Short communication

Smartphones, tablets and mobile applications for radiology

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ABSTRACT

Background: Smartphones are phone devices that may also be used for browsing, navigation and running smaller computer programs called applications. One may consider them as compact personal computers which are primarily to be used for making phone calls. Tablets or "tablet PCs" are fully functioning standalone computers the size of a thin LCD monitor that use the screen itself for control and data input. Both of these devices may be categorized based on the mobile operating system that they use. The aim of this study is to illustrate how smartphones and tablets can be used by diagnostic imaging professionals, radiographers and residents, and to introduce relevant applications that are available for their field.
Materials and methods: A search was performed on iTunes, Android Market, Blackberry App World, and Windows Phone Marketplace for mobile applications pertinent to the field of diagnostic imaging. The following terms were applied for the search strategy: (1) radiology, (2) X-ray, (3) ultrasound, (4) MRI, (5) CT, (6) radiographer, (7) nuclear medicine. Two radiologists and one radiology resident reviewed the results. Our review was limited to english-language software. Additional applications were identified by reviewing the list of similar software provided in the description of each application. We downloaded and installed all applications that appeared relevant to an appropriate mobile phone or tablet device.
Results: We identified and reviewed a total of 102 applications. We ruled out 1 non-English application and 20 other applications that were created for entertainment purposes. Thus our final list includes 81 applications in the following five categories: diagnostic reading, decision support applications, medical books, interactive encyclopedias, and journal reading programs.
Conclusion: Smartphones and tablets offer new opportunities for diagnostic imaging practitioners; these easy-to-use devices equipped with excellent display may be used for diagnostic reading, reference, learning, consultation, and for communication with patients.

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1. Introduction

Smartphones are phone devices that may also be used for browsing, navigation and running smaller computer programs called applications. One may consider them as compact personal computers which are primarily to be used for making phone calls. Several vendors offer similar devices, therefore smart phones can be categorized based on the mobile operating system that they run.

Tablets or "tablet PCs" are fully functioning standalone computers the size of a thin LCD monitor, which use the screen itself for control and data input. These devices may also be categorized based on the mobile operating system that they use.

Thus far, there are four main mobile operating systems: iOS [1], Android [2], Blackberry OS [3], and Windows Phone [4].

The iOS, which is a product of Apple, is run by the iPhone (smartphone), iPod Touch (media player and mini computer) and the iPad (tablet) exclusively. This is a closed and controlled system where each and every application must confirm to the rules set by Apple, though this also guarantees that one will find thousands of high-quality and safe applications on iTunes [5].

Android, a brainchild of Google, is a Linux-based, open source operating system that is run by a growing number of mobile phones, netbooks and tablets. The Android Market has been rapidly expanding, but as of now there are only a limited number of medical applications that may be relevant for diagnostic imaging.

Blackberry iOS runs solely on RIM's tablets and mobile phones, while Microsoft's Windows Phone is a unique operating system that is now also available on selected Nokia phones. The Blackberry App World, and Windows Phone Marketplace only offer a few applications of interest, but in the future their selection is expected to expand quickly.

2. Materials and methods

A search was performed on iTunes, Android Market, Blackberry App World, and Windows Phone Marketplace for mobile

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Table 1
Display parameters of a high-end laptop, the iPhone, the iPad and an EIZO medical grade display.

	Apple iPhone5	Alienware M18x	Apple iPad with retina display	EIZO RadiForce™ GS521
Screen size	10.2 cm (4.0 in.)	45.7 cm (18.4 in.)	25 cm (9.7 in.)	54 cm (21.3 in.)
Resolution (width × height; megapixel)	1136 × 640 0.71	1920 × 1080 2.0	2048 × 1536 3.1	2048 × 2560 5.2
Width of 1 pixel (mm)	0.077 mm	0.213 mm	0.09621 mm	0.165 mm
Maximum brightness	500 cd/m²	265 cd/m²	300 cd/m²	700 cd/m²
Maximum contrast	800:1	736:1	450:1	800:1
Maximum viewing angle	Horizontal: 170°; vertical: 170°	Horizontal: 135°; vertical: 135°	Horizontal: 170°; vertical: 170°	Horizontal: 170°; vertical: 170°

applications pertinent to the field of diagnostic imaging. The following terms were applied for the search strategy: (1) radiology, (2) X-ray, (3) ultrasound, (4) MRI, (5) CT, (6) radiographer, (7) nuclear medicine.

