

Pametni telefon v klinični praksi: tehnološka modna muha ali zdravnikov bodoči osebni asistent?

Smartphone Use in Clinical Practice: Technological Fad or the Future Physician's Assistant?

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Izvleček

Mobilni telefoni so v zadnjih letih doživeli izjemen razvoj. Pojavili so se novi, tako imenovani pametni telefoni, ki imajo lasten operacijski sistem in omogočajo nameščanje aplikacij po želji uporabnika. Njihova uporabnost se je hitro pokazala tudi v medicini. V ZDA ima pametni telefon v lasti več kot 80 % zdravnikov. Njihova uporaba omogoča hitrejšo zdravljenje, zmanjšuje število napak ter olajša dostop do mnogovrstnih informacij. Na tem področju je še vedno veliko prostora za izboljšave. Najpogosteje se pojavljajo dvomi glede varnosti, varovanja osebnih podatkov in zanesljivosti uporabe v zdravstvene namene.

Kljub temu pa se z nadaljnjim razvojem pametnim telefonom v zdravstvu najverjetneje obeta svetla prihodnost.

Abstract

Over the last few years, mobile phones have been undergoing rapid development, especially with the emergence of smartphones. Smartphones have their own operating system that is capable of running many user-installed applications. Their potential for use in the medical field was quickly acknowledged. More than 80% of physicians in the USA own a smartphone, and their use facilitates a rapid treatment, decreases the number of medical errors and allows a quicker access to patient and reference information. However, there is still some room for improvement. There are still some open questions regarding security, privacy and reliability of smartphone use, but their future use in clinical practice seems to be very promising.

INTRODUCTION

In the last decade, mobile phone technology underwent a rapid evolution especially with the development of new smartphone devices. A smartphone is a mobile device that offers more than just basic communication capabilities, such as voice calling and messaging (1). The main feature of a smartphone is its own operating system, which allows users to install and run a vast number of different applications (“apps”) (1). Multiple smartphone operating systems are commercially available. Global usage statistics show that the operating systems Android and iOS which share 64.1% and 18.8% of the market, respectively, are the most widespread (2). Other operating systems such as BlackBerry OS, Windows Phone and Symbian are lagging behind. Their combined market share is less than 14% (2). Android was released by Google as an open source code used by many mobile phone brands, however, iOS is used only on Apple products, such as the iPhone and iPad.

The medical field is not immune to new technologies, even The World Health Organization has recently introduced a new term “mHealth”, which is a term for practicing medicine with the help of mobile devices (1). In the past, many physicians simultaneously used their mobile phone, pager and personal digital assistant (PDA) for everyday work. Smartphones successfully merged those into a single device (3). More than 80% of physicians in the USA own a smartphone that is capable of downloading apps (4, 5). There are two main categories of medical apps the ones used by medical professionals and the others used by the general public (6). Medical apps can be downloaded from two main sources: the Android Market for Android-based phones and the iTunes Store for the iPhone. Currently, there are several thousand medical apps available for download on the Android Market and iTunes Store; most of them are free of charge (4, 5).

The purpose of this article is to present the current usage and application of smartphones in medicine as well as the limitations and dilemmas of this technology.

SMARTPHONE USAGE STATISTICS IN HEALTH CARE

The Menlo Park Spyglass consulting group study, released in August 2010, showed that smartphone use among physicians rose to 94%, compared to 56% in 2006. The rate of smartphone use seems very high; however, about 85% of the use is only reference-based apps. The percentage drops to only 4%, when the use of clinical apps such as lab results, viewing, chart capture, ECG viewing and electronic prescribing is taken into account (7). According to the QuantiaMD study, more than 80% of the 3798 participating US physicians own a mobile device that is capable of downloading apps. Notably, among physicians the iPhone has the biggest share (59%), compared to the general population, where Android-based phones have the leading role (8). The older and more experienced physicians use smartphones less compared to younger colleagues, although the percentage stays above 60% (5, 8). Less data regarding smartphone usage by European physicians is available. EPG Health Media market research in Italy, Germany, France, Spain and United Kingdom showed that around 44% of physicians owned a smartphone in 2010 and up to 46% of physicians who did not own a smartphone said that they may buy one in the next 6 months (9). Most of smartphones are still bought personally but some hospitals have already acknowledged the advantages of healthcare digitalization and started to purchase the phones for their employees (8, 10).

POSSIBILITIES OF SMARTPHONE USE

With the rapid evolution of technology, new possibilities for smartphone apps are presented daily. New mobile technologies are becoming affordable, user friendly and are making the work of doctors easier, which makes them appealing to use (4). There are many fields for possible smartphone use: administrative support, professional activities (e.g., patient information access, electronic drug prescribing, remote monitoring), decision support (clinical and drug references), education and research (11, 12).

