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Mobile personal health records for pregnancy monitoring functionalities: Analysis and potential

Mariam Bachiri ^{a,*}, Ali Idri ^a, José Luis Fernández-Alemán ^b,
Ambrosio Toul ^b

^a Software Project Management research Team, ENSIAS, Mohammed V University in Rabat, Rabat, Morocco

^b Department of Informatics and Systems, Faculty of Computer Science, University of Murcia, Murcia, Spain

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ABSTRACT

Background and objective: Personal Health Records (PHRs) are a rapidly growing area of health information technology. PHR users are able to manage their own health data and communicate with doctors in order to improve healthcare quality and efficiency. Mobile PHR (mPHR) applications for mobile devices have obtained an interesting market quota since the appearance of more powerful mobile devices. These devices allow users to gain access to applications that used to be available only for personal computers. This paper analyzes the functionalities of mobile PHRs that are specific to pregnancy monitoring.

Methods: A well-known Systematic Literature Review (SLR) protocol was used in the analysis process. A questionnaire was developed for this task, based on the rigorous study of scientific literature concerning pregnancy and applications available on the market, with 9 data items and 35 quality assessments. The data items contain calendars, pregnancy information, health habits, counters, diaries, mobile features, security, backup, configuration and architectural design.

Results: A total of 33 mPHRs for pregnancy monitoring, available for iOS and Android, were selected from Apple App store and Google Play store, respectively. The results show that none of the mPHRs selected met 100% of the functionalities analyzed in this paper. The highest score achieved was 77%, while the lowest was 17%.

Conclusions: In this paper, these features are discussed and possible paths for future development of similar applications are proposed, which may lead to a more efficient use of smartphone capabilities.

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1. Introduction

Electronic Health Record Systems (EHRs) allow authorized clinicians from different health care organizations to share information on a common patient. Personal Health Records (PHRs) rely on patients to control their own data, allowing them to both access and record events that are relevant to their

conditions [1,2]. From a technological point of view, PHRs are undergoing a rapid growth in the area of health information [3]. The risk of the limited adoption of PHRs by an individual may, however, be a problem [4]. PHRs are usually filled with medical terminologies, whereas patients need health knowledge that is useful and easier to understand [5]. Usability concerns and socio-cultural influences are also among barriers to the adoption and use of PHRs [6,7], in addition to privacy

* Corresponding author. Software Project Management research Team, ENSIAS, Mohammed V University in Rabat, Rabat, Morocco. Fax: +21253777230.

E-mail address: bachiri.mariam@gmail.com (M. Bachiri).

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and security issues, since sensitive data and vital information are stored in PHRs [8,9].

In 2010 there were already more than 250 million smartphones, and more than 5 billion people are expected to own one by 2025 [10]. Mobile phones are a particularly attractive avenue in regard to delivering health interventions [11], owing to their widespread adoption with increasingly powerful technical capabilities and people's attachment to their phones [12], since they take them almost everywhere [13]. We spend even more time with our phones than we do with our partners or even at our workplace [14]. Both physicians and patients are rapidly integrating application delivery channels such as Apple App store and Google Play store into clinical practice [15]. Mobile health applications are also targeting specific conditions that are common to many people and require extensive monitoring, such as diabetes [16]. PHRs for pregnancy are an interesting focus because of the heightened attention paid to health information by pregnant women. Pregnancy, as a health condition, lasts for a finite period of time of 40 to 41 weeks in the case of most normal pregnancies. Detecting problems in time is crucial if complications are to be prevented in this period of life [17]. Pregnancy monitoring is encouraged by obstetricians and gynecologists, which explains why there are already several PHRs for pregnancy monitoring for personal computers and as online services [18].