Two radiologists and one radiology resident reviewed the results. Our review was limited to english-language software. Additional applications were identified by reviewing the list of similar software provided in the description of each application. We downloaded and installed all applications that appeared relevant to an appropriate mobile phone or tablet device.

3. Results

We identified and reviewed a total of 102 applications. We ruled out 1 non-English application and 20 other applications that were created for entertainment purposes. Thus our final list includes 81 applications in the following five categories: diagnostic reading, decision support applications, medical books, interactive encyclopedias, and journal reading programs.

4. Diagnostic reading applications

The aforementioned devices cannot compete with the screen size and resolution of modern medical displays, but their viewing angles, brightness and contrast levels can match up to diagnostic monitors, therefore they may play an important role in diagnostic imaging [6]. In Table 1. we list the important display parameters of a gaming laptop, a popular smartphone, a tablet, and a medical grade EIZO display [7–10].

Though they are considered unfit for primary diagnostic reading, these smartphones and tablets can be an optimal and cost-effective extension of workstations [11]. Given the necessary security protocols and an adequate device, the referring doctor can access the results of diagnostic scans anywhere from the hospital grounds. Thus the clinician can get a more thorough picture of the patient's condition, and he can give a more informed answer to the patient regarding his or her treatment plan. Results of different rendering techniques such as MIP, VRT, and SSD are demanding on hardware, yet easier to understand for non-radiologists. If a dedicated central server performs the calculations that are necessary for these rendered images, then a portable, less powerful device can display these images via the hospital wireless network. This server can theoretically serve several portable devices at the same time.

This may also be relevant in the operating theather where a tablet has already proven itself useful. During surgery the surgeon need not turn away from the area under operation in order to view the relevant images, because the tablet can be taken into the operating room while respecting the rules of sterility [12].

At the ER, valuable time can be saved by having the relevant lab results, medical history and diagnostic images of the patient in an easy-to-access, compact device.

There are several applications for viewing DICOM files on mobile devices. Though the jury is still out on whether portable devices such as smartphones and tablets should be allowed, to be used for primary reading, the FDA [13], and Health Canada [14] have already cleared iOS applications for diagnostic reading.

A distinction should be made between tomographic and digital X-ray images since the latter may have a much higher resolution and also a wider tonal range. Mobile software developers have also addressed this issue. The majority of applications in the diagnosic reading category are described as "not for diagnostic use" or as "only for non-significant risk studies." These are rather for displaying DICOM datasets either for consultation with another colleague – during tumor board for example – or while discussing therapy plans with a patient. Some vendors specify that display is only supported up to 1024 × 1024 pixel images, and that larger files will automatically be downscaled. Others such as Mobile MIM (Fig. 1.) have FDA clearance for viewing, registration, fusion, and/or display for diagnosis of medical images for the following modalities: SPECT, PET, CT, MRI, X-ray and ultrasound. This application supports files up to 25 megabyte in size, but mammography is, as with all the other diagnostic reading mobile software, specifically excluded.

The results of two research teams proved that reading done on a workstation versus a mobile device can be performed with similar results [15,16]. In a third study, researchers compared the effectiveness of diagnostic reading on a Dell PDA and an iPod Touch against that of a Viewsonic secondary medical display [17]. The results of this study are promising; there was no significant difference between the performance of the radiologists using mobile devices versus that of radiologists using the Viewsonic display, however the sample size was only 84.

Further studies proved that the iPad2 is suitable for reading virtual colonoscopy studies [18], for evaluating pneumothorax [19], tuberculosis [20] and acute stroke on CT [21] and assessing solitary pulmonary nodules [22]. Furthermore, in a recent study, the iPad also deemed to be a valuable tool in evaluating MR spinal injury cases [23].

