

Online Pharmaceutical Care Provision: Full-Implementation of an eHealth Service Using Design Science Research

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Abstract. Chronic diseases are pressing health systems to introduce reforms, focused on primary care and multidisciplinary models. Community pharmacists have developed a new role, addressing pharmaceutical care and services. Information systems and technologies (IST) will have an important role in shaping future healthcare provision. However, the best way to design and implement an IST for pharmaceutical service provision is still an open research question. In this paper, we present a possible strategy based on the use of Design Science Research Methodology (DSRM). The application of the DSRM six stages is described, from the definition and characterization of the problem to the evaluation of the artefact.

Keywords. eHealth, Implementation, Healthcare services, Design Science Research Methodology, Pharmaceutical services

Introduction

Chronic diseases are the main cause of mortality throughout Europe.[1] The increasing prevalence of chronic diseases is leading to the necessity of health system reforms, with multidisciplinary teams as models of these movements.[2] Among these models is the Chronic Care Model (CCM),[3] that aims to transform the daily care of patients with chronic illnesses, with major roles for non-physicians, such as community pharmacists (CP) and nurses.[4]

Good communication is essential in the CCM. Information systems and technologies (IST) are a necessity to support patient care services in future health systems.[5] Most difficulties in IST implementation seem to be frequently attributed to managerial and behavioral factors.[6] IST development to support a healthcare service needs a user centered approach to be certain that the system will satisfy user's needs.[7]

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Pharmacy practices have long ago started to shift its focus from a disease oriented to a patient oriented practice.[8] There is a need for IT support, in developing an extended role for CP to include the interaction with patients.[9] Gregório & Lapão,[10] explored different scenarios for the future of community pharmacists, with eHealth emerging as one innovation that may develop in next years to harvest this potential. To test this hypothesis, we aim at designing, implement and evaluate a disease management web-based interactive service, within a community pharmacy setting, using design science research methodologies (DSRM).[11]

The paper is divided in 3 sections. First, in the methods section we highlight the different methods used through this work. After, the results section is divided in 5 subsections, reflecting the activities that support DSRM, where we present the main results. The paper then closes with a conclusion with our final remarks.

1. Methods

Hevner et al.,[12] have established the rules for DSRM in the form of guidelines. These guidelines enlist six activities, each with a specific set of tasks (table 1).

To assess the current state of pharmaceutical services provision and use of IT in community pharmacy (activity 1), we started by launching an online survey followed by a observational time-and-motion study.[13] The online survey was designed in the Google® forms platform and sent via email to 323 pharmacies. For the observational study, a set of four pharmacies was selected by convenience to study the patterns of pharmaceutical services provision. A list of tasks to be observed was developed after reviewing the literature on pharmacy workload studies.[14]

Table 1 - Design Science Research activities and tasks to perform

DSRM Activity	Method/Tasks
1. Diagnose of current situation and identification of problem relevance	Online survey and observational time-and-motion study, using the shadowing method
2. Defining the objectives for a solution	Set of qualitative interviews performed within primary health centers and hospitals
3. Design and development	Design of artefact (online platform) for pharmaceutical care services provision
4. Demonstration	Case-study to test de platform in two settings with a purposively selected group of patients
5. Evaluation	With an eye-tracking glass, the usability of the current version of the platform as assessed through the use of "task scenarios"
6. Communication	Done throughout the duration of the project, through journal or conference papers such as this.

For activity 2, the objective was to identify pharmaceutical service needs. A set of 50 qualitative interviews were performed within primary healthcare centers and hospitals. For the demonstration (act.4), a group of patients aged 64 to 75 years with chronic diseases were purposively selected. The platform was tested in two different settings: a) Three CP within a community pharmacy using the platform and face-to-face consultations to interact with patients (Pharmacists P); b) A CP using the platform, and scheduled meetings, interacted with patients without dispensing medicines (Pharmacist C). Patients were recruited during the first two months of the study. Initial training was given both to pharmacists and patients. The evaluation (act.5) occurred after 8 months of study. The objective was to assess the usability of the web platform and to identify non-existing features to improve design of the prototype for the new

service. It included testing both end users of the platform, to assess the usability of the current version of the platform. An eye-tracking glass was used to perform the study. A set of scenarios was defined, differing only in what was asked to be performed by pharmacists and patients (table 2).

