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Development of a Rating Tool for Mobile Cancer Apps: Information Analysis and Formal and Content-Related Evaluation of Selected Cancer Apps

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Abstract Mobile apps are offered in large numbers and have different qualities. The aim of this article was to develop a rating tool based on formal and content-related criteria for the assessment of cancer apps and to test its applicability on apps. After a thorough analysis of the literature, we developed a specific rating tool for cancer apps based on the MARS (mobile app rating system) and a rating tool for cancer websites. This instrument was applied to apps freely available in stores and focusing on some cancer topic. Ten apps were rated on the basis of 22 criteria. Sixty percent of the apps (6/10) were rated poor and insufficient. The rating by different scientists was homogenous. The good apps had reliable sources were regularly updated and had a concrete intent/purpose in their app description. In contrast, the apps that were rated poor had no distinction of scientific content and advertisement. In some cases, there was no imprint to identify the provider. As apps of poor quality can give misinformation and lead to wrong treatment decisions, efforts have to be made to increase usage of high-quality apps. Certification would help cancer patients to identify reliable apps, yet acceptance of a certification system must be backed up.

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Introduction

According to the World Health Organization, cancer is the second leading cause of death globally and accounted for 8.8 million deaths in 2015 [1].

Cancer is one of the most widely spread chronic diseases. In 2013, about 253,000 men and 230,000 women got cancer and in 2020 and approximately, 275,000 men and 244,000 women will get cancer [2].

Patients with cancer have a high disease-specific need for information [3].

This information can come from different sources: from talks with doctors, consulting laymen, or via media. For patients, most important is the communication with a doctor or a nurse [4, 5].

Yet, this communication is not always successful. The reasons are manifold: too little time, inadequate general conditions, technical language, and missing empathy. Shared decision making on comprehensive diagnostics and complex therapies requires detailed knowledge of the disease and the therapeutic options [6].

In this context, the Internet is becoming an increasingly important source of information.

Especially young people use the Internet [3].

The advantages for patients are easy access to all necessary information, autonomy of time and place, and possibility to read about the latest developments. Moreover, access to most information is free of charge [7].

While the Internet is an important source of information, it can also provide the wrong information or lead to the wrong decisions [6].

A study of the DIVSI (Institut für Vertrauen und Sicherheit im Internet) shows that 28% of the Internet users doubt the reliability of the information via internet [7].

Mobile health (mHealth) is an innovative and growing field, which is increasingly used for patient care. With the help of mobile devices like smart phones and tablets and with apps, a software specifically developed for mobile devices and cancer patients can get the information fast and at any time. This information includes prevention, diagnostics, treatments, and therapy options.

In their study "Chancen und Risiken von Gesundheits-Apps" (chances and risks of health apps), from the Peter L. Reichertz Institute for Medical Computer Technology in the authors conclude that health apps have the potential to effectively support the self-management of chronically ill people and to enlarge the treatment adherence. The results of the CHARISMHA study in 2016 was that there is still no comprehensive and valid guidance for assessing the trustworthiness of health apps [8].

In 2013, a study on the purpose and content of cancer-related smart phone apps analyzed hundreds of cancer-related apps with different aims: help for changing one's lifestyle, monitoring of symptoms, intervention etc. However, there was a lack of proof for their usability, effectivity, and safety [9].

Also, other authors are concerned on the quality of the apps [10–12].

Collado-Borrell et al. in 2016 discovered that much information is false and/or not actual [10].

They suggest a regulation of apps, in order to improve safety and usefulness. Certification has been proposed to make quality of apps transparent to the user [10–12].

Brouard et al. [13] looked at cancer-related apps with regards to their scientific fundament and the financial model they were based on. They discovered that only about one third of the apps was scientifically sound. While for medical personal a critically appraisal of an app is easy to perform, patients may not recognize insufficient or even wrong information.

The platforms where apps are available do not evaluate the content of the apps, and the developers of these apps are the only ones responsible for the content [14, 15].

As a consequence, Brouard et al. [13] propose an independent review of cancer-related apps.

A critical appraisal of German websites on cancer using standardized formal and content-related criteria disclosed a discrepancy between the visibility and the quality of the analyzed websites. Websites of providers from profit organizations have a higher visibility, but the information often has a bad quality, while websites form neutral providers often rank better but are less visible [6].

In order to support evaluation and certification of apps, it was the aim of this study to develop a tool, which tests mobile apps in the field of oncology concerning their quality.

Material and Methods

Development of a Rating Tool

After a critical evaluation of the literature, the following items were identified as relevant

–   The person who is responsible for the app
–   The included features
–   The actuality of the data
–   The qualification of the providers
–   The complete data protection declaration
–   The application purpose and the target group
–   If there is a quality seal, if the test method is validated
–   The inclusion of studies
–   The rating in app stores

The questionnaire MARS [16] was developed for the evaluation of health apps in general.