Diagnostic reading applications available for smart phones and tablets support raw data, and they also allow for basic manipulation of the images such as zooming, windowing, rotation, distance measurement, and changing the contrast and brightness. Their main disadvantage is that it can be difficult to perform measurements on the small screen using fingers, and to display the image data of the present and previous scans side-by-side. Viewing such a small screen can also be strainful for the eyes, therefore the FDA stated that these applications cannot substitute dedicated workstations, and that mobile devices are to be used for diagnostic reading only when no workstations are available at hand [24] (Table 2).
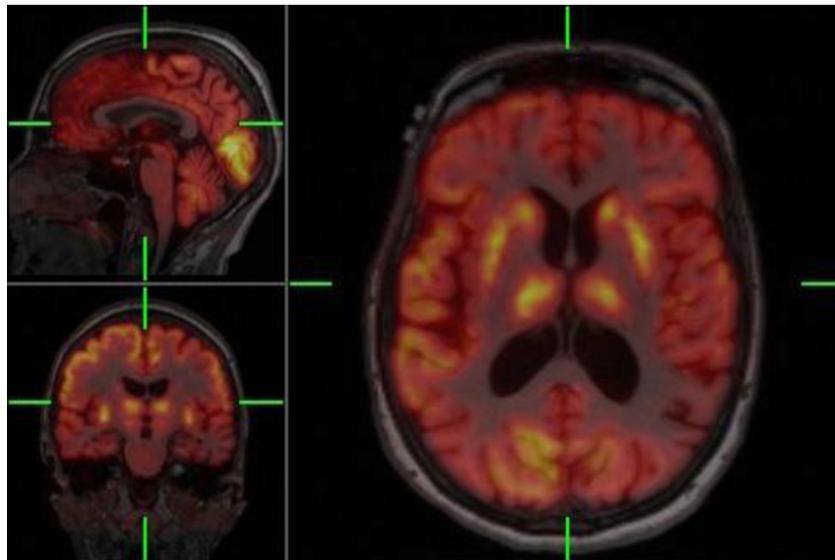
Fig. 1. A PET–MRI scan opened in the iOS application Mobile MIM, which has been cleared for diagnostic reading by the FDA.

5. Thousands of books in a small device

These multifunctional, compact devices may become important tools in education as well. They are capable of storing and displaying various document formats such as doc., pdf., xls., and ppt., thus one can carry thousands of colored textbooks, lecture notes and slides in a small device, and he can access or share these anywhere. A personalized library can be created and managed with a suitable application. Documents may be transfered from a personal computer to a mobile device for storage and reading. Text can be underlined, highlighted or crossed out, and handwritten notes can also be added to these documents.

Some medical books are available as applications; these are not just scanned, typed or pdf. versions of real textbooks, but fully functioning applications in their own right. They are superior to e-books in that the displayed content is fully optimized for the screen of the device; they feature a search engine, and they may contain simple animations or embedded videos as well. So far there are only a few of these book applications, and those are listed in Table 3.

Although reading off of a backlit in-plane switching panel for a sustained period of time may not be as practical as using a dedicated e-book reader or reading from plain old paper for that matter, the embedded animations, videos, and the sharp, colored images may by far compensate for those disadvantages.

6. Interactive encyclopedias for teaching and learning (m-Learning)

Interactive encyclopedias are more versatile than e-books, and they might be a valuable tool for many learners. With these in hand, residents may study in their free time as if they had their mentors with them. These interactive encyclopedias may open a new dimension in studying by providing the experience of diagnostic reading for those who wish to master it. Since the user does not only read a text passively, but scans through the axial slices of a CT scan, for example, studying becomes more efficient and new practical skills may be gained (Table 4).

Radiology 2.0: one night in the ED is one of the better interactive encyclopedias (Fig. 2). When launching the application we can choose to read cases with known or unknown diagnoses. For every case the program loads the CT image data for one body section. By sliding his finger in the longitudinal direction, one can flip through

Table 2
Applications for diagnostic reading.

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1. eFilm Mobile (iOS – 9.99 USD)
https://www.merge.com/na/estore/efilmmobile/index.aspx
2. OsiriX (iOS – 29.99 USD)
http://www.osirix-viewer.com/Downloads.html
3. iClarity (iOS – 9.99 USD)
http://www.icrcompany.com/RSNA/iclarity.html
4. Mobile MIM (iOS – free)
http://www.mimsoftware.com/products/iphone
5. ResolutionMD (iOS – free)
http://www.calgaryscientific.com/index.php?id=5
6. CoActiv (iOS – 19.99 USD)
http://www.coactiv.com/press_releases.htm
7. ImageVis3D (iOS – free)
http://www.sci.utah.edu/cibc/software/41-imagevis3d.html
8. DICOM Droid (Android – free)
https://market.android.com/details?id=be.ac.ulb.lisa.idot.android.dicomviewer&feature=search_result
9. Centricity Radiology Mobile Access 2.0 (iOS – free)
http://itunes.apple.com/us/app/centricity-radiology-mobile/id501936750?mt=8
10. Siemens syngo® via WebViewer (iOS – free)
http://itunes.apple.com/us/app/siemens-syngo-.via-webviewer/id410836437?mt=8
11. iPaxera (iOS – 4.99 USD)
http://itunes.apple.com/us/app/ipaxera/id432861550?mt=8

Table 3
Medical books as applications for iOS devices.

