Chapter 11
Medical Smartphone and Tablet Applications

There are approximately four billion mobile phones in the world, out of which 1.08 billion are smartphones. It is estimated that mobile Internet should take over desktop Internet usage by 2014 [1]. In 2012, 31 % of cell phone users used their phone to look for health information in the US, while this number was 17 % in 2010 [2].

The era of smartphones which are mobile phones built on a mobile operating system with advanced computing capability and connectivity, brought new opportunities in mobile health. The main smartphone operating systems include Google's Android, Apple's iOS, Nokia's Symbian, RIM's BlackBerry OS, Samsung's Bada, Microsoft's Windows Phone, Hewlett-Packard's webOS and embedded Linux.

Mobile health or mHealth can be defined as the delivery of healthcare services via mobile communication devices [3]. As mobile Internet access becomes a globally recognizable trend, it is inevitable to see more and more mHealth initiatives. It can include the usage of text message (SMS), smartphone applications or home monitoring devices.

Main Differences Among Mobile Operating Systems

As users have different needs about a mobile device, the comparison of features might help choose the hardware and software that suit our needs best [4] (Table 11.1).

TABLE 11.1 Differences between mobile operating systems

	Android	**iOS**	**Windows Phone**
Company	Google	Apple	Microsoft
License	Free and open-source	end-user license agreement	Proprietary
Browser search engine options	Many	Bing, Google, Yahoo Search	Bing, Google
Multitasking	Yes	Limited	Yes
Cost of developing apps	Free ($25 once to offer it on the Google Play)	Free ($99/year to distribute on App Store)	Free ($99/year to offer it on the Windows Phone Store)

TABLE 11.2 Resources and databases of medical smartphone applications

Name	URL	Short description
Webicina	http://www.webicina.com	Curated medical smartphone apps focusing on specialties and conditions
iMedicalApps	http://www.imedicalapps.com/	Blog publishing reviews of medical apps
Appolicious	http://www.appolicious.com/categories/26-health-fitness	Database of iOS apps in health and fitness
AppBrain	http://www.appbrain.com/apps/highest-rated/medical/	Database of Android medical apps

Medical Smartphone Applications

Smartphone apps are applications users run on smartphones. The number of medical and health-related iOS, Android and Windows Phone smartphone apps in the iOS App Store, Google Play and Windows App Store, respectively has been increasing for years. Searching for relevant apps requires properly designed and managed databases (Table 11.2).

Features to be checked before choosing a smartphone application:

- Check the author of the app, is it a real entity?
- Check out the reviews/ratings whether those are mostly positive.
- Check out comments looking for feedback.
- The app should be updated regularly. The publication date of the latest version is always shown.
- Choose apps that were designed for the mobile operating system of interest.
- Screenshots and videos assigned to the app profiles can also be helpful.

Medical or health-related smartphone apps can be divided into two main categories such as apps for consumers, and medical professionals.

Smartphone Apps for Consumers

Consumers use apps for their own health management, for keeping in touch with their doctors or for other health-related reasons. Real examples might represent the main ways of using smartphone apps as patients.

Example #1: Sensors or devices that measure health parameters such as blood sugar content can be attached to smartphones associated with a relevant smartphone app that logs and visualizes the levels. Results can be shared with the doctor.

Example #2: Augmented reality is a live view of the real-world environment augmented by computer-generated sensory input such as sound, video, graphics or GPS data. It means looking through a mobile phone's camera yields additional information from e.g. online resources. Apps can be developed that makes it possible for people with color blindness to see real colors [5].

Example #3: The Dutch university UMC Utrecht launched a project under the name Telebaby in which cameras were installed at the incubators of pediatrics departments and

FIGURE 11.1 The map of semi-automatic defibrillators on AED4EU

parents could watch their children live 24 h a day through a mobile device [6].

Example #4: UMC St Radboud in the Netherlands launched AED4.eu in 2009 with the ambition to map all automatic electronic defibrillators in the Netherlands which can be accessed via augmented reality by using a mobile phone. As of 2013, it covers several countries [7] (Fig. 11.1).

