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<http://hdl.handle.net/2117/333527>

Article publicat / Published paper:

Alvarez-Moya, E. [et al.]. Development of a Mobile Application for People with Obesity. "Journal of nutrition education and behavior", 19 Agost 2020, p. 1-5. DOI: <[10.1016/j.jneb.2020.07.004](https://doi.org/10.1016/j.jneb.2020.07.004)>

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Development of a Mobile Application for People with Obesity

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INTRODUCTION

Obesity is a multifactorial disease that causes considerable medical problems and public health costs. The National Institute for Care and Health Excellence guidelines consider that behavioral interventions should play a major role in any effective treatment for obesity.¹ The most recommended techniques are the following: providing information about the consequences of obesity; setting specific goals; daily self-reports on weight, physical activity, and dietary intake; feedback on performance; reinforcing changes; a social support plan; stimulus control; problem solving; cognitive restructuring; and relapse prevention.¹⁻⁴ However, although behavioral approaches are often successful, weight is frequently regained, partly because of poor adherence and a lack of motivation to follow treatment.⁴

Systematic reviews have found that technology-based interventions can provide a moderately effective way of facilitating lifestyle change and weight loss in patients with obesity.³ New technologies could help to reduce economic costs, improve accessibility and adherence to

treatment, reduce the time between medical appointments, and increase patient motivation and weight control. Within this context, the present study aimed to develop a mobile application (app) based on the promotion of healthy habits, to support current treatments for obesity and help to improve their efficacy. This app was intended for people with obesity.

DEVELOPMENT

A needs analysis was carried out following the Business Model Canvas,⁵ which is a qualitative assessment of the real needs of a target population. The participants were patients who had previously participated in a study of obesity funded by the Spanish Ministry of Economy and Competitiveness (PSI2013-48045-C2-2-P). The patients were recruited from public health services in a low- to medium-income city in Barcelona province. The services were provided through the hospital where the present study was carried out. Participants were recruited between September and December 2016. The study was approved by the Terrassa Health

Consortium Institutional Review Board
(September 2016).

Thirty-three patients with obesity (aged 18–40 years) were included in the original study, but the application of selection criteria and attrition finally reduced the sample to 15 patients (11 women, 4 men; mean age, 34.1 years, SD = 5.0 years). After an interview, the patient needs were grouped as follows:

1. *Pains* (frustrations): the most frequent were physical limitations, emotional distress, guilt, discomfort with medical attention received, and lack of motivation.
2. *Gains* (desires): the most frequent were information about healthy habits, easy access to recipes and weekly menus, increased motivation to follow the recommendations, and social support.
3. *Customers, jobs* (realities): the most frequent were weight regain after dieting, snacking between meals, bingeing when emotionally distressed, irregular meal times and excessive food intake, unbalanced diet, and the need to change habits.

The present app was based on the TCAApp (HealthApp, Inc, Terrassa, Spain, 2015), which was originally designed for people with eating disorders (both bingeing-purging and restrictive types). Several changes to the app were made on the basis of information from the following sources: literature about behavioral treatments for obesity,^{1,6} the guidelines provided by the Spanish Society for the Study of Obesity⁷ and the Mediterranean Diet Foundation,⁸ and the results of a needs analysis. The adaptations consisted of removing those elements of the original app that were not applicable to people with obesity (eg, purges, laxatives),

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Conflict of Interest Disclosure: The authors have not stated any conflicts of interest.

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J Nutr Educ Behav. 2020;■■:■■-■■

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<https://doi.org/10.1016/j.jneb.2020.07.004>

Table. Description of KickO v1.0 Application Components

Elements	Description
Main modules	
Guidelines	This module includes 3 sections: <i>Mediterranean Diet</i> (characteristics and menu proposals), <i>Tips</i> (32 guidelines to reduce caloric intake), and <i>Consequences</i> (information about consequences and main diseases secondary to obesity)
Activity ^a	This module includes information about the importance of physical activity (why and how) and a section with different aspects to record: <i>Which sport did you practice?</i> (different physical activities to choose), <i>How long?</i> (watch), <i>Which degree of intensity?</i> (quantification), and <i>How do you feel?</i> (different emotions to choose). It also included 2 more sections: <i>Binges</i> (quantification) and <i>Fasting</i> (quantification of skipped meals)
Meals ^a	This module includes a detailed record of meals with the following sections: <i>Meal selection</i> (options: Breakfast, Brunch, Lunch, Snack, Dinner, Other), <i>What were you doing just before (meal selection)?</i> (different activities and situations to select), <i>What did you eat?</i> (they can write down what they ate and upload a photograph of the dish), <i>How much did you eat?</i> (specify quantity), <i>Duration of the meal?</i> (watch), <i>Who did you eat with?</i> (different types of relationships to choose), <i>Where did you eat?</i> (different places to choose), and <i>How do you feel?</i> (different emotions to choose)
Other elements	
Configuration ^a	Selection of characters, language, and design
Situation ^a	The user can record what they are doing
Ranking ^a	With this tool patients can visualize graphically their position in comparison with other users of the App (scores based on the frequency of logs in the application)
Results	Here the user can see their records of food and physical activity (self-monitoring)
BackOffice ^a	Web-based tool where therapists can see streaming records of their patients
Rewards	The users can exchange their scores for rewards (eg, motivating sentences, medals, etc)
Chat	Here the users can chat
Positive messages/feedback	Every log or registered healthy habit will be followed by positive feedback. Support and encouraging messages will be given every 2 records.
Contact with therapist	Contact with the health care professional

