MOBILE APPLICATIONS AS A TOOL SUPPORTING HEALTHCARE MANAGEMENT

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Abstract: Mobile solutions revolutionize healthcare systems as well as the way of management in this area. The complex and dynamic character of healthcare organizations requires a special kind of management in the areas of healthcare knowledge and electronic health records (EHRs). Mobile applications can be very useful and helpful in the terms of information providing, but their role is not limited to transferring it between the doctors, patients and managerial staff. In this paper the role of mobile applications in the work of health care professionals (HCPs) has been shown.This article highlights the role of mobile applications in facilitating HCPs' work in the terms of time management and EHRs storage and management.

Key words: information management, electronic health records (EHRs), e-health, information technology (IT), mobile technologies, mobile applications

Introduction

Access to healthcare is one of the essential points in social inclusion (Frączkiewicz-Wronka and Wronka-Pośpiech, 2014). Creating and updating health records (HRs) is obligatory for each healthcare provider and should be done immediately after providing each healthcare service. It takes a lot of time though, which – in fact – would be better consumed when devoted to the patient. That's one of the reasons why implementing electronic health records (EHRs) is so important. Before it is possible, in general the common use of ICT in health services should be introduced. It's worth mentioning, that the use of computer during consultations by general practitioners (GPs) in Poland is still on lower level than it should be. In 2010 only 11% of the GP used computers in consultation with the patients while in EU – 66% (Bąkała and Korczak, 2010). Additionally eHealth performs mainly in the area of administrative and medical data storage, which makes a big distance between Poland and other EU countries (Michalski et al., 2015). In more developed countries computer in consultations room has been a common tool in diagnostics recording for many years (Pearce, 2012; Watkins et al., 1999). According to European Commission (2014 b), hosting and managing EHRs is one of the essential fields discussed in e-Health Strategy. Providing a better overview of patient's health is the aim of EHRs philosophy. On the other hand health data is given a special protection in Directive 95/46/EC as in some areas the data can be extremely sensitive (like e.g. information on sexual transmitted diseases, mental disorder, addictions to drugs or alcohol). Thus regulating information to be included in EHRs is the matter of EU Member States

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choice. In Poland the deadline for the obligatory transition to EHRs has been settled for 1 August 2017 (postponed by the Ministry of Healthcare from July 2014). According to (Korczak, 2014), polish health care system is still one of the least rated in Europe. In 2012 Poland was only at 27th place among 34 countries covered by the research. This situation proves that each action aimed at improving the electronic assets and processes in health care system is reasonable and worth implementing by all means (Hardinge, 2015). Despite the legal regulations, transforming into electronic data in health care systems, recording the data by each physician is absolutely required nowadays (European Commission, 2014a).

On the other hand a rapid growth of information technologies use in everyday life can be observed, which affects healthcare as well. One of the most important world trends in technologies is mobility.

Development of mobile applications accelerated by advantages of wireless technologies brings lots of benefits in the area of healthcare. They enable better personalization; provide better disease management and services to patients and their relatives, as well as more effective and flexible communication system for healthcare professionals, patients and medical suppliers (Buchbinder and Shanks, 2007). The literature review allows to see how many important areas of disease management are covered by mobile technologies. These are for example asthma, psychological disorder, diabetes, which symptoms can be tracked by the patients, the information can be briefly sent to the doctors and as a result the management of the healthcare process management can be more efficient. That in turn helps in recovery and wellness of the patients who remain the most important target group of the whole process. Among its elements the time together with electronic health records (EHR) are especially sensitive area for the new technologies. Managing time as well as information management are nowadays a big challenge for many organizations. In health care sector, primary health care institutions are the systems' basic elements that face it. Still a common practice is when health care professionals (HCPs) spend a lot of time entering data into a computer during the examination. This precious time would better be spent on the examination.