Smartphone Apps for Medical Professionals

All stakeholders of healthcare use smartphone apps either for personal or professional reasons. The challenges of using apps during work include regulations related to the Health Insurance Accountability and Portability Act which was inacted in order to protect the privacy of patients; whether the apps and the electronic medical record system of the healthcare institution are inter-connected or compatible; and whether the institution's policy approves the use of smartphones during work hours.
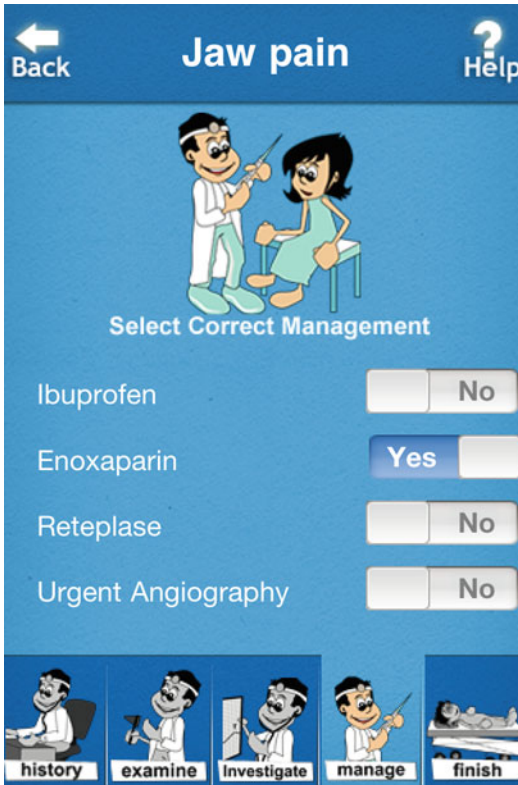
FIGURE 11.2 The main page of the Prognosis application

Example #1: The iCard ECG application for iOS devices can record 30 s of the patient's heart's rhythmic pulse and perform heart monitoring [8]. The AliveCor device was approved by the FDA to measure ECG with a smartphone [9].

Example #2: Pocketbody brings three dimensional anatomical structures to iOS devices [10].

Example #3: Prognosis published medical case studies in numerous medical specialties on different mobile operating systems (http://www.prognosisapp.com/) (Fig. 11.2).

Example #4: A Swedish dermatology practice developed an Android and iPhone application through which patients can submit photos of their skin condition which is analyzed for a fee (http://idoc24.com).

Tablets in Medicine

A tablet is a mobile computer operated by touchscreen on which the user's finger functions as the mouse and cursor. Introducing tablets into medicine and healthcare brought new possibilities as the larger screen and the easier navigation make them potentially useful for medical usage. Based on a 2012 survey, 62 % of physicians owned a tablet computer; and half of them use it at the point of care [11].

Tablets are used at several medical schools in education; in operating rooms, as well as in medical imaging [12].

The assessment of the quality of tablet-based medical apps is based on the same features that were described in relation to smartphone apps.

Potential Uses of Mobile Technology in Healthcare

- Appointment and medication reminders by SMS
- Patient support by SMS
- Accessing electronic patient records
- Smart homes in elderly care
- Patient diaries for clinical trials
- Locating blood and organ donors
- Patient consent
- Linking emergency services
- Disease monitoring
- Food and environmental contamination alerts
- Wireless stethoscope and other medical devices

Self-Test

1. What is a smartphone?
   A mobile phone built on a mobile operating system with advanced computing capability and connectivity.
2. What features should be checked before choosing a medical smartphone application?

The author, reviews, ratings, and updates, among others.
3. What is the difference between a tablet and a smartphone?
A tablet is a mobile computer operated by touchscreen on which the user's finger functions as the mouse and cursor.

Key Points
- Mobile health or mHealth can be defined as the delivery of healthcare services via mobile communication devices.
- The era of smartphones brought new opportunities in mobile health.
- The quality of medical smartphone apps should be assessed by medical professionals who can "prescribe" apps for their patients.
- Tablets are used at several medical schools in education; in operating rooms, as well as in medical imaging.
- Using mobile technologies is now part of the practice of medicine.

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