1. Pocket Atlas of Emergency Ultrasound (iOS – 69.99 USD)
http://itunes.apple.com/us/app/pocket-atlas-emergency-ultrasound/id408558888?mt=8
2. HD Radiology (iOS – 0.99 USD)
http://itunes.apple.com/us/app/hd-radiology/id373872837?mt=8
3. Radiology Ray X (iOS – 0.99 USD)
http://itunes.apple.com/app/radiology-ray-x/id374083450?ign-mpt=uo%3D5
4. The Handbook of Fractures (iOS, Android, Blackberry, Windows Phone – 72.00 USD)
http://www.skyscape.com/estore/ProductDetail.aspx?ProductId=2778
5-8. MRI in Practice Vol 01, 02, 03, 04 (iOS – £3.99/chapter)
Vol 01: http://itunes.apple.com/gb/app/mri-in-practice-app-01-static/id447595483?mt=8
Vol: 02 http://itunes.apple.com/gb/app/mri-in-practice-app-02-spin/id448164750?mt=8
Vol 03: http://itunes.apple.com/gb/app/mri-in-practice-app-03-phase/id448166516?mt=8
Vol 04: http://itunes.apple.com/gb/app/mri-in-practice-app-04-signal/id448198588?mt=8
9. NeuroRad Mini (iOS – 9.99 USD)
http://itunes.apple.com/us/app/neurorad-mini/id459333691?mt=8
10. NeuroRad for iPad (iOS – 9.99 USD)
http://itunes.apple.com/ca/app/neurorad/id452668265?mt=8
11. Emergency Ultrasound of the Eye (iOS, Android – 19.99 USD)
http://itunes.apple.com/us/app/emergency-ultrasound-eye-and/id480495369?mt=8
12. Handbook of Interventional Radiologic Procedures (iOS, Android, Blackberry, Windows Phone – 59.99 USD)
http://www.skyscape.com/estore/ProductDetail.aspx?ProductId=987
13. Radiology Review Manual (Android – 99.95 USD)
http://www.skyscape.com/estore/ProductDetail.aspx?ProductId=2930

the slices of a CT scan just as he would do using a dedicated workstation. The aim of the program is to teach novice radiologists to recognize lesions. Zooming, and other forms of manipulation are not possible in the program. For every case there is a discussion in which all key words are highlighted. By clicking on these the program automatically loads the relevant slice where the lesion or important anatomical part may be seen best.

Another great example for interactive encyclopedias is *iRadiology*, which features over 500 cases and can be downloaded free of charge (Fig. 3). There is also a quiz mode, but we may also browse through the various selections based on organs or disease type. This program offers a multimodality approach with X-ray, CT and MRI scans, which make learning with this program more valuable. Unfortunately, only one CT or MRI slice is loaded alongside the X-ray image and all are put in the same window. Even though the program allows zooming, the small screen size makes careful

observation a bit of a tedious process. Bookmarks make referencing and future access to cases quick and easy.

7. Decision support applications

Today, efforts to avoid unnecessary diagnostic procedures and to reduce patient radiation are being emphasized. Mobile technology can be a key part of this effort. With the help of evidence-based decision support applications clinicians, radiologists and technicians may choose the most appropriate examination type based on the leading symptoms, relevant history or initial diagnosis, thus ensuring that the rules of ALARA (as low as reasonably attainable) are kept.

