Apps for individuals diagnosed with breast cancer: a preliminary assessment of the content and quality of commercially available apps in Spanish

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Conclusions: Few free apps are specifically designed for breast cancer in Spanish. Their content and quality, as well as the number of BCTs they include, should be improved.

Keywords: Breast neoplasms; mobile applications; patient-centered care

Background: many apps are directly related to health issues. Recent studies show that apps are widely accepted by the population and contribute to the modernization of the healthcare system. However, before recommendation, their contents and quality should be assessed, as well as the behavioral change techniques they include. In Spain, no study has been found to determine which apps are aimed at addressing any aspect of breast cancer. The objective of this study was to identify and describe the contents and analyze the quality and behavior change strategies of the free applications available in the online stores of Android and Apple whose main purpose is related to some aspect of breast cancer.

Methods: Searches were conducted in the Apple App and Google Play stores in Spain, between October 2018 and February 2019, using an Apple iPad Pro and a Samsung Galaxy Tab A6. The Spanish search terms used were: “cáncer de mama” [breast cancer], “cáncer de pecho” [breast cancer], “cáncer de seno” [breast cancer], “tumor de mama” [breast tumor], “tumor de pecho” [breast tumor], “tumor de seno” [breast tumor], “neoplasia de mama” [breast neoplasm], “neoplasia de pecho” [breast neoplasm], and “neoplasia de seno” [breast neoplasm]. After screening, contents related to breast cancer, quality, and behavioral change were assessed.

Results: The contents of the 6 selected apps were related to breast self-examination and to the signs and symptoms that may warn the woman of the presence of a breast tumor. The MARS objective and subjective quality scores were 4.11 (SD =0.59) and 3.07 (SD =0.91), respectively. The mean number of BCTs included in the apps was 2.83 (SD =3.040). The app with the highest number of BCTs was APP1, with a total of 9 techniques.

Conclusions: Few free apps are specifically designed for breast cancer in Spanish. Their content and quality, as well as the number of BCTs they include, should be improved.

Keywords: Breast neoplasms; mobile applications; patient-centered care
Introduction

Breast cancer is the second most frequent tumor in the world and, by far, the most prevalent type of cancer among women, regardless of the level of development of the country in which they live (1). There is sufficient evidence to suggest that there are factors whose elimination may help women prevent the onset of breast cancer (2-5), as well as other factors whose presence, once the tumor is diagnosed, may improve the quality of life and chance of survival of the affected woman (6,7).

Taking action to reduce or remove risk factors and enhance protective factors may reduce the likelihood of suffering from a breast tumor (8) and improve the course of the tumor once it has been diagnosed (9). Multiple strategies and resources have been used over time. However, the use of mobile tools, popularly known as apps, has recently been incorporated.

The contents of many apps are directly related to health issues, such as physical activity (10), assistance in making health-related decisions (11), and weight management (12). Previous studies have shown that this type of tool has long been accepted by the population (13), which has led some authors to suggest that they should be incorporated into health services (10). At the same time, the use of health apps is of interest due to the paradigm shift we are witnessing in healthcare towards patient empowerment or a patient-centered model of health care (14). There is no doubt that this is a real option. Nonetheless, for it to be truly fruitful, the apps recommended by the health services should meet minimum quality standards, such as, for example, proven empirical effectiveness (15,16).

It may be safe to conclude that apps bring benefits in the context of health. However, when used expressly for health issues, existing apps must be reviewed and their contents, aims, and quality determined (17,18). This would allow health care professionals to recommend them to patients. At present, specifically in oncology, the prescription of apps is not popular, one of the reasons being the lack of help provided to clinicians in determining which app is the most appropriate for each patient (18).

In Spain, no study has been found to determine which apps are aimed at addressing any aspect of breast cancer. The objective of this study was to identify and describe the contents and analyze the quality and behavior change strategies of the free applications available in the online stores of Android and Apple whose main purpose is related to some aspect of breast cancer.

Methods

Search strategy and data extraction

Our methods sought to replicate the way a patient might access an app that includes breast cancer information. Searches were conducted in the Apple App and Google Play stores in Spain, between October 2018 and February 2019, using an Apple iPad Pro and a Samsung Galaxy Tab A6. The Spanish search terms used on both online stores were the following: “cáncer de mama” [breast cancer], “cáncer de pecho” [breast cancer], “cáncer de seno” [breast cancer], “tumor de mama” [breast tumor], “tumor de pecho” [breast tumor], “tumor de seno” [breast tumor], “neoplasia de mama” [breast neoplasm], “neoplasia de pecho” [breast neoplasm], and “neoplasia de seno” [breast neoplasm].

The free apps available on both stores were included in this review. The initial screening consisted of reading the description of the apps and downloading them for further evaluation. Two researchers (LlF, RM) used the apps and extracted data from their contents independently. The inclusion criteria were as follows: applications that (I) focused specifically on the prevention or treatment of breast cancer; (II) were free to download and use; and (III) were available in Spanish from Spain. The exclusion criteria were the following: (I) apps that required a wearable device to be used; and (II) apps that did not work or were malfunctioning.

