Lecture Notes in Educational Technology

Francisco José García-Peñalvo
Alicia García-Holgado *Editors*

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New Technologies to Quit Smoking. Analysis of Mobile Applications Available for iPhone

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Abstract. Mobile apps are one of the most widely used interventions for smoking prevention and treatment in recent years. This study sets out to examine the content of free Spanish-language smoking cessation apps that were distributed through AppStore. 29 applications that met the selection criteria were included. Calculator apps (48.3%) and progressive quitting apps (44.8%) were the most common. In general, the user did not have to create a profile, to include nicotine dependence, or to include length of time smoking or motivation to quit. The number of cigarettes smoked per day and the fact of establishing a D-Day were elements that were requested from the user when starting to use the application. Among the most common components were receiving daily progress updates, receiving notifications, general advice to quit smoking and tracking cravings. Finally, only 27.6% had been tested or evaluated and only 17.2% published works were found with the results of the evaluation of the application. In conclusion, it is necessary to carry out a more exhaustive review of the smoking cessation applications available, as well as to encourage the development of evidence-based applications for smoking cessation that consider the characteristics and needs of users.

Keywords: mHealth · Smoking cessation · iPhone · Tobacco · Mobile applications

1 Introduction

In Spain, tobacco is the second most widespread psychoactive substance in the population and causes more than 50,000 deaths per year, being the cause of 13% of all annual deaths [1]. In fact, smoking is the highest health and social cost that Spanish society must face due to the diseases caused by tobacco. However, this economic, health and human expense is avoidable [2]. In this sense, tobacco support and treatment interventions are a solution to this problem since these interventions show a very favorable cost-effectiveness ratio [3].

One of the most used interventions in recent years for the treatment of smoking are mobile applications. This is because smartphones have become a basic element of our daily lives and, with it, the use of mobile applications. In fact, there are currently around 325,000 health applications [4]. In this sense, at least 400 mobile applications are currently available to quit smoking and around 780,000 are downloaded per month

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worldwide [5–7]. In this way, mobile health applications, also known as mHealth, have the potential to transform the way health services are provided by offering health information more quickly [8]. Therefore, mHealth is part of what is called eHealth (or technology at the service of health) and includes the use of mobile devices in the collection, delivery, and access to health information by professionals, researchers, and patients. Although mHealth is an emerging and rapidly developing field, it has the potential to play a key role in the transformation of healthcare to increase its quality and efficiency, and whose mission is to complement rather than replace traditional healthcare [9]. In fact, mobile health technology (mHealth) is a promising tool to engage patients in their own health care because most people own and regularly use a mobile phone, and therefore mHealth is a very appropriate medium to deliver health information [10]. The use of mobile health apps verifiably leads to higher levels of autonomy and increases perceived self-efficacy. Mobile health apps have the potential to help people with and without a clinical diagnosis to promote desired behaviors [11].

Even though there are many mobile applications on the market (both for Android and IOS devices), we find that they suffer from three important problems: a) on many occasions the theoretical evidence bases on which they are based is unknow b) the empirical results obtained on their efficacy or effectiveness as intervention tools are inconclusive; and c) for the most part, the mobile applications for smoking cessation available only include simplistic elements such as calculators. In fact, despite the high number of Apps and downloads, the scientific community establishes that it is necessary to test the efficacy of the treatments they offer, since many of the applications available in stores do not adapt to the established guidelines [6, 12–14].

2 Objectives

The main objective of the study is to carry out a content analysis of mobile applications to quit smoking available on IOS for free to analyze the basic components of said applications, as well as whether they consist of empirical evidence or a test of their effectiveness. For it, the following specific objectives were established:

O1. Identify in the AppStore which applications are available for free for smokers.

O2. Check how many of the applications in the AppStore have a theoretical foundation or have been tested.

O3. Describe the basic components of mobile applications to quit smoking available on IOS for free.