This is important not only because of current initiatives to reduce radiation, but also because today patients are more involved in the therapeutic process than ever before. They may use mobile
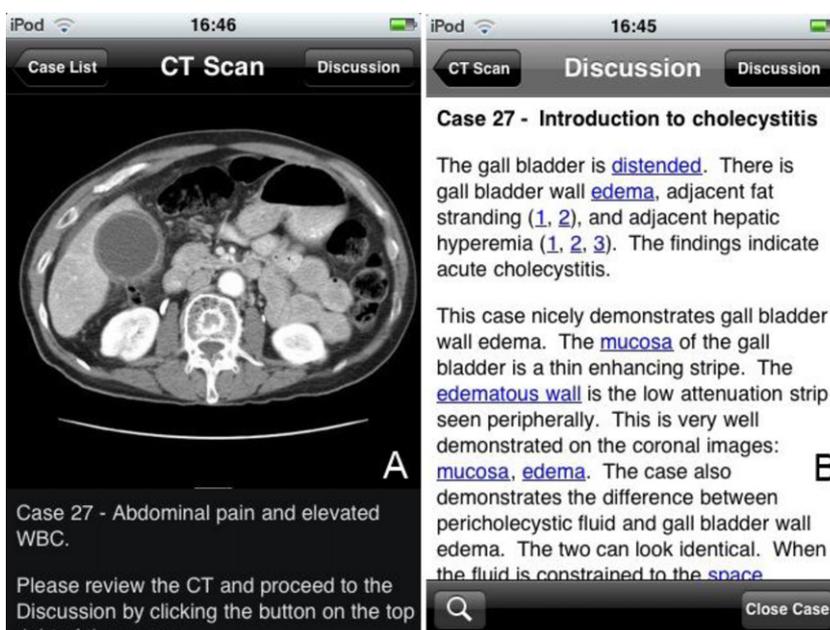

Fig. 2. Radiology 2.0 in an iOS device. (A) By sliding a finger in the longitudinal direction, one can flip through the slices of a CT scan. (B) For every case there is a discussion in which all key words are links to the most relevant slices.

Table 4
Interactive encyclopedias for studying and teaching (m-Learning).

1. Radiology 2.0: one night in the ED (iOS – free)
http://itunes.apple.com/us/app/radiology-2-0-one-night-in/id397926581?mt=8
2. iRadiology (iOS – free)
http://itunes.apple.com/us/app/iradiology/id346440355?mt=8
3. Radiology Assistant – Medical Imaging Reference & Education (iOS – 5.99 USD)
http://itunes.apple.com/us/app/radiology-assistant-medical/id383464901?mt=8
4. SonoAccess iPhone App (iOS – free)
http://www.sonosite.com/products/sonoaccess/features/
5–10. Radiopedia iPhone App 1-6 (iOS – 4.99 USD/fejezet)
http://radiopaedia.org/articles/iphone-app
11. iAnatomy (iOS – 0.99 USD)
http://www.imedicalapps.com/2009/10/improve-your-ability-to-read-ct-images-ianatomy-app-gets-reviewed-updated/
12. Joslin Chest Atlas (iOS – 14.99 USD)
http://itunes.apple.com/us/app/joslin-chest-atlas/id301252139?mt=8&ign-mpt=uo%3D6
13. X-rays and Body Scans (Android – 2.99 USD)
https://market.android.com/details?id=com.pixidapp.xraysandscanszip&feature=search_result
14. Surgical Radiology (iOS – free)
http://itunes.apple.com/us/app/surgical-radiology/id429287600?mt=8
15. BlueRadiology (iOS – 0.99 USD)
http://itunes.apple.com/in/app/blueradiology-2-4/id299457726?mt=8&ign-mpt=uo%3D2
16. GreenRadiology (iOS – 2.99 USD)
http://itunes.apple.com/us/app/green-radiology-professional/id303410234?mt=8
17. Ultrasound Protocols and Image Reference Handbook (iOS – 5.99 USD)
http://itunes.apple.com/us/app/ultrasound-protocols-image/id437574559?mt=8
18. CTisus iQuiz: The HD Edition (iOS – free)
http://itunes.apple.com/us/app/ctisus-iquiz-the-hd-edition/id406159923?mt=8
19. Radiology Terminology (iOS – 0.99 USD)
http://itunes.apple.com/ng/app/radiology-terminology/id497210843?mt=8
20. RadQuikQuiz MSK 1 (iOS – 0.99 USD)
http://itunes.apple.com/us/app/radquikquiz/id418822420?mt=8
21. RadTapTap (iOS – 0.99 USD)
http://itunes.apple.com/us/app/radtaptap/id426015308?mt=8
22. Interactive CT and MRI Anatomy (iOS – 19.99 USD)
http://itunes.apple.com/us/app/interactive-ct-mri-anatomy/id477076330?mt=8
23. X-rays4Medics (iOS – 2.99 USD)
http://itunes.apple.com/us/app/xrays4medics/id495125046?mt=8
24. iSonographer R/O DVT (iOS – 3.99 USD)
http://itunes.apple.com/us/app/isonographer-r-o-dvt/id495860556?mt=8
25. PocketRads (iOS – 0.99 USD)
http://itunes.apple.com/us/app/pocket-rads/id403451837?mt=8
26. Xray Instrumentation (iOS – 2.99 USD)
http://itunes.apple.com/kz/app/x-ray-instrumentation/id388381784?mt=8
27. Emergency Medicine Ultrasound (iOS – 4.99 USD)
http://itunes.apple.com/us/app/emergency-medicine-ultrasound/id344265948?mt=8
28. Ultrasound Physics Mock Exam and Test Bank by Donna M. Perry BS, RDMS, RVT (iOS – 9.99 USD)
http://itunes.apple.com/us/app/ultrasound-physics-mock-exams/id445868884?mt=8
29. X-ray Study (iOS – 0.99 USD)
http://itunes.apple.com/kz/app/x-ray-study/id406033044?mt=8
30. X-rays (iOS – free)
http://itunes.apple.com/us/app/x-rays/id342114343?mt=8
31. Emergency Radiology (Android 3.99 USD)
https://play.google.com/store/apps/details?id=uk.co.knightmair.spotdx.emergencyrad
32. Radiology for Medical Students (Android – 3.99 USD)
https://play.google.com/store/apps/details?id=uk.co.knightmair.spotdx
33. Essentials of Pediatric Radiology Companion App (iOS – free)
http://itunes.apple.com/us/app/essentials-pediatric-radiology/id440976594?mt=8