The use of mobile technology brings many advantages, such as fewer medical errors, better communication, greater mobility, easier information access and improved quality of patient care (11). A systematic review by Prgomet et al. revealed that handheld technology may be beneficial through facilitation of rapid response, prevention of medication errors and data management and accessibility (11).

Improved and faster treatment:

The help of mobile technology in prompt treatment is mostly studied in emergency medicine because rapid response is crucial in critically ill patients. Two studies investigated wireless transmission of prehospital ECG to a cardiologist's personal digital assistant (PDA). Door-to-treatment times of patients with myocardial infarction were greatly reduced. The findings from a study conducted in USA by Adams et al. showed a reduction of median door to reperfusion time from 101 minutes to 50 minutes (11). The conclusions in Danish study drawn by Clemens et al. were similar – the preintervention average door to treatment time of 94 minutes was reduced to 40 minutes (11).

Mobile phones can also be used in a chain of survival for patients with cardiac arrest. They are suitable for distributing educational materials that allow recognition of warning symptoms and promote necessary actions in case a cardiac arrest occurs. Mobile phones reduce notification times in emergencies. A



Figure 1. Mobile chain of survival (20).

rescuer can instantly call for help without leaving the victim. Studies have shown a better quality of the first aid with help of the video communication between rescuers and emergency medical service dispatchers (14). Mobile applications with a metronome to pace chest compressions and ventilations have been shown to increase the quality of CPR in a manikin situation. Early defibrillation is a crucial link in the chain of survival. A quicker access to automatic external defibrillators can be achieved with the aid of AED maps available on the Internet. Post resuscitation care can be improved with help of mobile phones transmitting a patient's physiological signals including ECG, blood pressure, saturation and others. This real-time telemetrical link between the hospital and the moving ambulance allows the hospital staff to modify and plan future treatment (14) (Fig. 1).



Figure 2. Mobile DICOM viewer OsiriX (21).

New high-resolution smartphone screens and broadband data connectivity allow the viewing of diagnostic imaging from a distant location – without PACS workstation or even a computer at hand.

Choudhri et al. evaluated the ability to diagnose acute appendicitis on abdominal CT using a mobile DICOM viewer (OsiriX). The pictures were interpreted on an iPhone, and the results showed that the rates of diagnosis were comparable to those made on PACS workstations (13).

Reponen et al. studied the accuracy of the data achieved on handheld devices by assessing CT images. The study compared 21 diagnoses made on PDA to reference diagnoses made from the original image. Compatibility of diagnoses was high (86%); in only three cases there were minor differences of no clinical importance and in one case an additional diagnosis was made on the PDA (11) (Fig. 2).

Reducing errors:

Smartphones may also help prevent medical errors with decision support systems (DSSs) for drug prescribing practices and generation of medication lists and prescriptions.

Sintchenko et al. studied the impact of information accessible via handheld device on patient management. Twelve ICU physicians were given PDAs loaded with guidelines and laboratory data. A significant decrease in antibiotics use occurred and the average length of patient stay decreased during DSS use (11).

Flanningan and McAloon compared the performance of students utilizing smartphones and consultants using the British National Formulary For Children when prescribing drug infusions in simulated pediatric emergency. Students utilizing smartphones were significantly more accurate, faster and more confident in their calculations, thus outperforming consultants (16).

Rudkin et al. researched physicians' access to resources and rates of change in patient management. Physicians accessed electronic resources more often (n=181) than paper resources (n=131) and changes in patient management were also significantly higher using electronic resources (11).

Grasso et al. compared error rates when nurses transcribed a physician's handwritten prescriptions with error rates when the physician entered prescriptions directly into a PDA. Error rates were lower in electronic (8%) compared to handwritten prescription lists (22%) (11).

Knowledge expansion:

As mentioned above, most physicians use their smartphones for reference-based apps (7). A study by Franko and Tirrel showed that the most commonly used apps were drug guides (79%), medical calculators (18%), pregnancy wheels (4%) and coding and billing apps (4%). The results also showed that most physicians would like to see more textbook reference materials, treatment algorithms and general medical knowledge apps (5).

One of the most widely-known and frequently used reference apps is Medscape. It is free of charge and available for Android, iOS and Blackberry phones. Currently, it is used by over 1 million healthcare professionals. It contains information for over 4000 disease references, over 8000 drug references, a drug interaction checker and more. All of the data can be downloaded, so it is accessible when an Internet connection is not available. Its content is provided by trustworthy authors and regularly updated (15) (Fig. 3).

