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Smartphone Apps as a Source of Cancer Information: Changing Trends in Health Information-Seeking Behavior

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Abstract There is an increased interest in smartphone applications as a tool for delivery of health-care information. There have been no studies which evaluated the availability and content of cancer-related smartphone applications. This study aims to identify and analyze cancer-related applications available on the Apple iTunes platform. The Apple iTunes store was searched for cancer-related smartphone applications on July 29, 2011. The content of the applications was analyzed for cost, type of information, validity, and involvement of health-care agencies. A total of 77 relevant applications were identified. There were 24.6 % apps uploaded by health-care agencies, and 36 % of the apps were aimed at health-care workers. Among the apps, 55.8 % provided scientifically validated data. The difference in scientific validity between the apps aimed at general population versus health-care professionals was statistically significant ($P<0.01$). Seventy-nine percent of the apps uploaded by health-care agencies were found to be backed by scientific data. There is lack of cancer-related applications with scientifically backed data. There is a need to improve the accountability and reliability of cancer-related smartphone applications and encourage participation by health-care agencies to ensure patient safety.

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Introduction

Smartphones have revolutionized the way people access information across the world. Their ability to engage the user and deliver high-quality content is unrivaled by any other device in human history. Smartphones are distinguished by their ability to run third party programs, also called applications or apps for short. The Apple platform is the pioneer of this technology and dominates the app market. As of 2012, more than 25 billion apps have been downloaded from the Apple App Store by more than 315 million iPhone and related devices all over the world [1]. Currently, there are more than 550,000 apps available for the iPhone on the App Store [1].

Health-related smartphone apps are being actively studied for potential applications in a wide variety of clinical and other health-care situations. Attempts are being made to utilize them in clinical scenarios with varying degrees of success, particularly in dermatology [2] and ophthalmology [3, 4]. The easy-to-learn and use designs can greatly impact day-to-day management of chronic diseases and could potentially lessen disease impact. There have been some studies evaluating the role and potential of smartphone apps in communicating health behavior risks and accelerating behavior change to improve health-care outcomes [5, 6]. Recent studies have demonstrated the potential application of smartphone apps in patient self-monitoring [7, 8]. The ability of smartphones to deliver directed health information to the patient is path breaking and opens up an entirely new era of health communication and directed support structure.

Recent years have shown an increasing number of medical professionals using smartphones for accessing clinical information on the internet and as clinical calculators. A study estimated that the percentage of medical professionals using

smartphones will rise 66–90 % by 2012 [9]. The increasing prevalence and popularity of smartphone apps among health-care professionals complements the medical practice and has gained wide acceptance as a training and information tool [10, 11]. The quality of information disseminated in these apps would therefore play an important role in determining the quality of health care provided. A few studies have been addressing this issue for different medical specialties [12, 13].

The primary aim of our study was to evaluate the cancer-related apps available on the Apple app store and to analyze the content and potential usefulness in the health care delivery system.

Methods

A search was performed using the iTunes app store to identify all apps related to oncology as of July 29, 2011. The search was conducted on www.apple.com/itunes.

Selection Criteria

The search terms used to select the eligible apps were "cancer" and "oncology". Basic and upgraded versions of the same app were considered to be separate if they differed in the information content. The content of each app was carefully evaluated in detail by two independent investigators (AP, SS). The following operational definitions were used to analyze and classify the apps based on the information content.

App Category: The stated category of the app on the iTunes app store.

Cost: All apps were classified based on the cost of downloading the app into the following categories:

- Free: The apps which could be downloaded free of cost.
- Paid: The apps which could only be downloaded on payment.

Uploading agency: The stated "seller" in the app. Additionally, uploading agencies were classified based on affiliation into the following categories:

- Health care-associated (HCA): If the uploading agency was a health-care organization (medical associations, hospitals, research associations, public health organizations, and medical journals).
- Non-health care-associated (non-HCA): Any uploading agency which did not fall in the above category.

Audience: All apps were classified based on the content into the following categories:

- Health-care professional-aimed: The apps with scientific, clinical, and technical information that could be considered useful for health-care professionals in taking care of their patients. This included apps with research updates, radiological assistance, treatment protocols, updated guidelines, etc.
- Patient and general population-aimed: The apps, which contained cancer-related information that was considered, by the independent observers, to be useful for patients and the general population. This included apps with information on the prevention of disease, self-monitoring of symptoms, drug side effects, etc.

