MediTake, a Medication App to Improve Adherence – a Service Design Evaluation

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Abstract. Medication is one of the most important factors for preventing, treating, or revealing the impact of illness and disease. Medication non-adherence is a challenge because it reduces the effectiveness of treatment and imposes significant resources on the healthcare system and society as a whole. Studies show that up to 50% of people with chronic illnesses do not take their medications as prescribed. MediTake application was developed to support people in their medication management, as a means to increase self-management and medication adherence. The aim of this study was to implement and evaluate a suggested pharmaceutical service, where the MediTake app had a central role, to support patients' medication adherence and self-management. We here report on the professionals' perspectives from the service design evaluation.

1 Introduction

Medication is one of the most important factors for preventing, treating and revealing the impact of illness and disease. The management of medications depends on several factors such as correct diagnosis, correct treatment, implementation of measures, and on the patients' adherence to medications prescribed. Many people do not take their medications as prescribed; this is particularly prevalent among people suffering from chronic diseases and among people that use multiple concomitant medications[1-3]. Studies show that up to 50% of all people suffering from chronic diseases do not take their medications as prescribed [1, 2].

Adherence is by the International Society for Pharmacoeconomics and Outcome Research defined as "the extent to which a patient acts in accordance with the prescribed interval, and dose of a dosing regimen" [4]. The cause of medication non-adherence is broadly categorized as intentional or unintentional [5, 6]. The latter involves that the patient intents to take a medication as instructed but fail doing so because of reasons such as forgetfulness, carelessness, misunderstandings etc. Patient characteristics, treatment factors, and patient-provider issues influence such non-adherence. Intended non-adherence involves that the patient stops taking a medication as instructed due to perceptions, feelings, or beliefs. Such non-adherence reflects a rational decision-making process where the treatment benefits are weighed against any adverse treatment effects [5]. Successful management of chronic disease is highly

dependent on the individual patients abilities to take responsibility for own care and treatment. The integration of mobile phones into our lives creates new opportunities to enhance self-management activities through features such as reminders, informational and motivational messaging, and, provides possibilities for self-monitoring of symptoms and behaviors (e.g. adherence to medications) [7].

It is estimated that 10% of all hospital admissions are because of reduced adherence, in worst case leading to illness and death [3]. The impacts of poor adherence to medication regimens are severe, both for the individual as in worsening of disease and death, and for the society as a whole because of health care costs and societal expenses. Physicians' ability to recognize patients' non-adherence has been poor, and interventions to improve adherence have been substantially complex, costly, and with mixed results [2]. In short-term drug treatments, studies show that counseling, written information and personal phone calls help [8]. For long-term treatments, no simple intervention lead to improvements in health outcomes, and only some of the more complex interventions are shown to have impact [8]. Therefore, the need to explore approaches for improved service delivery and creating support tools for those with long-term treatments are therefore still important. The two main objectives of the hospital pharmacy enterprise in Norway are: (1) to provide pharmaceutical services to ensure the correct use of medicine, and, (2) to ensure the reliable and cost efficient distribution of medicine [9].

As part of this research study, a proposed pharmaceutical service model "app @ the pharmacy" was implemented into the hospital pharmacies in Central Norway. The service involved that pharmacist promoted correct use of medication by introducing a medication app, as a means that the patients could use in their daily life to improve self-management and medication adherence. The objective of the current study was to evaluate the suggested pharmaceutical service. We here report on the pharmacists' perspective. The patients' experiences are reported elsewhere.

2 Methods

The study was conducted 2014 – 2015. Norwegian Social Service Data Services (NSD) approved the project. All participants provided informed consent when participating in the study.

2.1 MediTake Medication App

The MediTake app was developed by Pierre Major in cooperation with the hospital pharmacy trust and NTNU Technology Transfer. The app was programmed in Android Native Development Kit, and was available for Android phones through Google play at the time of the study.

