android. The *Brasil Sem Cigarro* [Cigarette-Free Brazil] app was found in both operational systems and was only included once, thus totaling 14 apps for analysis. This app was used for training the content classification method. For each operational system, two authors performed the app evaluation after using the apps and using all their features in up to 60 days. Classification was done independently, and disagreements were discussed in the presence of a third person until reaching a consensus.

Classification of the applications

Each of the 14 apps was classified according to its smoking cessation approach based on the categories identified by the National Tobacco Cessation Collaborative [22], as follows: (1) calculator: tracks the money saved and health benefits accrued since quitting; (2) calendar: tracks the days until and since the quit date; (3) hypnosis: presents hypnosis techniques used for cessation; (4) information tools: provides information on various aspects of smoking; (5) game: provides a game to help quit smoking; (6) lung health monitoring: measures the individual's lung health or lung function; (7) rationing: limits the number of cigarettes and/or the time in which the cigarette can be smoked; and (8) others.

The apps were also coded according to their level of adherence to the *Treating Tobacco Use and Dependence* guideline [5]. To measure adherence to the guideline, a 21-item index was developed and adapted by Abroms et al. [18,19]. In order to use the index in this article, a free translation was done by two independent translators, followed by an analysis by a third referee, who decided on any disagreements that appeared.

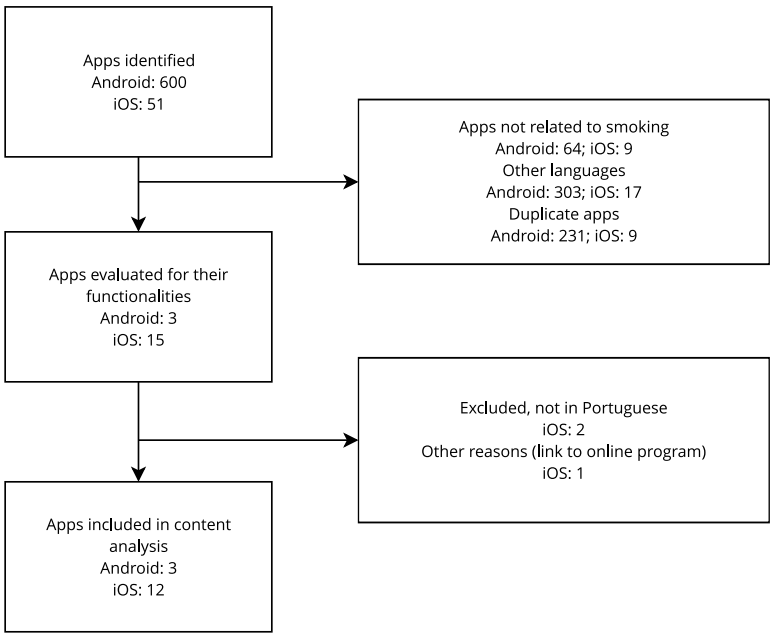
Classification of the apps as to adherence to the guideline was done by assigning a value to each of the 21 items in the translated index, available in an online repository [23]. As done by Abroms et al. [19], a value of 0 was assigned when an item was considered "absent", 1 when it was considered "partially present", and 2 when an item was considered "totally present". The highest possible score for each app was thus 42 points. Classification was performed by two different researchers in each operational system (iOS and Android), and disagreements were discussed until a consensus was reached.

Search for studies on development and evidence of efficacy, APIs, and license format

In addition to the content review, we conducted a search on the developers' websites and in scientific databases (PubMed, PsycInfo, and Google Scholar) for scientific articles describing the development process and evidence of efficacy of the APIs (application program interfaces) and source codes. The names of each app were used as the search keywords.

Figure 1

Search for and analysis of smartphone apps.



Results

Categorization of applications and adherence to guideline

Table 1 lists the characteristics of the 14 apps included in the analysis, including each app's operational system, categorization, adherence to the index, and price. Most of the apps were classified as calendars (n = 9), followed by information tools (n = 8) and calculators (n = 6). Three apps were used for rationing and one for hypnosis. No apps in Portuguese were classified as lung health tools, games, or others.

As for adherence to the index, which varied from 0 to 42, the mean score was 12.85 (SD = 7.35). The app with the best score was *Brasil Sem Cigarro*, with 29 points, approximately 70% of the maximum possible score. Eight apps scored from 17 to 14, with approximately 40% coverage. The majority (n = 9) were available free of cost. Five apps required a fee, ranging from USD 0.99 to USD 3.99.

Of the 14 apps, 11 were specific to smoking (78.5%) and 13 were interactive (92.8%). More than half of the apps (57.1%) counseled smokers to quit smoking, but only five (35.7%) provided clear orientation. Nine (64.2%) sent text messages to users and 7 (50%) offered complementary information (Table 2).