applications such as Radiation Passport [25] to estimate cancer risk associated with the radiologic examination that they are about to undergo, and they can also keep a record of their lifetime radiation. The primary goal of Radiation Passport is to educate and to increase awareness regarding radiation risks among patients and health care workers – including radiologists, so that they know how much radiation they would expose their patients to.

Some of these applications provide tools for calculating the GFR value or the amount of contrast agent needed prior to examinations; these handy applications can also be learning aids for medical students, student technicians or even resident doctors who are interested in all aspects of a diagnostic modality.

Decision support tools can be merged into clinical order entry systems on the computer that the referring physician is using [26] or they could be stand alone programs on the physician's mobile device. Although the former solution has been proven to significantly reduce the number of unnecessary CT and US examinations [27], to our knowledge there has been no study measuring the impact of a mobile decision support tool on referrals.

Moreover, there is some software that may facilitate communication between referring doctor and radiologist. Mirada Medical's CaseAccess is a web-based tool that can be also used on a mobile device by the referring doctor to view all patient imaging data including images, measurements and case notes. Thus, via this platform, the physician can exchange ideas with the imaging physician, track patient response and easily share the image data with the patient or any other colleague.

RadSnap [28] puts the knowledge and experience of thousands of radiologists in the palm of any physician who needs help with a difficult case (Fig. 4). With this software one can upload images

Table 5
Decision support applications.

1. eRoentgen Radiology DX (iOS – 19.99 USD)
http://www.iatrossoftware.com/
2. Radiation Passport (iOS – 2.99 USD)
http://www.tidalpool.ca/radiationpassport/
3. iCat–X-ray (iOS – 3.99 USD)
http://sites.google.com/site/icatsoftwareinc/home/icat-xray
4. iCat–MRI (iOS – 5.99 USD)
http://sites.google.com/site/icatsoftwareinc/home/new-mystery-app
5. iCat Scan Pro (iOS – 2.99 USD)
http://sites.google.com/site/icatsoftwareinc/home/icat-software
6. Radiology Toolbox (iOS – free)
http://itunes.apple.com/us/app/radiology-toolbox/id415176373?mt=8
7. Virtual Radiographer (Android – 19.99 USD)
https://market.android.com/details?id=com.v1_4.B258A4C7E970353E.com&feature=search_result
8. RadX Mobile (iOS – 14.99 USD)
http://itunes.apple.com/us/app/radx-mobile/id375114750?mt=8
9. iRADTECH (iOS, Android – 29.99 USD)
http://www.x-rayusa.com/?p=1
10. Nuclear Medicine Calculator (iOS – free)
http://itunes.apple.com/us/app/nuclear-medicine-calculator/id441438621?mt=8
11. NucRx (iOS – 4.99 USD)
http://itunes.apple.com/us/app/nucrx/id360970146?mt=8
12. Radiographic Calculator (iOS – 0.99 USD)
http://itunes.apple.com/us/app/radiographic-calculator/id427543626?mt=8
13. Radiographic Room Handbook & Charts (iOS – 24.99 USD)
http://itunes.apple.com/ng/app/radiographic-room-handbook/id426811476?mt=8
14. Radiographic Technique Charts (iOS – 9.99 USD)
http://itunes.apple.com/md/app/radiographic-technique-charts/id472804494?mt=8
15. Appropriate Use Criteria (AUC) for Cardiac Radionuclide Imaging (iOS – free)
http://itunes.apple.com/us/app/appropriate-use-criteria-auc/id391068250?mt=8
16. RadSnap - A free mobile application for cloud based Radiology consultation and Radiology teaching (iOS, Android, PC – free)
http://www.RadSnap.com