Health care sector as well as every other field of economy has changed a lot due to rapid technological development. In many areas computerisation can be observed as a natural process of facilitating and customizing the doctor's (and other medical staff's) duties. IT tools play a significant role, giving the term "e-health" meaning through products, systems and services that go beyond simply Internet-based applications (European Commission, 2004). Clinical practice has transformed in many aspects due to the use of mobile devices (Wallace et al., 2012). Still more apps are available to assist HCPs with various important tasks. These are information and time management, EHRs maintenance and access; communications and consulting, reference and information gathering, patient management and monitoring, clinical decision-making, and medical education and training (Ventola, 2014). Also from the patients' point of view mobile devices become very important tools in their education, disease self-management,

and remote monitoring of patients. The most popular mobile devices are tablets and smartphones, operating under the control of dedicated operating systems. These systems are adapted for touch screens, supporting gestures and voice. Their role is to make many aspects of life easier. Their implementation in health care sector is also remarkable. There are many patient-devoted apps adopted in personal healthcare management systems. Still more citizens use cell phones and tablets. According to a study of the telecommunication market, in Poland 58% of people aged 15 and older have the access to the Internet. In the case of 42% of the respondents the access is stationary, while 15% of people use mobile Internet (PBS, 2014). Almost half of mobile phone users (44%) use the smartphones due to their wide range of useful functionality (45%), the ability to connect to the Internet through the phone (41%) and the ease of use via the touch screen (40%). Mobile technologies are then a great and still more common communication tool. Thus using these solutions in healthcare sector is a necessity.

In the terms of the mobile technologies use in healthcare management, it's worth to focus on the population of healthcare professionals. As the research results show (AT&T, 2013), they still more often adopt the mobile solutions in their private and professional life. In the United States, 80% of HCPs use smartphones in their daily practice, 60% use tablets. Mobile devices become still more popular as they are affordable, easy to use, and can be easily carried between patient exams to access digitized patient information. Transferring the data from paper charts and forms is also still more common practice as nobody likes filling out forms, nor keeping track of endless healthcare-related documents. In the Figure 1 the way of the use of the devices for work purposes is presented.

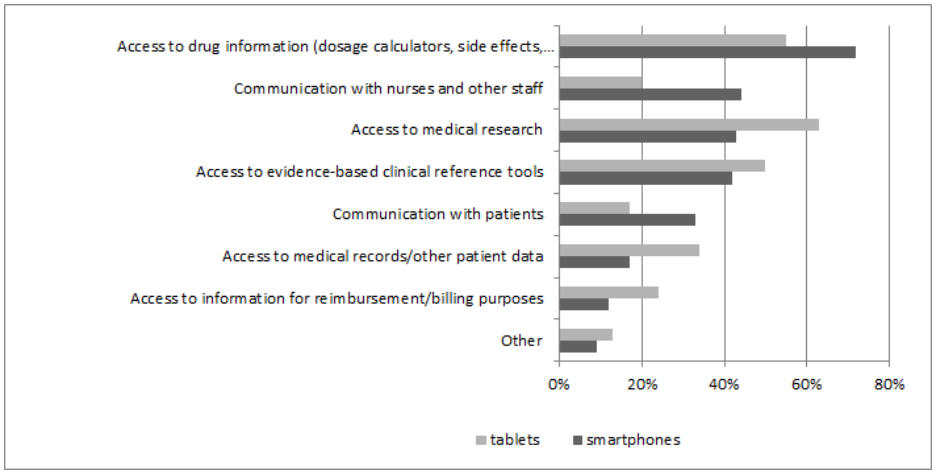

Figure 1. The purposes the HCPs use mobile devices at work *(AT&T, 2013)*

According to the survey results, the main purposes of using the mobile devices at work pointed by the doctors were connected with the access to: drug information

and medical research. Still not many HCPs use mobile technologies in the diagnosis process. One of the reasons can be the lack of Mobile Device Management (MDM) – an administrative area dealing with deploying, securing, monitoring, integrating and managing mobile devices in the workplace (Medina et al., 2015). The main goal of introducing MDM is to optimize the functionality and security of mobile devices within the enterprise. The strategy *helping employees be more productive providing them the needed tools to perform work-related tasks on mobile devices* has been defined Enterprise Mobility Management (EMM), integrating MDM.

Electronic Health Records (EHRs) Storage and Management

Management in the context of health care has been defined as *"the process, comprised of social and technical functions and activities, occurring within organizations for the purpose of accomplishing predetermined objectives through humans and other resources"* (Longest et al., 2000). Mobile technologies are the "other resource" then, helping to accomplish the objectives.
As Saraman (2009) suggests, in a healthcare organisation there must appear the synergy between: knowledge management, use of processes to better manage the healthcare, and existing achievements in the standardization of the interaction between medical applications. The healthcare management reference model below (Fig. 2) shows the links between certain elements of the cycle. Mobile applications should be put in the space of processes and services, fulfilling the area.