Both researchers (LlF, RM) screened the selected applications independently and extracted their data into a study-specific coding form. The extracted data included: name of the application; available on Apple, Android, or both; and content description. After screening, the researchers downloaded and used the apps. The included apps were installed on the devices for 2 weeks. Contents related to breast cancer, quality (19), and behavioral change (20) were assessed. Throughout this process, any disagreements regarding inclusion or content assessment were resolved by discussion and/or consultation with a third researcher (MA).

App quality assessment

The objective and subjective quality of each app was assessed by consensus between two researchers (LlF, CL) using the Spanish version of the Mobile App Rating Scale (MARS), developed by Stoyanov et al. (21), whose Spanish version was validated by Martin Payo et al. (19). MARS includes 23 items rated on a 5-point Likert scale ranging...
from 1 (“poor”) to 5 (“excellent”), except items 14–17 and item 19, which also included the “not applicable” option. The 19 items covering objective quality were divided into 4 subscales: engagement (items 1 to 5), functionality (items 6 to 9), aesthetics (items 10 to 12), and information (items 13 to 19). From the scores for individual items were obtained mean quality scores for each subscale. The objective quality total score was calculated as the mean of the scores for the 4 subscales. A mean subjective quality score was obtained as the mean of the scores for items 20–23. Finally, a 6-item app-specific content classification from MARS (awareness, knowledge, attitudes, intention to change, help seeking, and behavior change), designed for use in a health context, was included, in which responses were ratings between 1 (“strongly disagree”) and 5 (“strongly agree”).

**Behavioral change content assessment**

The behavioral change techniques (BCTs) included in the apps were assessed using the Behavioral Change Techniques Taxonomy version 1, developed by Michie et al. (20). This taxonomy includes 93 BCTs and has been shown to be a valid approach for assessing both BCTs in general, as well as health apps. A dichotomous scoring system was applied, as in previous studies (17), to assess the absence (0) or presence (1) of each BCT. This taxonomy generates a total BCT score per app (range 0–93).

**Statistical analysis**

A qualitative content analysis was conducted to determine the theme included in the apps. The total scores for each app on each MARS domain and BCT taxonomy were calculated using descriptive analyses. To analyze the differences in quality scores between the apps, the ANOVA test was used. All statistical analyses were conducted using IBM SPSS version 24.0, with the statistical significance threshold set at $P<0.05$.

**Results**

**App selection and description**

A total of 107 apps were identified and screened. Of those, 98 were excluded. Nine apps were downloaded, used, and assessed for eligibility. Finally, 6 apps, coded as APP1 to APP6, were included (Apple =2, Android =5, both =1). The reasons for exclusion after screening were the following: app contents not specifically related to breast cancer (n=54); in a language other than Spanish from Spain (n=40); and not being free (n=4) (Figure 1).

The contents of the 6 selected apps were related to 6 major themes, notably breast self-examination and information related to signs and symptoms that may warn the woman of the presence of a breast tumor (Table 1).

**Quality analysis of the apps**

The MARS objective and subjective quality scores were 3.06 (SD =0.802) and 1.96 (SD =1.132), respectively. Disparate scores were observed for both objective quality and subjective quality. Significant differences were observed between the apps and APP 1 stands out as the best rated, both in terms of objective and subjective quality and in the six items specifically designed for use in a health context (Table 2).

**Behavioral change techniques included in the apps**

Overall, the mean number of BCTs included in the apps was 2.83 (SD =3.040). The app with the highest number of BCTs was APP1, with a total of 9 techniques. Figure 2 shows the BCTs and their frequency of appearance in the apps. The presence of “Instruction on how to perform a behavior” stands out from the rest of BCTs.

**Discussion**

The results of the present study highlight the existing apps, designed in Spanish from Spain, whose final objectives are directly related to the prevention of breast cancer and other aspects of special relevance after a breast cancer diagnosis, such as, for example, the therapeutic regimen.

It should be noted that, unlike other assessments of breast cancer-related apps found in the literature, the number of apps is lower, although the selected apps coincide in terms of content (22).

The presence of information relating to self-examination is particularly noteworthy. Four of the six assessed apps included information about the proper procedure for performing this technique. Even though there is controversy in the literature about the usefulness of this technique (23), this method is still the most widely used by women in some contexts (24), which suggests that the breast self-examination technique should not be completely discarded (25) and perhaps women should be trained to do
it properly, especially in the absence of other resources (26).

Thanks to the scientific advances in recent years, the prognosis of breast cancer has improved. Screening and early detection strategies for some age groups have contributed significantly to this progress (27). In addition, given the influence that some behaviors have on the development of breast cancer, there seems to be consensus on the importance of making women aware of these risk factors, which makes it possible for them to establish preventive measures themselves (28,29). Of the apps assessed, only two included information regarding risk factors, which, as indicated, play a prominent role in the onset of breast cancer and, therefore, more efforts should be made in its dissemination.