Overlap in the two categories was allowed if the app catered to both patient and health-care provider.

Type of information: The apps were classified based on the information content into the following categories:

- General information of the disease: The apps with information on symptoms, management, and prevention of the disease.
- Research and recent advances: The apps with information on latest updates and research/news in the field of oncology.
- Health-care professional assistance tools: The apps with clinical information that can be used in management of the patient by health-care providers (e.g., Chemotherapy dose and regimen calculators, cancer staging apps, radiological imaging apps, etc.).
- Patient assistance: The apps with patient based utilities (e.g., Chemotherapy scheduling diaries, recruitment in clinical trials, etc.)
- General awareness and support group apps
- Miscellaneous: The apps with information that did not provide any clinical or educational information.

Scientific Validation: The apps were classified based on scientific validation into the following categories:

- Clinically/scientifically validated: The apps with information based on clinical/research studies.
- Non-evidence based apps: The apps with information based on no scientific backing of the content.

Usefullness: The apps were classified based on the cross product of user ratings and number of comments into the following categories:

- Not useful
- Moderately useful
- Very useful

Statistical Analysis

Values are expressed as simple proportions. Univariable analysis was performed using Pearson's chi-squared test or Fisher's exact test for categorical variables.

A 2-sided P value of <0.5 was considered significant.

All statistical analysis was done using IBM SPSS Statistics 12.0 for Windows (SPSS Inc.).

Results

A total of 93 apps were downloaded using the search criteria. Sixteen apps (17.2 %) were excluded from the study since they had no cancer-related information, leaving 77 apps in the final analysis.

General Classification of Apps

Table 1 describes the content analysis of the apps. Of the retrieved apps, 42.8 % were free of cost while 57.2%were paid ranging from $0 to 8. Although only 24.6 % apps were uploaded by health-care agencies, a majority of apps (55.8 %) had information that was based on scientific proof and validation. The apps focused on non-professional audience more than health-care providers, 49.4 % for HCP vs 59.8 % for non-HCP. Of these, 10 % had relevant information for both HCP and non-HCP audience; 5 % of the apps collated in the present study were uploaded under medical category; while 31 % were classified under lifestyle and fitness category. Based on the user ratings and reviews, 66 % apps were considered moderately to highly useful. Based on user ratings and reviews, 25 % of the apps targeting the general public were considered useful while only 7 % of the apps targeting the health-care professionals were considered useful by the target population.

Cost Analysis

User-rated usefulness was inversely related to app cost, and this association was found to be statistically significant (p value <0.01). Among the free apps, 57.7 % were aimed at the general public and were primarily uploaded by non-health-care agencies (64 %). Interestingly, more than half of the scientifically accurate and valid apps were available free of cost (66 %) as compared to 42 % of apps that cost > $1. Sixty-three percent of HCA uploaded apps were available free of cost, whereas only 36 % of the non-HCA uploaded apps were without charges.

Uploading Agency

Only 24.6 % apps were uploaded by health-care agencies. Majority of the HCA apps (31 %) dealt with clinician assistance tools. A large number of the non-HCA apps provided general information only (40 %).

Audience

Only 36 % of the apps aimed at health-care workers and 20 % of the general public apps were uploaded by health-care agencies. Fifty-two percent of the HCP-aimed apps had information about clinical tools to assist care providers like cancer staging, radiology assistance, oncology e-books, and pocket cards for references, while 32 % focused on research updates. Fifty percent of the general public apps (65 %) had information on prevention, symptoms, and management of the disease, and 27 % had information regarding the maintenance of chemotherapy diary, support groups, and cancer-awareness programs.