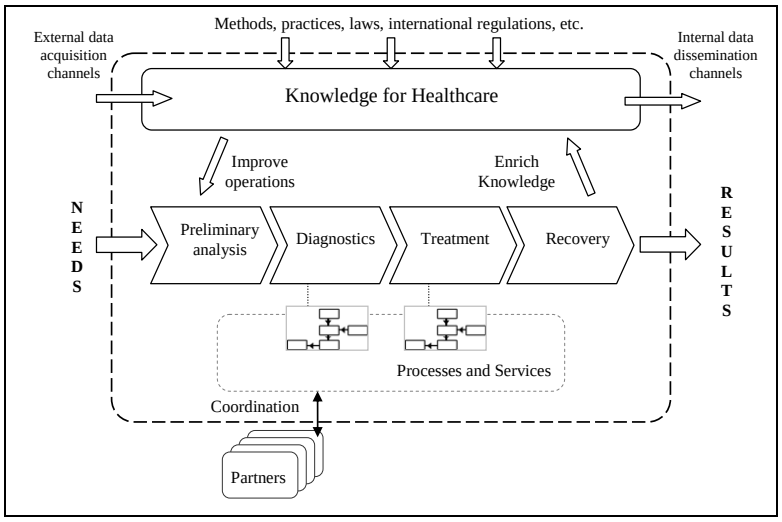

Figure 2. Healthcare management reference model (*Saraman, 2009)*

Management in the health care sector is a very complex issue. One of its components is the area of electronic health records (EHRs). Managing these

requires decision making and planning throughout the entire life cycle of the EHR—from planning, processing, distribution, maintenance, storage, and retrieval of the health record to its ultimate disposition, including archiving or destruction (Grzybowski and McLendon, 2004).
Health care services quality is hard to determine before buying them. To reduce uncertainty, customers are looking for all kinds of evidence of high quality which can include behaviour, appearance and experience of the staff, appearance of the clinic, equipment used, handouts, symbols and prices (Kotler, 2011). The use of mobile technologies for clinical purposes, can play a significant role in the healthcare service assessment.

Mobile Application use in a Healthcare Process

A mobile application or a "mobile app" is defined as a software application that can be run on a mobile platform, or a web-based software application that is tailored to a mobile platform but is executed on a server. The use of mobile apps to facilitate the examination seems to have a great potential due to the health care professionals' needs. HCPs conduct plenty of different medical examinations. Some of them are performed by the devices with little human interaction. Others rely totally on physician's activities. Examination duration can also vary – from seconds up to hours. The aim of mobile medical app manufacturers is to facilitate the examination process and to enable the HCPs to save time.
As Thompson et al. (2012) says computers support in healthcare system brings a lot of advantages both for the patients and the administration. On the other hand the use of mobile technologies in the consulting room is more often argued (Thompson et al., 2012). Even though mobile apps can be used in many fields of a primary health care institution's activity, as shown in Fig. 3 they usually consider rather administration than examination process.

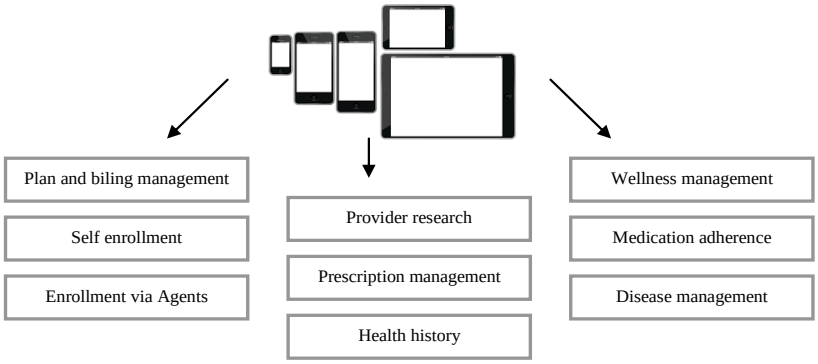

Figure 3. Use of mobile applications in a primary health care institution
(own elaboration, on the basis of Wallace et al., 2012, and Aungst, 2013)