from his or her mobile phone, tablet device or personal computer and present it to the online radiology community, "Radiolopolis" [29], for discussion. Upon uploading an image it is presented as a new case on the website in a designated area, and also an announcement is made in the activity stream so that registered users are notified and can be involved in the consultation process. These images may be sent directly from the radiologist's workstation or taken with the mobile device's camera (Table 5).

8. Journal access on a mobile device

It is very easy and convenient to access the contents of our favorite medical journals on the go, and now there are several applications for that (Table 6). In fact, the major radiology journals such as Radiographics and Radiology have released their own applications for iOS devices. With these one can access the latest and even previous editions of the journal in a special layout that has been optimized for the screen of the mobile device (Fig. 5). Since content is optimized, images and text are scaled just the right size, and loading times are minimized. All users can access the abstracts of publications, while those with subscriptions can read the full pdf. versions of the papers. Viewing portable document files are no problem on a smartphone or table, since the screen resolution is high and with the touch screen it is a breeze to zoom and navigate in the documents.

Also open access journals such as the Journal of Radiology case reports make access of their journal contents via mobile devices more convenient via a special layout [30]. These mobile versions
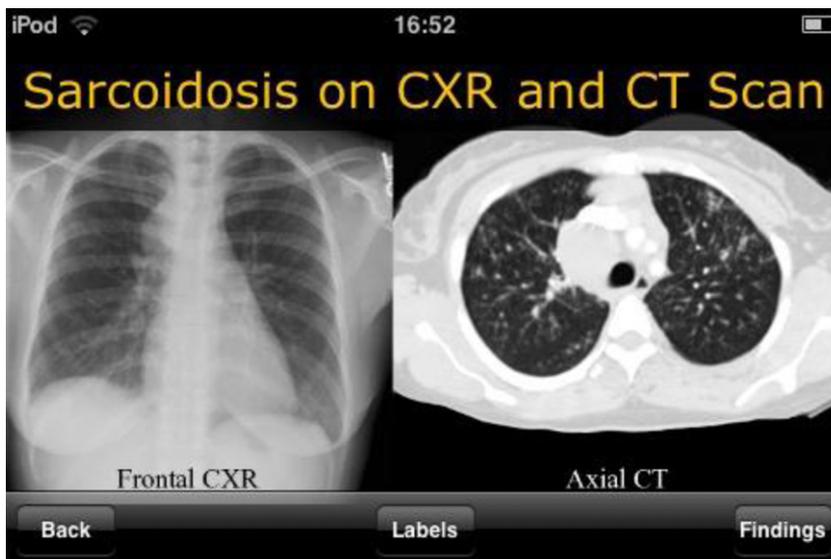
Fig. 3. iRadiology offers a multimodality approach with X-ray, CT and MRI scans, which make learning with this program more valuable.

Table 6
Journal access applications.