The features of the app included:
- The patient's medication list (had to be registered manually)
- Reminders (about when to take the medication: pop-ups with sound)
- Self-monitoring (statistics adherence rate: medications taken)

- Information about medications (hyperlink to felleskatalogen which delivers patient information about medications)
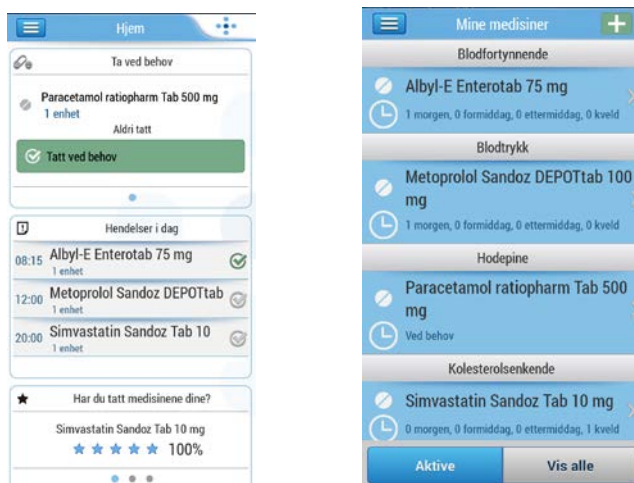

Fig. 1: Two Screen Captions from MediTake Medication App

2.2 The Pharmaceutical Service

The pharmaceutical service, "App @ the pharmacy", was implemented at the 6 hospital pharmacies in the Mid-Region of Norway. The service was implemented into the regular daily work at the pharmacies without extra incentives, and involved that pharmacists requested and offered the service to patients. Patients' inclusion criteria to receive the service were: (1) age above 16 years, (2) have an Android smartphone, (3) manage own medications, (4) use medications for more than three weeks (long-term use), and (5) provide an informed consent.

The service involved that the pharmacists taught the customer about the app and provided patient information about the customers' medications. To get access the app, it had to be downloaded from Google play to the patients' phone. The pharmacists were instructed to facilitate the customer and provide a short introduction about the app, before registering some of the patients' medication so that the patients' could complete the list by their own, and, thereafter use the app in their home environment. The pharmacists were instructed to call the patients' by phone after a couple of weeks, to follow-up the patients and provide support if necessary.

2.3 Data collection

Throughout the project period, 18 pharmacists provided the service. Data collection involved 4 semi-structured group interviews with 13 (9 women & 4 men) of the pharmacists who had provided the service. Both authors conducted most of the group interviews together, except from the last interview, which was conducted by the first author alone due to practical reasons. In each interview, 3-4 professionals attended,

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and the participants represented 4 of the 6 involved pharmacies where the service was implemented.

During the group interviews, participatory design methods were applied, such as brainstorming sessions, storyboarding activities, presentation rounds, and plenary discussion. Each interview lasted 2-2,5 hours, was tape-recorded, transcribed verbatim, and analyzed inductively.

Fig. 2: Participant in group-interview creating a storyboard

3 Results

The participants reported on barriers and benefits of conducting the pharmaceutical service. Four major themes were identified: (1) user groups, (2) workflow integration, (3) usability, and (4) usefulness.

3.1 User groups

During the study period, the pharmacists provided the service to 77 patients but reported to have offered the service to significantly more people than included. The main reasons for customer rejection to the service were because of lack of experience or competence to enable the technology, that they did not have the required smartphone, or the time required to acquire the service. The fact that some customers had limited experience in using a smartphone became a challenge for the professionals, who used considerable recourses in teaching some customers basic features of using a smartphones, a task they considered to be beyond their responsibility:

> "Well, I don't think the challenge is merely the app. We are to access Google-play. Okay! It is all the other stuff. Not all patients are qualified, even though they have an Android phone, they aren't there. We partly used lots of resources in teaching them how to use a smartphone. And that isn't, I don't think that is our... then we could have let it be. I don't think it will be successful either" (male, pharmacist).