3 Method

3.1 Sample

The present study examined the content of free applications in Spanish to quit smoking available in the AppStore (iPhone) between November-December 2021. A total of 168 applications for iPhone were identified through the words “dejar de fumar” “fumar” and “stop smoking”, of which 29 met the selection criteria. First, it should be noted that there are multiple applications to quit smoking on the market, in fact, previous studies such as

the one by Abroms et al. [6] located a total of 400 applications to quit smoking on IOS and Android. Studies such as Abroms et al. [6] limit the sample considering the most popular applications (both IOS and Android). This criterion was not applied, since the AppStore does not include the number of downloads. On the other hand, if those with the highest score were considered popular, it could be that an application was more popular but only had one rating. In addition, reviews such as the one by Haskins et al. [13] observed that some of the applications were not found with terms or plain language in store search engines, for example, they observed that the *SmokeFree28* application that consisted of empirical evidence did not appear among the list of the 50 best apps to quit smoking. Therefore, to have a more general vision and considering that the large volume of applications exceeded the available resources, the decision was made to analyze only applications available on IOS, free and in Spanish:

- Mobile applications available in the AppStore. Considering the high volume of apps on both platforms, we focus on the AppStore as this store requires the app to meet certain criteria to be listed and maintained on the AppStore. Therefore, we consider that the applications available in this store have a previous quality filter by the platform itself.
- Free download mobile applications. Due to the scarcity of available resources, the analysis was limited to free downloadable mobile applications.
- Mobile applications in Spanish. As the objective is to know the applications that smokers in Spain can enjoy, only those applications available in Spanish were selected (Fig. 1).

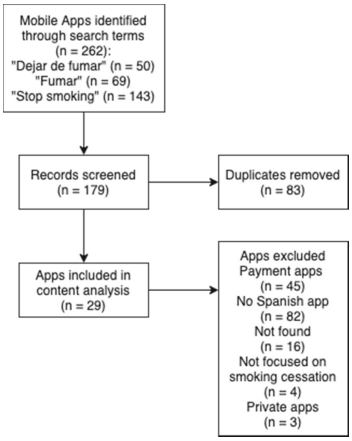

Fig. 1. Flowchart of IOS applications selected for analysis.

3.2 Procedure

The study analyzed the main components of the applications with the aim of deepening the knowledge of what characteristics the smoking cessation applications available on

the market have. Coding was carried out by two coders. The average agreement between the evaluators was carried out with 10% of the total sample (N = 10) and the inter-rater agreement was calculated based on Krippendorff´s Alpha (>.70). The code book was structured in four different blocks of questions:

- Block one: encoder identification questions were displayed.
- Block two: included questions to identify each application (e. g. identification number, place where the application is developed, developer, etc.) as well as the words or groups of words with which the application has been in the AppStore and if it has content under payment once the application is downloaded
- Block three: Basic features of the application. It includes items referring to the elements that the application offers when it is installed (e. g. profile creation, dependency evaluation, if the user sets a date to quit smoking, etc.) as well as the type of application (e. g. calculator, game, hypnosis, informative), the general components of the application (e. g. includes prizes, daily updates, progress, notifications, information about tobacco, tips…) as well as if it includes additional information (e. g. helpline, external resources, drug recommendation, etc.).
- Block four: items were included to establish whether the application had been evaluated and whether there were published works on the evaluation of the application (Table 1).

Table 1. Inter-coder reliability data.

Variable	**Krippendorff´s Alpha**
Variable identification	
Main objective of the apps	1.00
Price of the app (free or not)	1.00
Price of the app (in-app purchases)	1.00
Developer (country)	1.00
Developer (individuals, private companies, university…)	0.75
Main components	
Profile	1.00
Nicotine dependence evaluation	0.74
Nicotine dependence evaluation (Fagerström Test)	0.76
Evaluation of the motivation to quit	1.00
Number of cigarettes smoked per day	1.00
D-Day (day for quitting)	0.74
User age	1.00

(*continued*)

Table 1. (*continued*)

Variable	Krippendorff´s Alpha
Time smoking	1.00
Prices or badges	1.00
Updates	1.00
Smokeless cigarettes update	1.00
Money saved update	0.80
Improved health update	0.80
Time without smoking update	0.74
Notifications	1.00
Information on tobacco and its consequences	1.00
Benefits of quitting smoking	0.80
General advice	0.79
Personalized advice	1.00
Other elements	
Tracking of cravings or relapses	0.79
Relaxation techniques	0.80
Links (external resources)	0.60
Share achievements (social networks)	0.74
Evaluation	
App evaluated or tested	1.00
Published works	1.00

4 Results

The main objective of the applications considered for the analysis (n = 29) was 48.3% calculators, 44.8% applications to gradually quit smoking and 6.9% were classified as other. It should be noted that, despite considering only free apps, 62.1% included in-app purchases. Therefore, even though the download was free, many of the components were blocked and the user had to pay for them. Likewise, it is important to highlight that most of them are applications developed outside of Spain (75.9%) and by individuals (51.5%) or private companies (24.1%). In this regard, it was observed that the apps categorized as calculator were developed either by private companies (35.7%) or individuals (64.3%) and were mostly developed outside Spain (85.7%). Those apps with a plan to quit smoking in a progressive manner are those developed by a university (*Quitmedikit*), a hospital (*DayQ-stop smoking*), an association (*Respirapp*) and an organization or institute (*S'acabó*). Also, three applications developed in collaboration with the above (*Stop Tobacco Mobile Trainer, Kwit and Smoke Free*) were found.