1. Radiology RSNA (iOS – free)
http://itunes.apple.com/au/app/rsna-radiology/id404034325?mt=8&ign-mpt=uo%3D2
2. Radiographics RSNA (iOS – free)
http://itunes.apple.com/au/app/rsna-radiographics/id404101332?mt=8
3. European Radiology (iOS – free)
http://itunes.apple.com/us/app/european-radiology/id473168112?mt=8
4. American Journal of Neuroradiology (iOS – free)
http://itunes.apple.com/au/app/ajnr-mobile/id412064251?mt=8
5. AJR (iOS, Android, Blackberry, Kindle Fire – free)
http://www.arrs.org/Publications/AJR/AJRapp.aspx
6. Molecular Imaging Insight (iOS – free)
http://download.cnet.com/Molecular-Imaging-Insight-Mble/3000-2129_4-75643560.html
7. Journal of Vascular and Interventional Radiology (iOS – free)
http://itunes.apple.com/gb/app/jvir-journal-vascular-interventional/id547876114?mt=8
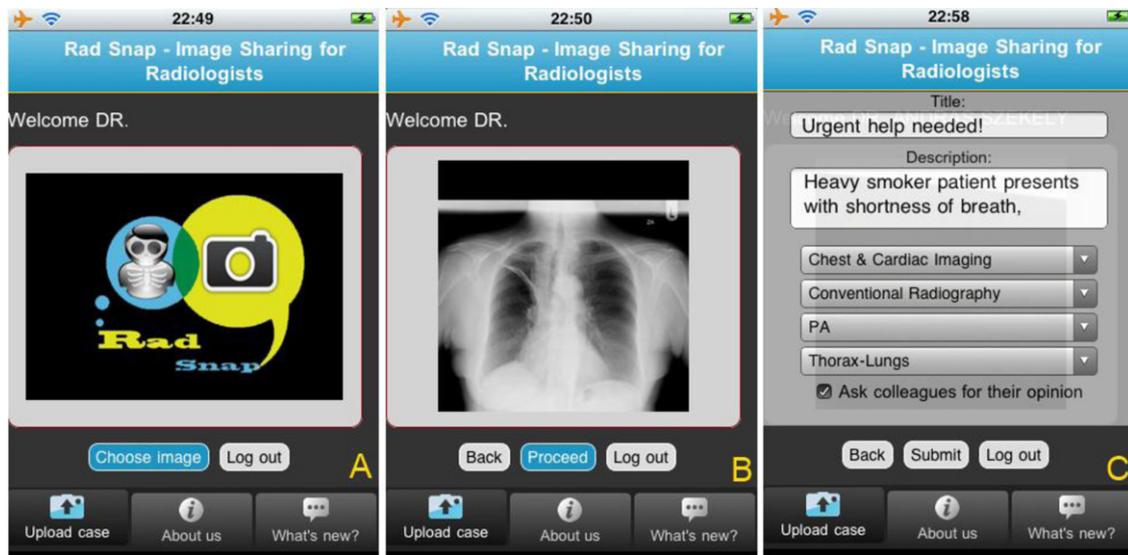8. Journal of Radiology Case Reports (iOS, Android, Blackberry, Kindle Fire – free)
http://www.radiologycases.com/mobile

Fig. 4. RadSnap at work. (A) After selecting and (B) finalizing the image, (C) a brief description can be added along with some meta data before uploading to the radiologist community site.

Fig. 5. Mobile version of the Journal of Radiology Case Reports. (A) Demonstrates the start screen with access to journal archives and educational sections. B and C are examples of an educational section ("The Teaching Point") which provides Radiology teaching points (B) and image examples (C).

may even provide additional educational features tailored to the mobile device.

9. Conclusion

The rapid advance of technology has resulted in the re-birth of the personal computer in the form of smartphones and tablets. Due to handy functions such as built-in GPS, camera, Wi-Fi, these devices have become popular in a very short time, and their use in the medical field is beginning to take form just now.

Their main advantage is that they are portable, thus they may prove to become valuable tools in everyday practice: they may hold thousands of books, journal articles, radiology images, lab results and so on.

Their shortcomings are that they are relatively expensive, good quality applications are only available for a limited number of devices, and the screen size is generally small. Irrespective of device and platform, it is a matter of taste whether the increase of mobility – being available anytime from anywhere – is an advantage or a disadvantage.

There are numerous applications available for diagnostic imaging professionals on the iOS platform, but the other platforms are expected to catch up soon. These applications may be categorized into one of the following: decision support, diagnostic applications, medical books, interactive encyclopedias, document organizer and journal reader programs.

Conflict of interest

Dr. Talanow is editor-in-chief of the Journal of Radiology Case Reports, president of the Radiolopolis community and has been involved in the development process of the RadSnap application.

Dr. Székely and Dr. Bágyi declare no conflict of interest related to this work.

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