Table 2 - Scenarios developed for the testing of ePharmaCare platform

Pharmacists scenarios	Patients scenarios
<u>Scenario I</u> - Enter the ePharmaCare platform with your username and password. Look for the date of the next visit to your user XXX.	<u>Scenario I</u> - Enter the ePharmaCare platform with your username and password. Seek new messages.
<u>Scenario II</u> - Add a new medicine for the user XXX: Ben-u-ron 500mg, 20 tablets; take one tablet after breakfast and one after dinner. Set the end date of package.	<u>Scenario II</u> - Add the value of fasting glucose of 182 mg/dL.
<u>Scenario III</u> - Send a message to the user XXX: TEST.	<u>Scenario III</u> - Add the blood pressure value 135/85 mm/Hg.
<u>Scenario IV</u> - Add the value of postprandial glucose of 182 mg / dL for the user XXX.	<u>Scenario IV</u> - Add the height and weight values.
<u>Scenario V</u> - Find the last blood pressure to the user XXX.	<u>Scenario V</u> - Find the last blood pressure value.
<u>Scenario VI</u> - Arrange a visit for the user YYY for the day 07/20/2014, 10:00 am.	<u>Scenario VI</u> - Add a new medicine to the user profile: Ben-u-ron 1000mg, 18 tablets; take one tablet after breakfast and one after dinner.
<u>Scenario VII</u> - Verify the value of total cholesterol to user XXX.	<u>Scenario VII</u> - Verify your next appointment with the Pharmacist.
<u>Scenario VIII</u> - Verify that the user forum has calculated BMI.	<u>Scenario VIII</u> - Send a message "TEST" to the CP.
	<u>Scenario IX</u> - Find the end date for the package of Ben-u-ron.
	<u>Scenario X</u> - You have been taking two cups of green tea daily, add this information to your profile.

2. Results

2.1. Problem identification

The online survey had a low response rate (4.76%, comparable with similar surveys). In these pharmacies the average number of computers was 5 (min: 2; max: 10), in a ratio of 2.5 computer per pharmacy; the main use of the IST is for dispensing medicines and administrative tasks (stock management, reimbursement activities); 23% of the pharmacies have an Internet site and 38% have a site in some social network (e.g: Facebook®). Also, all pharmacies claimed to check their email daily, although only 15% used it to answer to patients' queries, and do so less than 5 times a month.

The observational study took place during a weekday's full 8 hours shift. In total, 16 pharmacists were observed. Eighty five percent of the tasks were performed by pharmacists, corresponding to 65% of the total recorded time. Among the tasks, between 77% and 85% had some sort of medicine dispensed. In this study it was found that pharmacists have about 40 minutes of free or idle time.

2.2. Objectives for a solution

To identify the service needs a set of 50 qualitative interviews were performed within health centers and hospitals, to understand customer's service perception. The

interviews involved 24 males and 26 females (mean age of 44.4 years) who reported using community pharmacy services. 46% of the interviewees admitted that they sought healthcare provision with the CP for minor issues before going to a GP. About new service concepts, the home delivery was the most referred service. There was a broad wish for a better CP follow-up and integration between the pharmacy and the NHS.

2.3. Proposal

From the insights on the demand of pharmaceutical services the DSRM objectives were set: to design a disease management web-based platform to support pharmaceutical care services provision for chronic patients, allowing therapeutic monitoring by CP and offering patients the ability to self-manage their disease and therapeutics. The design of the web-based pharmaceutical service followed the second consensus of Granada as the protocol of interaction with patients.[15]

2.4. Demonstration

Pharmacists P1, P2 and P3 recruited 2 chronic patients each and none used the platform more than one time, the recruitment moment. When CP “P” were asked about the main reasons related with recruitment’s difficulty they argued that they were too busy attending at the pharmacy. Also, they anticipated non-compliance with this type of intervention by their usual chronic patients, leading them to under-recruit.

CP “C” recruited 10 patients, but only 5 stayed in the study during the eight months. For this CP, the information exchange between patients and CP was related to questions of medications’ changes, self-administration or self-medication. We found that the registration, monitoring and storage of biochemical and physiological data, recorded by the CP and the patient in the platform, contributed to a common interest that may allow an improvement in patient’s health outcomes. To maintain patient’s motivation to use the platform in a regular basis, we found that regular meetings or consultations have to be performed.

2.5. Evaluation

Considering the CP’s scenarios, we found that a CP took an average 7:38 minutes to perform the scenarios. This is an important finding, since it fits in the idle time of CP. There is indeed potential time to use the platform to perform patient follow-up if the pharmacists overcome their self-imposed barriers to patient recruitment.

For patients, the time to perform a scenario is not significant since they can use the platform whenever they wanted it. The main evaluation results were:

- A dashboard is needed on the front page to simplify the access to information. This was felt by both users. The font size was found to be too small for patients, and not suitable for the screen resolution of pharmacies’ information system.
- Patient’s main request was to have a text box where to add information about non-conventional therapy, and the possibility to edit information previously inputted. Patient’s also asked for messages to alert them for therapy ending, to screening values out of the ordinary or above the established objectives.
- Among CP, we found some confusion amid sending a message and scheduling a visit (which also allows sending a message). The message

system needs further improvements, to allow the sending and receiving of attached files.

3. Conclusion

DSRM helps in implementing eHealth services through a higher involvement of the stakeholders. It is clear that there are already benefits to chronic patients by using the platform to be more connected with the CP. The quality and usability of the web-based platform is critical. But the web platform is not everything. To develop eHealth services it takes properly trained and motivated professionals. The eHealth services also needs to be more integrated in the current daily business and some communication and marketing efforts needs to be done to recruit and demonstrate value to the chronic patients.

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