Slightly more than half of the apps (8, or 57.1%) boosted users' motivation to quit smoking by showing the benefits accrued from quitting, five (35.7%) motivated smokers to quit by focusing on the risks of smoking, and only four (28.5%) boosted smokers' motivation by providing tips to deal with the difficulties while attempting to quit. Only two (14.2%) offered follow-up for users (Table 2).

Only three apps (21.4%) offered help to develop a quit plan, four (28.5%) helped the quit plan by offering strategies to help quit smoking, and none offered social support during treatment. Although ten apps asked about smoking status (71.4%), none assessed the smoker's desire to quit smoking.

Table 1

Characteristics of smoking cessation apps in Portuguese.

App	Operational system	Category	I *	Price
Brasil Sem Cigarro [Cigarette-Free Brazil]	Android + iOS	Calculator/Information tool/Calendar	29	Free
Kwit	iOS	Calculator/Information tool/Calendar	17	Free
Kwit 2	iOS	Calculator/Information tool/Calendar	17	USD 3.99
My Last Cigarette Free	iOS	Calculator/Information tool/Calendar	17	Free
My Last Cigarette	iOS	Calculator/Information tool/Calendar	17	USD 0.99
Quit Smoking in 60 Days	iOS	Rationing	16	USD 1.99
Pare de Fumar [Quit Smoking]	Android	Information tool	15	Free
H4u Tobacco	iOS	Information tool	14	USD 2.99
You Can Quit	iOS	Calculator/Information tool/Calendar	14	Free
Daily Cig	iOS	Rationing	9	USD 1.99
Fume Menos ou Pare de Fumar [Quit Smoking or Smoke Less]	Android	Rationing/Calendar	6	Free
Metas de Vida [Life Goals]	iOS	Calendar	4	Free
Good Habits	iOS	Calendar	3	Free
Hypnomatic	iOS	Hypnosis	2	Free

* Adherence to the *Treating Tobacco Use and Dependence* guideline.

Table 2

Apps' adherence to the smoking cessation guideline.

Adherence to items	%	n = 14
Specific to smoking	78.5	11
Interactive	92.8	13
Counsels all smokers to quit	57.1	8
Counsels all smokers to quit: personalized	57.1	8
Counsels all smokers to quit: clear	35.7	5
Counsels all smokers to quit: emphatic	71.4	10
Asks about smoking status	71.4	10
Increases motivation: rewards	57.1	8
Increases motivation: obstacles	28.5	4
Increases motivation: risks	35.7	5
Evaluates desire to quit	0.0	0
Helps with a quit plan: overall	21.4	3
Helps with a quit plan: practical counseling	28.5	4
Helps with a quit plan: social support during treatment	0.0	0
Helps with a quit plan: recommend approved medications	0.0	0
Recommend counseling and medicines	0.0	0
Text alert (report)	64.2	9
Referral for treatment	0.0	0
Helps develop a quit plan: complementary information	50.0	7
Offers follow-up	14.2	2
Connected to quit hotline	0.0	0

Of all 14 apps, none recommended counseling or medication, and none referred the smoker to evidence-based treatments. None of the apps were connected to quit hotlines (Table 2).

No study was found in scientific journals describing the apps' development or efficacy. None of the apps had any type of API. Only one app, *Good Habits*, had the code available for study, although the license format was not located.

Description of the apps' functionalities

The apps were analyzed for their functionalities. The characteristics and functions of the iOS apps are described next. *Brasil Sem Cigarro* was available in both operational systems. The first available function was a video with information on the app's use. Next, the user had to provide information on his smoking history. The app calculated how many cigarettes the user had smoked in his lifetime, how long he had spent smoking, and the total money spent on cigarettes. It also furnished tips on how to quit smoking, benefits accrued from quitting, and harms from continuing to smoke. The user could also record a motivational video to help during the most difficult times. The app also sent messages with tips to remain tobacco-free.

The *Kwit* and *Kwit 2* apps calculated the number of lifetime cigarettes smoked and the amount of money the user was saving. Both contained information on the benefits of quitting, since the moment the user smoked his last cigarette. The paid version contained two additional topics. The *You Can Quit* app had the same function and information on the benefits of kicking the habit.

The *My Last Cigarette* and *My Last Cigarette Free* apps displayed functions such as calculating the increase in life expectancy after quitting, savings, number of cigarettes not smoked since quitting apps, and graphs showing the health benefits of quitting. They also contained information on the harms of continuing to smoke, such as the number of deaths caused by tobacco and the risk of heart attack and lung cancer. The app had a function that sent daily messages on reasons to continue tobacco-free. The paid version followed the same pattern as the free version, but with no advertisements.