Previous studies have covered the evaluation and analysis of the functionalities of Web-based PHRs [19] and USB-based PHRs [20], in addition to the evaluation of the functionalities of mobile PHR (mPHRs) in general [21] or mPHRs for specific purposes such as blood donation [22]. The aim of this paper is to analyze the features and functionalities of mobile PHRs focused on pregnancy monitoring, in order to discover whether or not they comply with the needs, guidelines and scientific pregnancy literature in regard to tracking pregnancy. The results of this study can be used to identify possible lines for improvement in the near future. The study of the current status will be performed through the analysis of applications available for iPhone from the Apple App store and for Android devices from Google Play store.

2. Method

In order to carry out the review of the mPHRs for pregnancy monitoring, a method based on the popular SLR process was applied [23] (Fig. 1). In this paper, a set of recommendations obtained from PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analysis) [24] was followed. This method has been used in previous e-health studies, such as studies concerning blood donation [22,25] or diabetes [26], in addition to those regarding PHRs [19], mPHRs [27] or m-Health apps in general [28].

The first step of the method involves determining the research questions (RQ), which will guide the next phases. The second step consists of selecting the sources from which the candidate apps will be collected, and setting the terms and keywords used to fulfill the search in these sources. The aim of the third step is to define the eligibility criteria and apply them to the candidate apps in order to retrieve those eventually

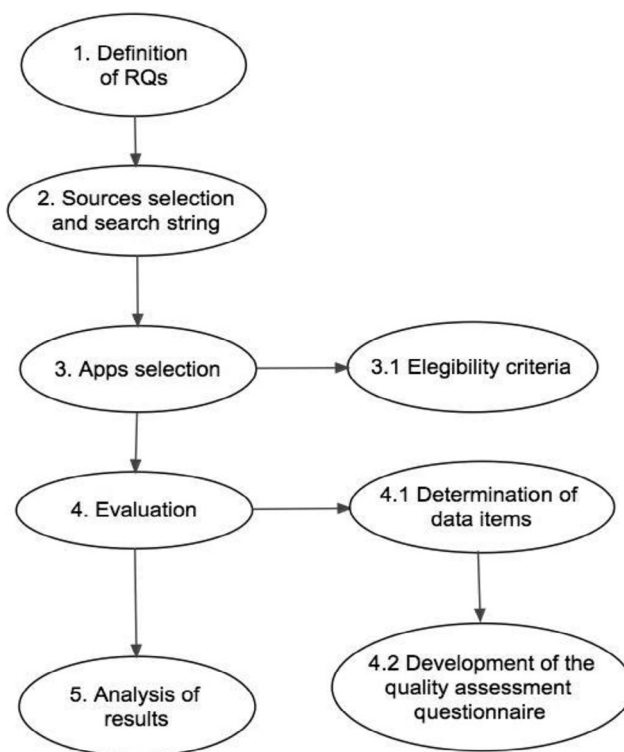


Fig. 1 – Description of the method used.

selected. Finally, in the fourth step, a group of data items that should be extracted from each application is defined, which will serve to develop a quality assessment questionnaire in order to evaluate the apps selected.

2.1. Research questions and protocol

As the first step of the method used, five research questions have been established by the authors for the purpose of analyzing the features and functionalities of mPHRs for pregnancy monitoring for both iOS and Android. The research questions have been formulated on the basis of the existing mobile applications for pregnancy monitoring on the market, in addition to an analysis of scientific literature concerning pregnancy, in order to study the relevant features and functionalities that this study will cover [29–31]. These research questions are detailed in Table 1.

2.2. Application sources and search terms

The search was based on two main sources: Apple App store and Google Play store. These repositories are currently the most relevant mobile application markets as regards the number of applications available for download (1.6 million apps in Google Play store and 1.5 million apps in Apple App store by July 2015 [32]). They also represent the official app sources for the leading iOS and Android platforms, respectively. Both stores classify applications in categories. The applications in the *Health & Fitness* and *Medical* categories were considered in this review.

The search string was determined by following the PICO criteria [33]: population, intervention, comparison and outcome,

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