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Toward a use case based classification of mobile health applications

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Abstract. Smartphones are growing in number and mobile health applications (apps) are becoming a commonly used way for improving the quality of health and healthcare delivery. Health related apps are mainly centralized in Medical and health&fitness categories in Google and Apple app stores. However, these apps are not easily accessible by the users. We decided to develop a system facilitating the access to these apps, to increase their visibility and usability. Various use cases for 567 health related apps in French were identified and listed incrementally. UML modeling was then used to represent these use cases and their relationships with each other and with the potential users of these apps. Thirty one different use cases were found that were then regrouped into six major categories: consulting medical information references, communicating and/or sharing the information, fulfilling a contextual need, educational tools, managing professional activities, health related management. A classification of this type would highlight the real purpose and functionalities of these apps and offers the user to search for the right app rapidly and to find it in a non-ambiguous context.

Keywords. Mobile Applications, Telemedicine, Classification, Computer Models, Cellular Phone

1. Introduction

Mobile health (m-health) is a developing field that can play a significant role to improve healthcare quality and efficiency. Mobile health applications (apps) running on smartphones and tablet computers are growing rapidly. These applications provide healthcare professionals and the general public including patients with specialized tools, processes, and communication means [1–3] to support electronic healthcare practice and to improve the quality of health among the general public. A large number of routine medical tasks including access to clinical reference, drug dose calculation, consulting medical records, and clinical decision support system is provided, with unprecedented ease, by medical applications designed for professional healthcare staffs [4–7]. The general public including patients would also benefit from m-health technology across a variety of health related services provided by apps designed for them [8–11]. These applications provide the right information where and when people need it.

M-health apps are a recent phenomenon, but their number is exploding and there is no signs of letting up. A large number of m-health apps exist on the markets today with

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a variety of functionalities from simple text message reminders to sophisticated management of diseases.

Google play and Apple's app store are centralized app stores provided by Google and Apple. These app stores constitute the number one marketplace for Android and iOS systems in terms of usage volume and number of apps available. Applications are distributed in various categories in these stores according to their functionality. All medical and health related applications are gathered in two categories: Medical and health & fitness. With the growing number of applications, it will be difficult for the user to search the appropriate health app according to his/her needs. There is a search engine to find the apps by entering keywords in the app stores but the keywords are not able to determine the various existing use cases for these applications. We hypothesized that the contents of these application stores might be used more effectively if a more rigorous classification of health related apps was developed to facilitate access of users to the right application. French language mobile health related apps are gathered on our website available at www.dmdpost.com from Google play store and Apple iOS app store. They are categorized by their target users (health professionals or the general public). We thought that this number of m-health apps could be used as a starting point to find various use cases existing in health related apps.

The main aim of this study was therefore to develop and evaluate a new classification of the health related applications, based on a model derived from an analysis of their use cases.

2. Materials and Methods

2.1. Materials

There are 896 French language mobile health applications, gathered on the dmdpost website (from Google and Apple stores). These applications constitute the material for this study. These applications are divided into two categories according to their target user: health professionals and the general public. Among 896 apps, a certain number are present in the two markets with the same name and functionalities. After the verification, we identified 567 non-redundant apps of which 218 apps were designed for healthcare professionals and 352 apps were addressed to the general public. Three applications were designed for both healthcare professionals and the general public.

2.2. Modelling

In order to identify the various functionalities contained in these health related apps, we first randomly assigned each category to two groups. The first group, the study group, containing 517 apps (193 apps for healthcare professionals and 324 apps for the general public), was used to explore the various use cases and structure a model. The remaining apps, the validation group, (25 apps in each category) were used to validate the model obtained.

In a first phase, a team of medical doctors and IT professionals, specialized in mobile health apps, listed all various use cases for each app in the study group. Whenever a use case did not match a type already encountered, a new use was added to the list. The use cases found in each app were therefore listed incrementally, as they were discovered. A weekly meeting was set up to discuss the discordant use cases

found by different individuals and reach a consensus. Unified Modeling Language (UML) was used to model the categories of use cases. In a second phase, once the model had been developed, two medical doctors working in medical informatics validated the model with the 50 remaining apps of the validation group. The two medical doctors did not participate in the development of the model. They were asked to extract the various use cases of the 50 validation group apps and instantiate each use case in the model. If the evaluators were unable to match a use case with a use case in the model, they had to report a "new use case".

3. Results

Our analysis showed that the needs that may lead to the consultation of an app are very heterogeneous. In total, 31 different use cases were found in all 517 apps from the study group. Some apps were multifunctional and included various use cases, whereas others were specific to only one use case. Potential users of the applications are: health professionals (physicians, nurses, midwives, etc.), the general public including patients and healthy individuals, and health institutions (hospitals, insurance companies, drug stores, etc.).

All the use cases found in these apps and the related users are represented in our UML model in figure 1. The UML graphical representation of a binary association is a simple line between the user and the use case. For example, a physician uses a decision support system app or a patient uses a treatment reminder app. The graphical representation of a "generalization" is a hollow triangle shape on the superclass end and indicates that one of the two related use cases (the subclass) is considered to be a specialized form of the other one. For example, "consulting guidelines" is a specialized form of "consulting medical information references".

These use cases were regrouped into six major categories: consulting medical information references (for example, medical text books, health news, guidelines, etc.), communicating and/or sharing the information (for example, asking a question from a physician via the application in a forum, or an app that provide a multidisciplinary consultation platform for physicians, etc.), fulfilling a contextual need (for example, using the mobile device as a diagnostic tool, a reminder in a decision support system, etc.), educational tools (for example, serious gaming, sample educational questions, etc.), managing professional activities (for example, searching for job offers, practice fee calculator, etc.), health related management (for example, managing the drug stock, locate a nearby health service, etc.).