Currently, there are algorithms which have been designed to estimate the likelihood of developing breast cancer. Their use makes it possible to determine which risk reduction options are the most effective in the prevention of breast cancer risk (29,30). Although these algorithms have been shown to be valid for population estimates, they appear to be limited when it comes to individualized estimates. Moreover, they include parameters limiting their usefulness, such as the minimum age for estimates (31). However, some authors point out the need to continue carrying out studies

<table>
<thead>
<tr>
<th>Content</th>
<th>App1</th>
<th>App2</th>
<th>App3</th>
<th>App4</th>
<th>App5</th>
<th>App6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-examination</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Signs and symptoms</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Risk calculator</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Aesthetic tips after diagnosis</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Diet</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Adherence to treatment</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
to develop more specific tools (32), since they allow women to become aware of their situation and recognize the need to act to reduce potential risks, for example, by adopting healthy lifestyles that may remove modifiable risk factors (30).

In general, the score obtained regarding the quality of the assessed apps indicates that there is clearly room for improvement. Only APP1 obtained high scores in all items. 

Previous studies have obtained similar data, highlighting the presence of only a small number of highly-rated apps, while most apps could be improved (17). Also have shown that the use of apps brings benefits to people diagnosed with cancer, both physically and psychosocially (33,34). However, in order to achieve these benefits, several authors point to the need for apps to meet minimum quality criteria, such as, for

Table 2 Mean scores (SD) of the MARS components for each app

<table>
<thead>
<tr>
<th>MARS components</th>
<th>App1</th>
<th>App2</th>
<th>App3</th>
<th>App4</th>
<th>App5</th>
<th>App6</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective quality</td>
<td>4.48 (0.141)</td>
<td>3.00 (0.071)</td>
<td>3.60 (0.044)</td>
<td>2.09 (0.062)</td>
<td>2.87 (0.180)</td>
<td>2.58 (0.162)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Engagement</td>
<td>4.40 (0.566)</td>
<td>2.50 (0.424)</td>
<td>3.60 (0.000)</td>
<td>1.40 (0.283)</td>
<td>2.10 (0.424)</td>
<td>1.70 (0.707)</td>
<td>0.004</td>
</tr>
<tr>
<td>Functionality</td>
<td>4.25 (0.354)</td>
<td>4.25 (0.000)</td>
<td>4.38 (0.177)</td>
<td>4.38 (0.884)</td>
<td>4.13 (0.177)</td>
<td>4.13 (0.530)</td>
<td>0.983</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>4.67 (0.000)</td>
<td>3.00 (0.471)</td>
<td>3.50 (0.236)</td>
<td>1.83 (0.707)</td>
<td>3.00 (0.000)</td>
<td>2.83 (0.236)</td>
<td>0.004</td>
</tr>
<tr>
<td>Information</td>
<td>4.58 (0.354)</td>
<td>2.17 (0.236)</td>
<td>2.92 (0.118)</td>
<td>0.75 (0.354)</td>
<td>2.25 (0.118)</td>
<td>1.67 (0.236)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Subjective quality</td>
<td>3.88 (0.177)</td>
<td>1.25 (0.354)</td>
<td>2.75 (0.707)</td>
<td>1.00 (0.000)</td>
<td>1.75 (0.707)</td>
<td>1.13 (0.177)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

*All results are expressed as means (SD).

Figure 2 BCTs and their frequency of appearance in the apps.
example, scientific endorsement (18) and being accessible to the target population (33,35,36).

In addition, the literature consulted recommends determining which BCTs are included in the apps. BCTs serve as indicators of the effectiveness of educational interventions. Therefore, having a classification of apps according to the BCTs they include would help select the most appropriate apps in terms of effectiveness (20). According to these authors, the use of BCTs helps to better understand the mechanisms that influence behavioral changes in the population. The number of BCTs identified in the assessed apps was lower than those included in apps assessed in previous studies. In recent studies, such as the study carried out by Yang et al. (10), a total of 39 BCTs of the 93 BCTs available were identified, while Martin-Payo et al. (17) found an average of 3.96 BCTs per app. It would therefore appear that BCT content could also be improved. The BCTs most frequently found in the apps did coincide with the BCTs reported in the literature, such as “providing instruction on how to perform a behavior” (37) or “feedback on behavior” (17).

Limitations of this study include the inclusion of only free apps and apps designed in Spanish from Spain. Both restrictions were made deliberately, as they conform to Spain's free and universal health care model, as well as to avoid potential confusion from semantic differences between the Spanish spoken in Spain and the Spanish spoken in other countries.

In conclusion, on a positive note, it is worth highlighting the availability of apps in Spanish that are specifically related to breast cancer, breast cancer prevention, and other aspects that may undoubtedly help women who have been diagnosed. However, it should also be noted that the contents and quality of these apps, as well as the number of BCTs they include, should be improved so that they can be safely recommended to this population.

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Footnote

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