Patient information access and monitoring:

Introduction of the electronic medical record pro-



Figure 3. Medscape application.

vided a great opportunity for easy access to patient data by handheld devices. Some hospitals have already acknowledged this potential and are encouraging their use (10, 17).

Another possibility for smartphone use is wireless patient monitoring. Currently, there is an EU-funded project running; its goal is to develop an Android-based mobile application, Enhanced Complete Ambient Assisted Living Experiment (eCAALYX), for monitoring patients with multiple chronic conditions. This app receives input from wearable wireless health sensors and geographic location from mobile GPS sensor which is sent to a remote server accessible by healthcare professionals (12) (Fig. 4).

DRAWBACKS AND LIMITATIONS

The potential use of a smartphone in healthcare is enormous; however, some limitations and possible drawbacks should be taken into consideration. First of all, most of the studies failed to show the benefit of mobile handheld devices compared to a standard desktop computer platform (11).

Some patients may not be comfortable with smartphone use in exam rooms. However, a study by Strayet et al. showed a mostly positive reception of tablet computers during the examination. The main concerns were depersonalization of the medical encounter, increased likelihood of mistakes and possible breach of information privacy (18). Mccord et al. demonstrated that patients rate interactions with physicians who use PDAs more positively when they explain the nature of their PDA use (19).

The need for medical care is increasing with patient age. We should be aware that older patients are usually not technologically cognizant, so this should be considered when developing devices for remote patient monitoring, thus making them as foolproof as possible (12).

Smartphones usually have smaller screens intended for individual use, which makes collaboration difficult. Entering relevant information in the absence of a QWERTY keyboard may prove difficult and time consuming (11).

In healthcare information systems, the issue of patient data security is always challenging and also expensive to implement. With the use of smartphones, this issue is broadening and new problems are arising. Many communication protocols for smartphones are not compliant with security standards in healthcare. For example, instant messaging that is a commonly used form of exchanging information with smartphones introduces weaknesses, like the fact that the messaging clients are always on, that logs can contain sensitive information, and that the communication goes via an externally controlled server. Most instant messaging services were never intended for secure communication. Alternatively, the regulators in the field of medical informatics are (as is usual with the implementation of new information technologies in any regulated field) lagging behind the possibilities of new technologies and are not considering smartphones yet – even though smartphone technology is unquestionably able to provide secure communication and sufficient data protection for healthcare data security. According to the opinion of the authors, the near field communication technology can solve several security problems regarding the required location of the device. The same technology is being used for financial transactions with smartphones.

In the end, we should be aware that there is almost no control over the quality and reliability of smartphone apps. Currently no organization or govern-

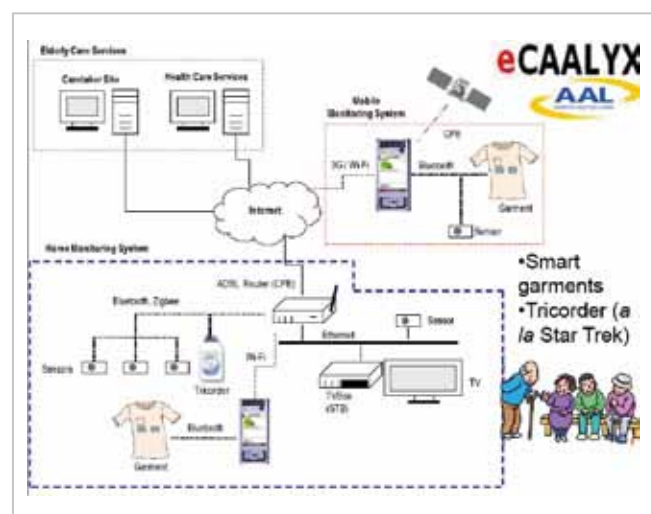


Figure 4. Architecture of the eCAALYX platform (22).

ment body reviews, validates or accredits the apps. The Food and Drug Administration (FDA) has considered regulating medical apps, but this has yet to happen because medical apps are not treated as medical devices, which need FDA approval (5, 6).

CONCLUSION

Many healthcare workers own smartphones, however, the use of these phones in a professional manner still has a lot of unexploited potential and room for improvement. Many studies show the possible positive effects of mobile technology such as faster treatment, fewer medical errors, and easier access

to information. However, there are some issues that need to be addressed before they can be fully implemented in everyday professional use.

Privacy protection, reliability and regulation issues are the main cause of concern. Within the healthcare sector, information security aspects are of vital importance, and may be of serious hindrance for the fast and wide adoption of smartphone-based medical applications.

When those issues are resolved, the enormous potential of this new groundbreaking technology will greatly outweigh the risks of its use. At this point, we can certainly say that smartphones are becoming real medical devices and not just a current fad.

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