^aThese modules were conserved from the original application (TCApp).

maintaining some common elements (listed in [Table](#)), and adding specific elements for obesity (menus, behavioral strategies for reducing caloric intake, information about obesity, guidelines about physical activity in obesity, etc). The end product was a prototype called KickO (version 1.0, Healthapp, Inc) ([Figures 1 and 2](#)).

The KickO app was designed to connect patients to therapists, who can instruct them about how to use the app. The therapists are mainly workers in the public health system, but the app is also available to some private institutions. The latest version of this app can be downloaded at online market places such as Apple Store. Because the app is regarded as being complementary to professional work, the participants know the therapist and even the nutritionist. As previously mentioned, having a direct connection between the patient and the therapist could help

improve treatment adherence, which is one of the main problems of traditional interventions relating to obesity. Data from the app feeds a back-office application that customizes outputs and reinforces positive activities. The therapist can send the patient customized messages, challenges, tips, and rewards, all in real-time. Raw data acquired with this tool can be used to perform data analytics modeling relating to the user's behavior. This is achieved by means of artificial intelligence-based algorithms (ie, generation of charts reflecting time-specific results and the general evolution of the patient). KickO can also track patient engagement (sections visited, time spent, location—with permission, etc) and total connection time. This app was developed to be used by individuals of all ages, ethnicity, and gender with customization (diet, habits, language, etc). It was designed to be intuitive and self-explanatory.

The [Table](#) shows the components of the final prototype version of the app.

EVALUATION

A mixed-methods design with elements of qualitative and quantitative analysis and measurements was performed.

The usability of the KickO app (version 1.0) was tested. Eighteen more patients (aged 18–40 years) were then added to the previous sample. The final sample consisted of 21 patients (5 men, 16 women; mean age, 33.7 years, SD = 5.2 years). Each patient was given an Android-based mobile phone with the KickO app and encouraged to use it freely for 30 minutes. The 10-item System Usability Scale (SUS)⁹ was then administered. Comments, suggestions, and criticisms were requested and submitted for thematic content analysis according to Raigada.¹⁰ Spontaneous

Figure 1. Screens of KickO application showing Activity and Breakfast records (Spanish version).

comments were registered and transcribed. A selection of categories was then established for comments on the usability of mobile apps (Ease of Understanding, Coherence, Technical Questions, and Comfort in Use) and the content of the present app (Start Menu, Mediterranean Diet, Tips, Consequences, Restrictions, Binges, Physical Activity Log, Meal Register, Ranking, and Results), and a selection of analysis units was also established. Literal sentences were split up, and significant parts were coded

according to SUS-based usability criteria and the content of the app. The coded parts were then grouped according to similarity. Almost all the content categories were considered easy to use, coherent, understandable, and technically correct. The Physical Activity Log and Meal Register were the sections that caused the most problems (for all 4 categories of usability), whereas the Mediterranean Diet had no negative comments in any usability category. At the quantitative level, the mean total

SUS score was 82.3 (SD = 14.1), suggesting that the usability of the prototype was acceptable.

DISCUSSION AND IMPLICATIONS

In contrast to other mobile apps for the promotion of healthy habits (eg, MyFitnessPal, Diet Point, etc), the present app was specifically designed to meet the needs of people with obesity and included a specific set of

Figure 2. Screens of KickO application showing Activity and Breakfast records (English version).

behavioral modification techniques that are supported by scientific research. The implementation was based on a Spanish sample, but the app is available in English, Spanish, and Catalan. This technology-assisted tool for self-management of behavior related to diet and physical activity was judged acceptable by the study participants. They considered it an easy, comfortable, and simple-to-use system, as well as a dynamic mobile app that promotes greater awareness of recommendable behavior related to eating and physical activity.

The direct connection between the patient and the therapist and the use of personally customized tips and rewards helped to address several of the *pains* referred by the participants in the need analysis and could help to improve treatment adherence and efficacy. The results of the needs analysis support the importance of providing information about obesity and healthy lifestyles. They also provide social support—through elements such as a ranking and a chat function—and facilitate communication between the patient and the therapist (ie, offering

real-time contact) for future applications in this field.

FUTURE PLANS

Future improvements of the KickO app will include the implementation of new artificial intelligence algorithms that will apply data from other sources, including wearables (eg, smartwatches, and bracelets) and medical records, to improve customization. Other improvements will include image recognition software, to facilitate the recording of meals,

and developments based on positive thinking to help reduce binge eating. The app will be marketed through medical and insurance companies.

NOTES

This study was approved by the Research Ethics Committee (Institutional Review Board) of Terrassa Hospital Health Consortium.

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