This model was developed from 517 apps of the study group and was validated on the 50 remaining apps. The validation showed that the model was able to represent all the use cases contained in the remaining 50 apps with no "new use case" reported.

4. Discussion

The smartphone is one of the fastest growing sectors in the technology industry, and its impact in medicine has already been significant [7]. The adherence to health related applications should lead to improve the quality of life and healthcare. However, if this technology is to be useful, the user must be able to search for the necessary app rapidly and to find it in a non-ambiguous context. In this study, we proposed a model

for structuring the classification of health related applications based on their uses cases. A quick glance at the use cases provides the user with a concise overview of the

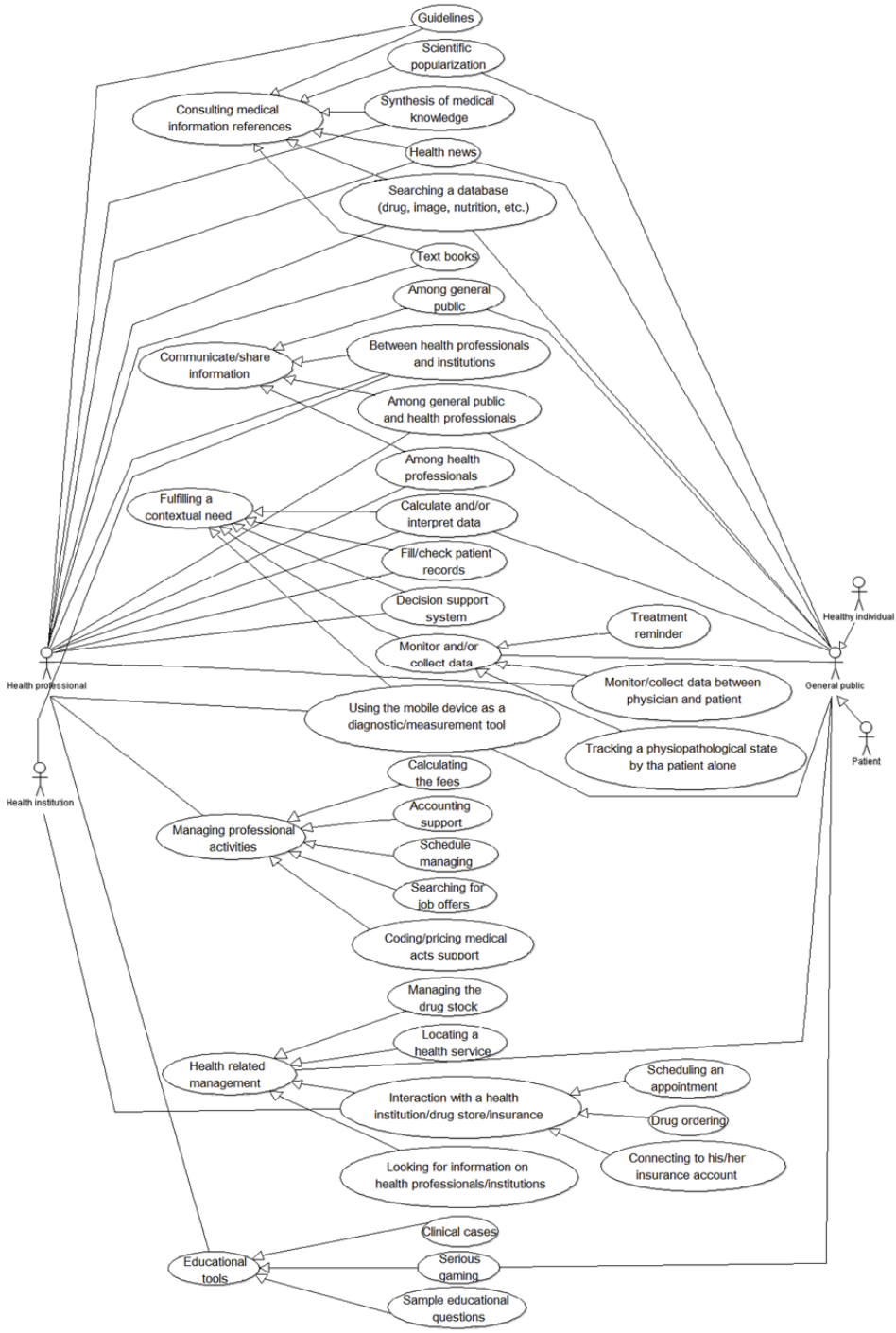

Figure 1. UML diagram describing the organization of various use cases found in health related apps

contents of the categorized apps.

The model was validated by the two medical doctors working on medical informatics, who were independent from the model developers. This independence could reduce the risk of a potential bias. However, further evaluation of the model by other users with a greater number of apps is required to confirm its generic nature.

We used a bottom-up approach to identify the various use cases existing in the mobile health applications. This classification may therefore change over time if new uses cases appear in the future.

5. Conclusion

Since there are only two categories for health related applications in the app stores, a classification based on the use cases would highlight the real purpose and functionalities of French language apps for the users. App providers will create more visibility for their apps if they publish their apps in dedicated stores with associated model-based information. A model of this type can pave the way to some other possible applications for improving the quality of mobile health. For example, it offers a greater visibility to some specific apps. Future work to derive statistics from this classification would help the application editors and developers to find the thematic in which there is a need to work and create new and useful applications.

A quantitative evaluation of the impact of this classification in terms of the user satisfaction by creating an interface based on this model would be of considerable interest.

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