The pharmacists acted deliberate in whom they offered the service, and whom they avoided to request. Several reported that customers non-verbal language influenced whether they would introduce the service: "*it's something with their body language,*

they are like "can't I just get my pills and leave?" (male, pharmacists). Thus, some reported that it was easier to offer the service to the elderly, who they found to have time. In other instances, the pharmacists would purposely avoid to suggest the service to certain user groups whom they considered the service would to be an extra burden: *"I don't remember all the reasons, but for instance a couple with a chronic ill child, and those kind of customers, don't bear to consider asking them"(female, pharmacist).* The pharmacists reported that they had avoided customer groups whom they perceived to be vulnerable, such as cancer patients and patients in palliative care:

> *"I think it is so... I have avoided cancer patients, because I have felt that they have enough. Even though they use complex medications" (male, pharmacist).*

> *"Another group are those in palliative care. Come and get their last dose with strong opioids, then you don't start talking about this service... No, so there were actually quite many, I experienced, who were like that"(female, pharmacist).*

Another said that she wanted to protect the customer from an information overload: *"for those patients that already are frequently in the hospital and get a lot of information, it is something with not overloading them totally" (female, pharmacist).* On the other hand, the pharmacists reported that the inclusion criteria for receiving the service were too restricted because they considered that other user groups, in addition to those with long-term medication treatment, would benefit of getting the pharmaceutical service:

> *"User groups that would benefit of using the app would for instance be parents of small children, or customers that are to use antibiotics for a week, or ten days or so... [] I feel that some user groups are excluded. And some who I really would like to get hold of, like the orthopedic patients, would probably have been very positive, some of those who go for rehabilitation, right? [...] They use anticoagulant drugs and they use painkillers. It would be very practical to get a summary of how much painkillers they have been using."(male, pharmacist)*

Among other potential user groups they mentioned: (1) relatives that managed the medication for their children or parents, (2) users that needed to establish new dosing schedules, (3) users that needed time critical dosages (e.g. Parkinson's disease, people using painkillers), (4) for complex dosing schedules, (5) for people using time limited medication (antibiotics) – and particularly if several times a day, and, (6) for those who needed cognitive support/reminders to take medications.

3.2 Workflow integration

Most of the pharmacists in this study worked at the front desk in the public department of the pharmacy, while a few also worked in the hospital wards, conducting medication reconciliation and reviews. The success of the workflow integration depended on where the service had been carried out. Those who conducted it during their work in the hospital ward reported that the service became an integrated part of their already established work:

"And when I was in the ward, I didn't ask everyone, but I asked those who I during the interview identified had a problem, who didn't remember to take their medication […] So when you start talking to them, you find that they don't have a regular intake, or that they don't take it, that they forget it in the evening, or that they... so you reveal many of those kind of things during the conversation, and then I have asked if they would like this […] When I have been in the ward, I think it has been easier to introduce it in a way, when you have a conversation about their medications anyway" (female, pharmacist).

Providing the service in the public department involved more challenges with limited workflow integration. The service often fell behind due to other work tasks, resulting in that the pharmacists forgot to offer the service to their customers, as a female pharmacist explained: *"yes, I have just forgotten it"*. Another pharmacist reported: *"And it is to remember to offer the service, in general. I feel that I have to [prioritize] to have it in my head somewhere: That day, yes, okay, that day I will really do it."* Another expressed that he found it challenging to introduce the service to the customers: *"Sometimes I think it has been difficult to introduce MediTake in a good and informative way. But then, I have become better for each time I have done it."* This was a shared experience by several. Self-confidence about providing the service was connected with experience:

"Yes, I have asked everyone. Had to force myself to ask, though. Because, then I felt, it became a routine, yes, to get used to it. But in the beginning it was like "oh, no, don't want to get rejected"(female, pharmacist).

The main difficulties of conducting the service were related to limited time, resources, and infrastructures. Short of staff, heavy workload and limited time at the front desk and influenced if the pharmacists could prioritize conducting the service. Some reported that they preferred requesting the customer about the service, and making an appointment for the customer to come back to receive the service. Among the infrastructural challenges, Internet access was reported to be cumbersome and inconvenient, which made it a barrier because installing the app required Internet access to download it from Google play.