The *Hypnomatic* app contained three hypnosis sessions, plus information on hypnosis, such as susceptibility to the technique, curiosities, functioning, and instructions. However, the app was not specific to smoking and the sessions were not personalized. Likewise, the *Metas de Vida* [Life Goals] app was not specific to cessation. The user was supposed to choose which life goal he wanted, like "quit smoking", "lose weight", or "drink more water", among others. After choosing the goal, he was supposed to set the target, which in the case of tobacco was the number of cigarettes he wanted to smoke per day. Over the course of the days, the app automatically displayed a graph with the number of cigarettes smoked/day. The user could receive app alerts with messages on cessation. Likewise, *Good Habits* was also an app to improve on unwanted habits. There was a questionnaire on life habits such waking up early, smoking, and others. The user was supposed to fill in the calendar every day, reporting on the habit change (in this case, not smoking).

The *H4u Tobacco* app had three types of information: strategies to quit smoking, motivational messages, and popular sayings. There was also an option to fill in the most critical hours in which the user was accustomed to smoking, in order for the app to send messages at these times. The *Daily Cig* app contained the same function of sending messages at personalized times, but it was classified as "rationing" since the user had to set the daily target, or number of cigarettes he wanted to smoke. The app also had a session on the harms of tobacco and rerouted the user to a site, but the site was not available when we categorized the app. In the *Quit Smoking in 60 Days* app, the user also had to choose how many cigarettes he wanted to smoke per day and record how many cigarettes had been smoked. The app reported when the user reached his daily target.

The *Fume Menos ou Pare de Fumar* [Smoke Less or Quit Smoking] and *Pare de Fumar* [Quit Smoking] apps were exclusive to Android. The first began with a question on the user's target for smoking. The user recorded his objectives, such as stabilizing, reducing the number of cigarettes, or quitting. According to the objective, he had to record how many cigarettes he wanted to smoke per day and a date to reach the target. Like the apps categorized as rationing tools, the user had to record the number of cigarettes smoked per day, and the app reported when the limit was reached. The app also offered follow-up in graph form, the number of cigarettes smoked, and the daily target until the quit date. The second of these two apps was strictly informative. It contained information on the benefits

of cessation, curiosities, tips, and techniques for quitting, in addition to dietary recommendations to help with cessation. It was possible to choose the categories to be displayed on the app's home screen and wallpaper. It was also possible to share tips on social networks and select favorite tips.

Discussion

The apps available in Portuguese generally presented problems of low quality and low adherence to the smoking cessation treatment guideline. This shows that the apps' public health potential has still not been properly achieved in Brazil. Although one app scored 70% adherence, the rest had less than 40% coverage, showing that evidence-based information is still insufficiently used.

Mobile technologies such as smartphone apps for health treatments – and specifically for smoking cessation – are promising forms of intervention and education. The main advantage for public health is cost-effectiveness, scalability, and wide reach when compared to traditional treatments [24,25,26,27]. Rapid dissemination of such interventions and remote reach can potentially boost traditional treatment programs, reduce waiting lines, and increase the quit ratios in Brazil.

Despite evidence of the efficacy of mobile technologies for smoking cessation treatment in English [10], no studies were located in scientific journals that describe the development and/or clinical efficacy of the Portuguese-language apps described in the current study. However, there are several models in the literature for the development of apps and web interventions, such as Persuasive Systems Design [28] and studies on the impact of given elements and components on the efficacy of these health interventions [29,30]. Such studies provide evidence-based information for the development of health interventions through the use of mobile technologies and Internet.

The low number of apps for Android also shows an opportunity, as yet unexplored, for smokers' education in Brazil. Approximately 90% of 40 million devices in Brazil use the Google operational system. The development of apps for this platform could help smokers find evidence-based information on smoking cessation treatment, as well as promoting news and information on the services offered by the SUS, such as primary healthcare units and the Health Hotline.

The use of smoking cessation apps can also be a strategy to reach teenagers and young adults, audiences that rarely seek face-to-face treatment offered by the SUS. Studies have shown that people that seek treatment for smoking cessation are generally older adults, mostly women, and who also display higher nicotine dependence levels [31,32].

The WHO [1] proposes a variety of treatment models for smokers, citing the offer of treatment by telephone and Internet as accessible, low-cost programs. Still, average adherence to the smoking cessation guideline in the current study was 12.9 points (SD = 7.3), a similar finding to that of Abroms et al. [18,19]. In addition, of the 14 apps analyzed here, 10 had their names in English, although the content was available in Portuguese. Of the 9 Portuguese-language apps that reached higher-than-average adherence to the guideline, 7 had names in English. Thus, smokers looking for help with cessation through smartphone apps may fail to download the apps because they think the content is only available in Portuguese, which may restrict access by individuals interested in this cessation strategy.