Regarding the main components when installing the application, it was observed that in less than half of the applications (34.5%) the user created a profile. In this case, it is in calculator applications that users create fewer profiles. Only 21.4% of the calculator applications (n = 3) allowed the user to create a profile. Compared to 46.2% of applications to gradually quit smoking. Likewise, only 17.2% of all the applications analyzed evaluated nicotine dependence and, of these, only 6.9% (n = 2) did so through the Fagerström Test [15].

Similar results are observed in relation to the evaluation of the motivation to quit smoking, only 17.2% include this element. However, most of the applications (72.4%) asked the user the number of cigarettes smoked per day, as well as the fact of including a D-Day (day for quitting) (72.4%), but not other elements to personalize your profile or smoking quitting process such as age (only asked in two of the applications) or the time you have been smoking (only 17.5% include this information).

Among the general components that free applications on the market usually include is the fact of receiving prizes or badges (48.3%) or receiving updates on their progress (82.8%). Many of them show progress through graphs of cigarettes not smoked (55.2%), money saved (65.5%), improved health (51.7%) and time without smoking (58.6%). Likewise, most of the applications include notifications or alert messages (72.4%). They normally do not include information on tobacco and its consequences (20.7%) or on the benefits of quitting smoking (41.4%). Although more than half included general advice (55.2%), only 6.9% (n = 2) included personalized advice considering the information provided by the user.

Other elements that are observed in the applications is the tracking of cravings or relapses (51.7%), however, most of the users do not indicate the number of cigarettes smoked (37.9%), a new date of abandonment (13.8%) and the user does not indicate his state of mind after the relapse (10.3%). Other complementary elements that some of the reviewed applications include are relaxation techniques (34.5%), incorporating external resources to the application through links (e.g., links to web pages with additional information) (24.1%) or being able to share achievements through social networks (20.7%).

Finally, it is important to highlight that of the total number of applications, only 31% of them were found to have been evaluated and only 17.2% of published works with the results of the evaluation were found.

5 Conclusions

The aim of this study was to determine which smoking cessation apps have been developed based on empirical evidence and to determine the availability of such apps on the market, although it has been observed that many of the existing free applications on IOS have not been tested or have been developed by experts, it is true that there are others that can help you during your attempt to quit smoking by smoker, such as *S'acabó*, from SEDET (Society of specialists in smoking cessation), *Stop Tobacco Mobile Trainer*, created by psychologists with the support of the University of Las Palmas de Gran Canaria, or *Respirapp* developed by psychologists from the AECC (Spanish Association Against Cancer). Therefore, although many applications contain specific components to quit

smoking and motivate the smoker, in the vast majority they are not based on empirical evidence. The results of the present study are consistent with those of meta-analyses and reviews by other authors. In general, previous studies agree that most mobile apps rely on calculators [5, 6]. Moreover, very few apps are based on empirical evidence [13, 16].

This study was limited to iPhone apps in the AppStore at the time of analysis, a limitation given that apps are frequently added to and removed from the AppStore. Also, only those that were downloadable and free are part of the study. On the other hand, the search was limited to the applications that appeared for the terms "dejar de fumar", "fumar", or "stop smoking", so the current frequency data may be biased towards the populations that use this term more frequently.

Future research can delve into the analysis of mobile applications that exist to quit smoking in Spain, also considering Android applications (because it is the operating system that most people in Spain use) and not having consider only the free ones. Therefore, it is necessary to carry out a more exhaustive review of the smoking cessation applications available on the market, as well as to encourage the development of evidence-based applications for smoking cessation that consider the characteristics and needs of users.

In conclusion, in an era in which the prevalence of smartphones and their associated applications has skyrocketed, it is relevant to explore the applications of these devices to promote public health, specifically, smoking cessation. In this sense, the present study sheds light on the tested and evaluated applications, as well as the applications that are available to the smokers.

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