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Designing a Patient-Centered Notification System into a PHR

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Abstract. Personal health records could help patients overcome the anxiety related to gaps on health related information. The objective of this research was to explore what type of information was perceived by patients as useful to receive as a notification on their PHR as a framework for the design of a patient-centered notification system. We applied a qualitative approach followed by usability tests. From interviews to patients, we obtained main categories of notifications to include according to its perceived usefulness while, from iterative usability tests, we obtained a final version of prototypes developed according to patient-interface interaction experiences. This research helped us to understand patients needs and behavior to design an efficient notification system and also represents the first step for the development of clinical decision support systems for patients into the PHR with the potential to improve clinical outcomes and healthcare delivery.

Keywords. Personal Health Records, Software Design, Patient preferences

1. Introduction

At present, patients are increasingly demanding information and effective communication in order to understand the background in which healthcare is taking place [1, 2]. In this context, personal health records (PHR) are tools developed to meet these needs [1,3], helping patients to overcome the anxiety related to gaps on health information [4]. Besides, PHR contributes to the interaction of patients and families with healthcare systems, facilitating a shared decision-making process and empowerment [5, 6].

As highlighted by Johnson et. al. [7], patients usually appreciate receiving test results notifications at the appropriate time, the availability of a direct communication channel with providers, and any tool that could facilitate healthcare management. Delays related to these needs might lead to increased anxiety generated by lack of information.

The objective of this research is to explore what type of information is perceived by patients as useful to receive as a notification or reminder on their PHR. The latter, as a framework for the design of a notification system applying user-centered design techniques, to ensure information availability at the appropriate time.

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2. Methods

Hospital Italiano de Buenos Aires (HIBA) is an academic non-profit tertiary level organization that covers all health specialities at different levels of the care system. Since 1998, HIBA has his own health information system (in-house) [8]. An integrated PHR is available since 2007. Its main functionalities include: appointment scheduling, test results visualization, patient-physician secure messaging, management of prescribed medication, and different modalities of teleconsultation. At present, our PHR has approximately 400,000 registered users [9].

We conducted a mixed-methods research divided into 2 stages. On the first stage, we performed semi-structured individual interviews with patients to explore what type of information they found useful to receive as a notification or reminder into their PHR, as well as the preferred means to receive it. Once the data had been collected, we defined notifications categories determining the system functionalities that would support them and finally, we designed prototypes of the different interfaces.

At the second stage we applied a user-centered interaction approach to adjust prototypes design and usability. This approach gave as a clear input on how patients used the system. The interaction of users with prototypes was suitable to detect usability problems. Test participants were asked to read aloud 4 tasks related to notification functionalities and tried to solve them. At the same time, they were requested to describe the actions they were performing, expressing their thoughts as regards the interaction with interfaces. These tests included 3 participants: the user, the facilitator, and the observer.

Both, interviews and usability tests, were performed on a convenience sample of adult outpatients on different hospital waiting areas and dates. Both were recorded previous oral informed consent. The data was kept anonymous, protecting confidentiality of participants. In what concerns to data-analysis, we proceeded to analyze the previously recorded audios and categorize the information in domains according to the main findings. Data collection and data analysis were initiated simultaneously. The analytic process was performed through codification and categorization of the information, based on a process of constant comparison. The categories were defined taking into account both the research main questions and the findings that emerged from the interviews [10].

To analyze usability tests, we classified users' problems to fulfill the given tasks using a severity 3 point scale (critical, serious and minor), and we complemented this information with participants' suggestions.

3. Results

15 interviews were conducted on patients (table 1). 80% were female and age range was from 31 to 78 years old. 100% of participants were PHR users.

Table 1 - Patients characteristics

	n: 15
Female	12 (80%)
Age	
31-50	4 (26,7%)
51-70	9 (60%)
+70	2 (13,3%)
PHR users	15 (100%)

When participants were asked about those subjects/information they considered as useful to be notified of, 5 main categories emerged:

3.1 Appointment scheduling management

Patients explained that they found suitable to be notified about their closest medical appointments and any changes on them in advance. They considered this remainder will facilitate their own time management according to health visits.

3.2 Medication management

Interviewees considered as valuable to receive notifications whenever they need to request their physician for a prescription update before it expires. Besides they expressed the need of a tracking system, with notifications, for home delivery of medication.

3.3 Test results management

Participants mentioned as useful to receive notifications whenever test results were informed and available to read into the PHR. Also, they highlighted as an advantage, to be notified when a complementary study order was close to expire.

3.4 Administrative processes

Users expressed they would appreciate being notified on different administrative procedures needed to receive medical care, such as bill payment information and help desk answers upon their requests for support, among others.

3.5 Hospital Information

Hospital news and activities were other topic in which a notification process was found useful. Another type of information included institutional changes or system

downtimes. As regards the mean by which they preferred to be notified, we didn't find consensus in favor of a unique mean of notification. Some participants chose the email, while others preferred push notifications on their mobile PHR. Besides, they suggested that the mean of notification could vary according to the type of notification.

With the information collected from patients inquiries we defined notification categories. For the notification system design, we opted for a fully customizable feature, meaning each user can configure what notification to turn on or off, upon their preferences along with the preferred mean to receive them (email, push notification or mobile PHR).

Departing from designed prototypes, we conducted 3 iterations of usability tests with final users of different ages and technological literacy levels. Each iteration cycle resulted in prototypes modifications to overcome usability problems detected until reaching a final proposal. Each testing cycle was carried out with different users. 6 patients participated in the first set of usability tests and, its results, evidenced the presence of 3 degrees of usability problems: critical, serious and minors. After some adjustments that emerged from the analysis of these results, we performed a second iteration with the participation of 8 final users. Analysis of results showed that minor problems were still present. With this in mind, we completed another set of prototype adjustments that were tested, in a third iteration, with 8 patients. After this cycle no usability problems were detected and thus, we arrived to a final version of prototypes.

4. Discussion

Results obtained from this research allowed us to design a patient-centered notification system into our PHR. From interviews with patients, we obtained 5 main categories of notifications to include in the system according to its perceived usefulness. Besides, performing iterations of usability tests to patients, we obtained a final version of prototypes developed according to patient-interface interaction experiences.

Usability evaluation and user experience are key points for design and development of PHR functionalities [11,12,13]. In line with this fact, the results of our research, contributed to a better PHR user experience. Final versions represent an efficient design adjusted to user' needs.

The development of this functionality for the PHR, might enhance patient empowerment by displaying suitable information in time, optimizing the management of health-related aspects and decision making. A notification system gives patients the option to choose what to receive and when, acting according to the delivered information. PHRs could send notifications and reminders and contribute to a better healthcare without generating alerts fatigue [14]. In concordance with our findings as regards preferred functionalities to be notified, the implementation of a notification system for test results avoids important results to be overlooked [15].

We also arrived to similar conclusions concerning means of notification, that is, the preferred mean depends on the type of notification [15]. Furthermore, evidence suggests that message or notification systems to patients can improve outcomes such as infant vaccination coverage by sending reminders to patients [16] and increase smoking cessation rates [17]. This research also represents the first step for future research for the development of clinical decision support systems for patients into the

PHR. These tools might contribute to the shared-decision model with the potential to improve clinical outcomes and healthcare delivery.

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