The parameters of the questionnaire are as follows:

–   Interactivity of the app, individualization, and degree of involvement of the user and his social environment (engagement, 5 questions)
–   Functionality of the app, handling, and easy use (functionality, 4 questions)
–   Attractive presentation of the app, visual imagery that is likable, and offers an intuitive handling (esthetics, 3 questions)
–   Quality and presentation of information, credibility of the sources (information, 7 questions)
–   Assessment of the subjective quality (recommendations etc. 4 questions)
–   Subjectively felt effect of the app concerning knowledge, attitude, intention of the user etc. (6 questions)

To further develop this questionnaire according to the specific needs of cancer patients, it was compared to the tool used for the analysis of German websites that was developed by the working group Prevention and Integrative Oncology of the German Cancer Society (GCS).

This tool is based on several established samples of criteria for evidence-based patient information:

–   Criteria for evidence-based patient information (Steckelberg et al.) [17]
–   Manual patient information: recommendations for the creation of evidence-based patient information (ÄZQ) [18]

– HONcode [19]
– DISCERN [20]
– Afgis criteria [21]

In the instrument, the different criteria were clustered and merged this resulting in a new comprehensive tool, which has all the necessary formal and content-related information [6].

In order to combine MARS with the GCS instrument, criteria from MARS that were irrelevant for cancer patients were removed. Formal and content-related criteria from the GCS instrument applicable to apps were added. Especially, the items in section "information" were specified and expanded.

The questionnaire is divided into three sections (engagement, esthetics, and information) and includes 22 items to be assessed:

- The first section includes the subscales interactivity and target group: Does it allow user input, provide feedback, contain prompts, and is the app content appropriate for the target audience?
- Layout and visual appeal are the subscales of the second category.
- Most of the additions relate to the third section for example purpose of the information, requirements with regards to information, detailed information on therapy methods, data protection.

The complete contents of the questionnaire are shown in Table 1.

Selection of the Test Apps and Data Collection

In the next step, we searched the two largest platforms: German app store of Apple (iTunes) and German Google play store (android) for apps. The search was made with the German search words: "Krebs" (cancer) and "Onkologie" (oncology). In the Apple app store, $n = 143$ apps were found and in the Google play store $n = 249$.

The following exclusion criteria were defined:

– Fee-based apps
– Apps that do not use the word "cancer" as an oncological disease

The remaining apps were assessed for the following inclusion criteria:

– Target group: patients
– Aim: information on disease, diagnostics, therapy, aftercare

After the selection based on the above criteria, $n = 3$ apps remained in the Apple App Store and $n = 16$ apps remained in the Google Play Store.

Table 1 Categories and subscales of the questionnaire

Category	Subscale
Engagement	• Interactivity • Target group
Esthetics	• Layout • Visual appeal
Information	• Accuracy of app description • Purpose of the information • Separation of content and commercials • Goals • Complementarity • Requirements with regards to information • No statement to sections without safe information • Detailed information on therapy methods • Statements refer to patient issues • Quantity of information • Visual information • Additional material (material for the doctor-patient communication) • Use of a language that enhances participation • Credibility • Information on sources • Data protection • Evidence-based • Findings about the presentation of numbers and results is being considered

For the test phase, we needed only ten apps. Therefore, we initially chose $n = 3$ apps from the Apple App Store. From the Google Play Store additional $n = 7$ apps were selected via randomization.

The remaining $n = 10$ apps were assessed by three people (2 assistant doctors not specialized in cancer care and 1 computer scientist). They assessed the chosen apps over a time-period of 18 days with a three-step Likert scale:

1 = the criteria were fully met
2 = the criteria were partly met
3 = the criteria were not met or only met insufficiently

The results of the three authors were summarized and added up as arithmetic mean equally weighting each category.

Results

From March 1–18, 2017, we found and assessed ten apps fitting to our criteria (Table 2).

Four apps were in German and six in English.

These apps were listed in different categories: four apps in "health and fitness," four apps in "entertainment," one app in "medicine," and one app in "news and magazines."

Table 3 presents the results of the ratings.

Table 2 List of apps assessed by the new instrument

Number	Name of the app	Provider	Category	Intent	Language
1	Österreichische KrebsHILFE (Austrian cancer support)	Österreichische KrebsHILFE	Health and fitness	Many info on disease, therapy, side-effects, diet, rehabilitation etc.	German
2	KrebsApp Thüringen (CancerApp Thuringia)	Health dept. Erfurt (and others)	Health and fitness	Advice, help, tips, oncological therapy centers, personal medical file	German
3	Leben mit CML (Life with CML)	Novartis Pharma GmbH	Medicine	Info, tips, contacts, medication intake, lab results	German
4	Hautkrebs (skin cancer)	Sport Apps Empire	Health and fitness	Info, symptoms, treatment	English
5	Prostatakrebs (prostate cancer)	Sport Apps Empire	Health and fitness	Info, symptoms, treatment	English
6	Prostatakrebs (prostate cancer)	Anastore	Entertainment	Causes, symptoms, cancer statistics	English
7	Brustkrebs (breast cancer)	Anastore	Entertainment	Causes, symptoms, info	English
8	Augenkrebs (eyes cancer)	Anass apps	Entertainment	Causes, symptoms, treatment	English
9	Schilddrüsen-krebs (thyroid cancer)	Anass apps	Entertainment	Causes, symptoms, treatment	English
10	Einblick/Deutsches Krebsforschungs-zentrum (Insight/German cancer research center)	Deutsches Krebsforschungs-zentrum	News and magazines	Causes of cancer, projects, latest treatment methods	German

Category of apps (the app is listed on the platform)

Four apps had very good to good results, two apps average to poor results, and four apps were insufficient.

