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Review

Smartphones and tablets: Reshaping radiation oncologists' lives

Alfonso Gomez-Iturriaga[a,*], *Pedro Bilbao*[a], *Francisco Casquero*[a], *Jon Cacicedo*[a,b], *Juanita Crook*[b]

[a] *Department of Radiation Oncology, Hospital Universitario de Cruces, Barakaldo, Vizcaya, Spain*
[b] *Department of Radiation Oncology, British Columbia Cancer Agency, Center for the Southern Interior, Kelowna, BC, Canada*

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ABSTRACT

Background: Smartphones and tablets are new handheld devices always connected to an information source and capable of providing instant updates, they allow doctors to access the most updated information and provide decision support at the point of care.
Aim: The practice of radiation oncology has always been a discipline that relies on advanced technology. Smartphones provide substantial processing power, incorporating innovative user interfaces and applications.
Materials and methods: The most popular smartphone and tablet app stores were searched for "radiation oncology" and "oncology" related apps. A web search was also performed searching for smartphones, tablets, oncology, radiology and radiation oncology.
Results: Smartphones and tablets allow rapid access to information in the form of podcasts, apps, protocols, reference texts, recent research and more.
Conclusion: With the rapidly changing advances in radiation oncology, the trend toward accessing resources via smartphones and tablets will only increase, future will show if this technology will improve clinical care.

1. Background

Smartphones and tablets are handheld devices that offer not only the standard facilities such as voice and text communication, but also advanced computing and communication capability, including, for example, Internet access and geo-positioning systems. Most of the newer generations incorporate other features such as on-board personal management tools, high quality cameras and recording devices. They run on a specific operating system and can download applications (apps) that run on the operating system.[1,2]

These portable systems enable users to accomplish tasks anywhere, anytime, are significantly cheaper than personal computers and can be easily carried wherever a medical professional is working.

The subject of new technologies and medicine is the connection of two fast-evolving systems: health and technology. This connection is a dynamic one in which communications advance both consumers' and providers' engagement with

* *Corresponding author at*: Department of Radiation Oncology, Hospital Universitario de Cruces, Plaza Cruces-Gurutzeta, 12, 48903 Barakaldo, Vizcaya Spain. Tel.: +34 946006232; fax: +34946006627.
E-mail address: alfonso.gomezdeiturriaga@osakidetza.net (A. Gomez-Iturriaga).
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Table 1 – Functions and topics of the apps presented in the manuscript.

Topic	Name	Functions
Radiology	*Mobile MIM*	Evaluation of images from CT, MRI and PET scans
General oncology	*NCCN guidelines* *CTCAE v. 4.0*	Access to the guidelines and updates Access to the latest approved version of the National Cancer Institute's Common Terminology Criteria Adverse Events standard.
Radiation Oncology	*BED calculatoreLQRadiation Oncologist tool* *Varian medical systems*	Use the linear-quadratic (LQ) model to calculate the biologically effective dose (BED) in various radiotherapy protocols involving different numbers of dose fractions. Series of interactive Educational Videos, for both patients and physicians on the latest advances including IMRT and IGRT for professionals
General medicine	*Up to dateMedscape* *Draw MD*	Access to the interactive encyclopaedia of medical knowledge Allow anyone to sketch, stamp, or type directly on detailed anatomic images. Providing the ability for doctors to communicate and explain treatment plans, including surgical procedures, as well as document these plans for patient records

health information technology. It is here that the ubiquity of these small, interconnected computers plays a very appealing role, meaning that every physician will soon have access to a wide collection of software and hardware to help them perform their daily work, and it will happen sooner than we probably think.

2. Radiation oncology and technology

The practice of radiation oncology has always been a discipline that relies on advanced technology and the key clinical, technical and administrative support roles it plays are now firmly established.

In recent times, radiation oncology clinical practice has become increasingly dependent on images and servers that can be accessed in real-time from decentralized locations. The rapid development of Internet web sites in combination with portable technology has opened a new and growing communications pathway to ensure that these workflow needs can be met successfully.

Students, trainees and early adopters among us have embraced the notion that smartphones and tablets improve clinical care because of rapid access to most updated information in the form of podcasts, apps, protocols, reference texts, recent research and more. It is not necessary to carry tons of books or subscribe to dozens of hard copy journals anymore.

3. Apps

Today's smartphones provide substantial processing power, incorporating innovative user interfaces and applications ("apps").[3] Based on growth trends, by August 2012 there will be more than 13,000 iPhone health apps available for consumers.[4]

Apps have become so prolific and comprehensive that the federal Food and Drug Administration (FDA) felt the need to craft a review and approval process for medical apps, which is about to be enforced for the most vital ones out there. The first will be those that transform smartphones or tablets into medical devices, such as glucose meters or blood pressure monitors, and which control existing FDA-approved gear like insulin pumps.[5]

Those apps such us medical calculators simplify the bedside use of medical equations, scores, stratification, and risk prediction and prevention models. These devices can assist with physical examinations using applications to check hearing, eyesight, and color recognition; evaluate mental status; or photograph or video document physical findings (Table 1).

They are no longer restricted to numeric or text data and allow viewing of "digital information and communication in medicine" (DICOM) formatted 3-dimensional imaging data from "radiology information" or "picture archiving and communication systems" (RIS/PACS) in conventional radiology, ultrasonography, computed tomography and magnetic resonance imaging, or endoscopy.[6] The first application for diagnostic image review on the iPad, iPhone, or iPod touch was approved by the FDA in February. The application – the Mobile MIM from Cleveland-based MIM Software™ [7] – can be used to view results of CT, MR imaging and PET exams on mobile devices and use those images to make diagnoses. This application opens a new scenario that could be of great interest for radiation oncologists. In the near future, we are likely to be able to contour structures, design target volumes and evaluate dosimetric plans, check the cone-beam images, perform DRRs fusion, etc.

For example, in iTunes App Store there are currently around 150 apps accessible by searching for "oncology", although not all of them are relevant for oncologists, there are a few that may well be of interest.

The National Comprehensive Cancer Network (NCCN; Fort Washington, PA, USA) Clinical Practice Guidelines in Oncology are free mobile apps developed for the iPhone and Android systems. These are free to download and support access to all NCCN guidelines, and their updates.[8]

Another attractive free app available in the iTunes App Store is CTCAE v4.0. This app uses the latest approved version of the National Cancer Institute's Common Terminology Criteria Adverse Events standard. Members of a research team now have the access to more than 190 pages of the original document in a portable, highly intuitive, hierarchical interface.[9]

The old-fashioned medical encyclopaedias and popular journals, now have entered the Medicine 2.0 era with an interactivity and search functions galore. A good example is UpToDate. A huge interactive encyclopaedia of medical knowledge which has half a million subscribers, and is now sporting an iOS app. There is a free alternative, Medscape by webMD,