In this part of the article, an idea of a mobile app supporting a medical examination is presented (this mobile apps technical details are described by the authors in another documentation, not included in this article). This type of examination can be conducted by a medical specialist. It is a non-invasive test enabling diagnosing blood clots, blocked arteries, heart valve defects, blood circulation issues, bulging arteries, narrowing of arteries and poorly functioning valves in leg veins. The examination is based on the Doppler Effect. In practice the examination looks like the following: the operator of the ultrasonograph uses a hand-held transducer and moves it along the skin of the patient's body. The device is connected to the computer where the real time image of the inner body can be seen. Basing on this image, the physician can draw plenty of conclusions concerning functioning of the patient's body and the existing pathologies. There is a short list of veins and arteries that are usually examined with the aid of the Doppler ultrasonography. Duration of the examination is usually longer than 15 minutes. At that time the physician does plenty of moves with the device, manipulates the patient's body, analyses the real time image visible on the screen and takes notes that are transferred to the official examination results paper, which is created at the very end. As one can see these are plenty of activities that have to be carried out simultaneously. They require physical strength (mainly because of the necessity to manipulate the patient's body – pressing blood vessels, lifting extremities, etc.). The essence of the problem comes with the test results creation. Why does the physician need to take notes manually? This process should be automated. The answer to this demand is the proposed mobile app.
The mobile application supposed to support the Doppler ultrasound examination once deployed on a tablet would serve as the main tool when collecting the test results. Instead of taking paper notes, the physician would use the graphical user interface of the application in order to mark the proper selections. This should shorten the examination duration and help the operator of the ultrasonograph to focus more on the live image of the patient's inner body. In the terms of healthcare management process, this kind of mobile application enables to send the patient's EHRs immediately to the database, starting their management process by which the records are preserved for evidentiary (legal or business) purposes (Grzybowski and McLendon, 2004).

Summary

The increasing use of mobile technologies in everyday life leads to a reflection on their use in healthcare management in order to increase the quality of the healthcare process. The article brings closer to the concept of mobile applications role in managing a HCP's work. Still more healthcare professionals and patients use medical applications for smartphones. In everyday practice of HCPs many processes could be automated in order to give the medical staff more time for the patients. The conducted research and analysis of the problem enable stating that for example Doppler ultrasound examination needs to be automated. Though the

technically advanced equipment is available and commonly used, the infrastructure supporting this type of examination is incomplete. The software system facilitating medical test process is desired, which refers to the majority of branches of the health care sector, especially in Poland.

Large scale governmental ventures will never assure the delivery of specialised and customized software products that could provide the professionals with the demanded comfort level and drive the economy at the same time. This is where the smaller initiatives ought to step in. Doubtlessly, what starts as a minor importance activity can push the development forwards and revolutionise the health care sector soon.

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APLIKACJE MOBILNE WSPIERAJĄCE PROCES ZARZĄDZANIA W SŁUŻBIE ZDROWIA

Streszczenie: Rozwiązania mobilne są bardzo silnym trendem w systemach opieki zdrowotnej, jak i w zarządzania w tym obszarze. Złożony i dynamiczny charakter organizacji opieki zdrowotnej wymaga specjalnego rodzaju zarządzania w zakresie wiedzy medycznej i elektronicznych rejestrów medycznych. Aplikacje mobilne mogą być bardzo przydatne i pomocne w zakresie dostarczania informacji, ale ich rola nie ogranicza się do przenoszenia ich między lekarzy, pacjentami i personelem kierowniczym. W niniejszym artykule uwypuklono rolę aplikacji mobilnych w pracy pracowników służby zdrowia (HCPS), podkreślono rolę aplikacji mobilnych w ułatwianiu pracy pracownikom służby zdrowia w zakresie zarządzania czasem i EHRs przechowywania i zarządzania.
Słowa kluczowe: zarządzanie informacją, elektroniczna dokumentacja medyczna (EHRs), e-zdrowie, technologia informacyjna (IT), technologie mobilne, aplikacje mobilne

移動應用程序的工具支持醫療管理

摘要：移動解決方案，徹底改變醫療保健系統，以及管理在這一領域的方式。醫療機構的複雜性和動態性，需要在醫療知識和電子健康記錄（電子病歷）領域的一種特殊的管理。移動應用是非常有用和有益的信息提供了條件，但他們的作用不限於醫生，患者和管理人員之間傳遞它。在本文的醫護人員（醫療專業人員）的工作移動應用中的作用已被證實。本文重點介紹的移動應用便利的時間管理和電子病歷的存儲和管理方面醫療專業人員“工作中的作用。
關鍵詞：信息管理，電子健康記錄（電子病歷），電子醫療保健，信息技術（IT），移動通信技術，移動應用