The assessment of any chosen apps with the help of our new instrument by three independent scientists led to homogenous results.

The very good to good apps had reliable sources, were regularly updated and had a concrete intent/purpose in their app description—These were the apps of the following providers:

– Österreichische KrebsHILFE
– Leben mit CML

– KrebsApp Thüringen
– Einblick/Deutsches Krebsforschungszentrum

Only one of the providers is a pharmaceutical company. However, no advertisement is visible in this app. All other providers are either charities, public associations, or a scientific magazine published via app.

The apps that were rated poor and insufficient differed significantly in their structure from the very good to good apps. There was no distinction of scientific content and advertisement. In some cases, there was no imprint to identify the

Table 3 Rating of the ten cancer apps

Number	Name of the app	Engagement—mean	Esthetics—mean	Information—mean	Total average—mean
1	Österreichische KrebsHILFE (Austrian cancer support)	1	1,33	1,44	1,2566667
2	Leben mit CML (Life with CML)	1	1,33	1,57	1,3
3	KrebsApp Thüringen (CancerApp Thuringia)	1,16	1,5	1,83	1,4966667
4	Einblick / Deutsches Krebsforschungs-zentrum (Insight / German cancer research center)	2	1,33	1,53	1,62
5	Prostatakrebs (prostatecancer)	2,5	2	2,64	2,38
6	Hautkrebs (skin cancer)	2,5	2	2,74	2413
7	Prostatakrebs (prostate cancer)	3	3	3	3
8	Brustkrebs (breast cancer)	3	3	3	3
9	Augenkrebs (eyes cancer)	3	3	3	3
10	Schilddrüsen-krebs (thyroid cancer)	3	3	3	3

provider. Medical information often is only made available by linking to websites of medical professional associations (for example American Cancer Society, cancer.net).

Also, actualization by the provider is lacking. All insufficient to totally insufficient apps are only available in version 1.0.

Discussion

With the development of an assessment instrument for cancer apps consisting of content-related and formal criteria, we were able to assess ten apps in a pilot study. The ratings by different scientists were homogenous. The ranking via average scores proved to be very suitable to assess the quality of cancer apps.

It was shown that 40% (4/10) of the tested apps reached good to very good results, 20% reached satisfactory to poor results (2/10), and another 40% (4/10) was rated insufficient.

Sources of information and the intent and purpose of the information offered were associated with the achieved average score.

Especially noteworthy data protection was only provided by 2/10 apps, and 8/10 had no data protection. In 2015, another study reported similar results. All in all, the privacy statements were missing in 57% of the medical apps [22].

While in Germany, a comprehensive data protection law exists and compliance from the side of the providers obviously is missing. Insufficient transparency of consenting to data transfer as well as the missing sensibility of the users with respect to data protection helps providers to non-comply [8, 23, 24].

The ranking of the apps in stores, especially in the Google play store by the number of downloads is criticized by some authors. Although being downloaded more often could be interpreted as a sign that an application has been considered relevant by a large number of users, it is not a clear proof of the quality of the information provided [13].

A solution to this problem could be certification which could make quality of certified apps transparent to patients. The aim could be to filter out apps of high quality with an evidence-based content from a reliable source. Certification could be used to enhance visibility of high-quality apps. Yet, one condition for the efficacy of such a certificate would be that patients are aware of its existence and acknowledge its importance. In order to increase the acceptance of the certificate, it must focus on the following criteria which are important for cancer patients:

– Searched for information must be easily accessible [25]
– It must come from highly qualified authors and must be reliable [25]
– Information should be easy to understand [4]

Information from cancer apps should always be seen as complementary to physician provided information.

It is the task of doctors to give the patients comprehensive information about diagnostics, treatment possibilities, and supportive options as well as palliative methods.

The instrument we derived from formerly published works was applicable to cancer apps and allows to quickly assess apps intended for use by patients. One limitation of this feasibility study is that we only used the instrument on German apps. Yet, there is no reason why the items and categories should not work with apps in other languages. Another point to discuss is whether equal weighting of the categories is adequate. Yet, the question is open whether any other weighting would be more adequate. Stoyanov et al. [16] calculated the arithmetic mean in the four sections of their instrument. Also, in the instrument from the German Cancer Society which contains two sections with different numbers of items, equal weighting was chosen [6]. In fact, these authors reported to have looked for different strategies to solve this problem but decided to weight all items equally as there seemed to be no valid algorithm for applying a diversified scoring system (personal communication).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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