Evidence indicates that smoking cessation text messages can increase the quit rates [33]. In this study, 9 of the 14 apps (64.2%) used this approach. Various apps are also connected to social media. This may be a positive feature, but future studies should assess its real effectiveness for smoking cessation.

The current study's strength is that it was the first to systematically evaluate the content of apps for Android and iOS available in Portuguese to assist smoking cessation. With the expansion of smartphones and thus the increase in the number of apps available for download, it is important to explore the use of such tools for health, including smoking cessation.

The study's potential limitations included difficulty in finding identical results when conducting the searches, probably due to the personalized system in iOS, since iTunes searches are shaped by the user's personal preferences. To fill this gap, future studies should use more than one iPhone with different configurations to conduct the search, in order to identify the largest number of apps. In addition, there is no way of knowing whether and how the apps are being used after downloading (if they are being used alone or in combination with other kinds of care; who is downloading the apps and

where in the world; and whether the apps are effective). Since privacy policies prevent access to these data, a possible solution would be to contact the app developers for them to request users' authorization to collect data on access, usability, and efficacy, and then analyze the resulting data. Third, the index was built on the assumption that the guideline was developed in a clinical setting and that it would be effective in the context of a mobile app. However, it is possible that such recommendations would not be effective in a different context. Thus, new studies should be performed to assess whether the guideline is applicable to the mobile context, as well as to evaluate the app's efficacy for smoking cessation. Finally, it may be the case that some evidence-based apps are available but were not found by the current study's search.

Conclusion

The current study identified and analyzed smoking cessation apps available in Portuguese. Although there were fewer apps than those available in English, they nevertheless represent an expansion of this form of smoking cessation treatment in Brazil. However, the apps found here still lack many elements that are recommended to help smokers quit smoking. Smartphone apps thus need to be optimized in order to include current clinical guidelines and other evidence-based practices. If these apps prove to be effective, they can be a promising strategy for smoking cessation. We thus recommend the development of apps based on smoking cessation treatment guidelines and the review and evaluation of the existing apps' efficacy.

Contributors

All authors contributed equally in the production of the paper.

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Resumo

Aplicativos de smartphones *estão sendo desenvolvidos como uma forma complementar ao tratamento do tabagismo. O presente estudo teve como objetivo analisar o conteúdo de aplicativos disponíveis na língua portuguesa em dois sistemas operacionais: Android e iOS. Cinquenta e um aplicativos foram encontrados no iTunes e 600 no Google Play. Foram incluídos na avaliação do conteúdo aqueles aplicativos que tivessem como foco a cessação do tabagismo, com um total de 12 no iOS e 3 no Android. Cada aplicativo foi categorizado por meio da sua abordagem na cessação de tabagismo e pontuado de acordo com o seu nível de aderência às diretrizes de tratamento de tabagismo do* Treating Tobacco Use and Dependence*. Em relação às categorias, 9 foram classificados como calendário, 8 como informativo, 6 como calculadora, 3 como medidor de cigarros fumados e 1 como hipnose. Os aplicativos apresentaram baixo nível de aderência às diretrizes, com uma média de 12,8. Recomenda-se que os aplicativos disponíveis sejam revisados e que futuros aplicativos sejam desenvolvidos utilizando práticas baseadas em evidência para a cessação do tabagismo.*

Tabagismo; Abandono do Hábito de Fumar; Smartphone*; Aplicativos Móveis*

Resumen

Aplicaciones para smartphones *se están desarrollando como un complemento al tratamiento del tabaquismo. Este estudio tuvo como objetivo analizar el contenido de aplicaciones disponibles en el idioma portugués en dos sistemas operativos: Android y iOS. Cincuenta y un aplicaciones fueron encuentradas en iTunes y 600 en Google Play. Se incluyeron en la evaluación las aplicaciones que se han centrado en dejar de fumar, con un total de 12 en iOS y 3 en Android. Se clasificó cada aplicación de acuerdo a su enfoque para el abandono del hábito de fumar y se anotó de acuerdo con el nivel de adherencia a la guía de tratamiento del* Treating Tobacco Use and Dependence*. Nueve aplicaciones se clasificaron como calendarios, 8 como herramientas de información, 6 como calculadoras, 3 como seguidores de cigarrillos y 1 como hipnosis. Las aplicaciones mostraron un bajo nivel de adherencia a la guía de tratamiento, con una puntuación media de 12,8. Recomendamos que se revisen las aplicaciones disponibles y que las aplicaciones futuras se desarrollen utilizando prácticas basadas en la evidencia para dejar de fumar.*

Hábito de Fumar; Cese del Tabaquismo; Teléfono Inteligente; Aplicaciones Móviles

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