Analysis of Validity and Scientific Proof

Of the available apps, 55.8 % provided scientifically validated data. The apps uploaded by HCA had more accurate and scientifically valid information, as compared to those uploaded by non-HCA (79 vs. 44 %). Ninety-six percent of the apps aimed at health-care workers had valid information, while only 32 % of the general public apps had scientifically valid information. This difference in scientific validity

Table 1 Content analysis of the cancer-related iTune apps

Type of information	Total Number (%)	Cost		Uploading agency		Aimed audience		Scientific validity	
		Free	Paid	HCA	Non-HCA	HCP	Non-HCP	Yes	No
General information about the disease	28 (36.4)	12 (42.9)	16 (57.1)	5 (17.9)	23 (82.1)	5 (17.9)	23 (82.1)	17 (60.7)	11 (39.3)
Research and recent advances	10 (12.9)	6 (60)	4 (40)	3 (30)	7 (70)	10 (100)	0 (0)	10 (100)	0 (0)
Health-care professional assistance	13 (16.9)	3 (23.1)	10 (76.9)	6 (46.2)	7 (53.8)	13 (100)	0 (0)	12 (92.3)	1 (7.7)
Patient assistance tools	13 (16.9)	8 (61.6)	5 (38.4)	3 (23.1)	10 (76.9)	0 (0)	13 (100)	4 (30.8)	9 (69.2)
General awareness and support group	10 (12.9)	4 (40)	6 (60)	2 (20)	8 (80)	10 (100)	10 (100)	NA	NA
Miscellaneous	3 (3.9)	0 (0)	3 (100)	0 (0)	3 (100)	NA	NA	0 (0)	3 (100)

Values are expressed as number (%)

HCA Health Care Agency, *HCP* Health Care Professional

between the two target population (HCP vs. non-HCP) was statistically significant ($P<0.01$). Only 60 % of the apps with general information and 30 % of apps with tools to assist patients had the information with experimental scientific literature. Ninety-two percent of the clinician assistance apps and 80 % apps about research news and updates had scientifically valid information.

Discussion

Use of smartphone apps has been a significant advancement in the field of information dissemination over the past few years. An increasing trend has been observed in the utilization of smartphone apps to get information on clinical topics by the general public and health-care professionals [14, 15].

Our study addresses the nature and volume of information about cancer available to users, both HCP and non-HCP, through iPhone apps. The use of smartphones by health-care providers has witnessed a sharp rise in the last few years [15]. This rise makes them a very important audience for this instrument of health-related communication. The specific, targeted delivery of information to health-care professionals can be accomplished very quickly and in a cost-effective way by suitable apps.

iPhone apps have been studied as a source of information for different medical specialties [2–4, 10–13]. These studies have found a paucity of medical accuracy and relevance of a majority of apps directed at general users [8, 16–19]. Also, there are concerns regarding the quality and validity of information available through these apps for use in the clinical setting by health-care professionals [17–19]. Our study showed that the apps developed by health-care agencies were more likely to have scientifically accurate information. Unfortunately, only one-fourth of the available apps were from health-care agencies, indicating an underutilization of this form of media by these organizations. Similar findings have been reported by studies conducted on apps concerning other medical specialties [20].

Health-care information-seeking behavior in the general population has seen a paradigm shift over the past years. The internet has been widely regarded as a potentially important health communication and education tool [21–23]. Studies in the past have shown a fast-rising trend in the use of internet by patients and health-care practitioners, not only for seeking health information but also for health care-related communication [24–28]. Recent studies have also looked into the uses of specific domains like YouTube, Facebook, and various other Internet forums for the dissemination of health-care information [29–34]. Use of smartphone apps is the next big step in revolutionizing the health information-seeking behavior among consumers.

The smartphone has changed the way in which people search and access information. There is a huge and unappreciated demand in the society for health-care information about debilitating and fatal illnesses like cancer. Information can now be targeted and provided right at the fingertips of the appropriate user. In this fast-changing area, it is very important that health-related information is provided adequately and accurately to those seeking it. The need of the hour is to work on methods and strategies to harness this fast-evolving technology and to encourage the health care-seeking behavior of the general public. This is likely to improve the quality and quantity of the available information regarding public health issues.

Conclusion

There are many advantages of cancer-related smartphone apps as a tool to disseminate information among patients and health-care professionals. However, the lack of specificity and validity of the app content has a risk of potentially endangering patient safety. Additionally, there is a lack of involvement of health care agencies which only intensifies this problem.

Therefore, there is a need to set up regulating guidelines to improve the quality and validity of information disseminated by the apps. Also, encouraging the involvement of health-care agencies in developing apps aimed at health professionals and general audience would ensure that valid and relevant information reaches the consumers.

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