3.3 Usability

A structured usability evaluation was not within the scope of the current study, but usability issues concerning the app were identified as part of the project. The main usability issue that influenced the service delivery was the required time to register medications in the app, a task the pharmacists assisted the customers with. The participants reported that time to conduct this task depended on the customers' experience with smartphone and the number of medications prescribed:

"It takes enormous amount of time before they can register the one medication. And it is not intuitive, that you are supposed to go there, and there, and then I have to help them. It is not as integrated as for us younger... if it is a person with less technological experience and who has many medications, then it takes very long time. So it is a challenge (male, pharmacist).

This resulted in that the pharmacists tried to plan to have sufficient time to carry out the service, which again influenced the (dis) integration with their workflow.

3.4 Usefulness

The pharmacists reported about the usefulness of the service and app. They considered the app to be a good support tool that they could offer to their customers. Some experienced that the service involved increased direct patient contact that facilitated promotion of correct use of medication:

> *"They, I have taken them [patients] with me to the information room, right? And then they share more about their medications and their experience. And I became kind of surprised, because when we are at the front desk, then, I don't think people are that sharing. So, then I have like...there was this guy who said that he had impotence problems, and questioned the medications. And then I asked about when he had started to take his beta-blockers. And I said that he absolutely needed to discuss this with his doctors, and he was a bit...I felt that I was useful there. Those kind of things."(male, pharmacist)*

The participants talked about the convenience of providing the app to certain users, particularly younger users who needed a support tool to manage their medications:

> *"[…] in the conversation you discover that there are too many [medications to handle], and that they need help to remember to take their medication. And I feel that they get good help when you can offer them a support tool. And in the hospital ward... you have more time and you can offer something to those who feel too young to use a pillbox. Because, many are. You like, when you ask them: "do you use a pillbox?" many answer "no, no, no, no! I am not that old"" (female, pharmacist)*

The pharmacists reported that pillboxes could be perceived as stigmatizing. The app was not connected with stigma in the same way and was therefore considered to be a great benefit:

> *"First of all, I think it is very good, a good support tool, if you get hold of the right customers to recommend it to. And then I think, I feel that some customers become so offended if you offer them a pillbox. Because then I indirectly say that they are developing dementia. But you don't get the same problem when you start talking about the app. Then no one feels old and forgetful […] so here you can say the same, but a bit, in a more youthful way to say it. You don't get this, or, it is actually opposite." (female, pharmacist)*

4 Discussion

In this study we have identified benefits and barriers of conducting a pharmaceutical service concerning patient counseling involving introduction to a smartphone application to long-term medication users. The results show that such a service model has potential for various patient groups. From a professional point of view the

application offers an entry to a more profound conversation with the patients about their medications, and an approach to promote correct use of medications and self-management activities.

The pharmacists expressed that the application could be a support tool for patients in need of reminder aid, as well as to those that needed to establish new dosing schedules, and to patients that had complex dosing schedules. In this way the service model supports patients in the acquisition of skills and techniques to learn to manage a chronic disease. Such interventions might be effective as one of the foremost challenges in chronic disease management is the engagement in self-management activities of patients in their daily routines [7]. Depending on the type of non-adherence and patient characteristics, using a combination of tailored interventions such as patient education, patient self-monitoring and stimuli to take medications have the greatest potential for improving adherence [8, 10-12]. However, a number of barriers such as usability issues, lack of workflow integration and challenges with including users according to the inclusion criteria, influenced on how the service was carried out. Another hazard in the front-desk pharmacy setting was the fact that other customers were waiting for turn, and thus the pharmacist would not always prioritize the counseling service because it would lead to additional waiting time for the customers.

As part of this study the pharmacists collected patient questionnaires for quantitative data collection. This involved paperwork that had to be done together with the customer, but that would not have been part of a real service. This required additional time and might explain some of the challenges considering time to conduct the whole service. The situation in the hospital ward was different, and the pharmacist found it easier to carry out the service there, as demands about time-efficacy was not as prevalent there as at the front-desk. Conducting such patient education and counseling is in line with the hospitals' intention to conduct patient education and medication reconciliation at discharge.

4.1 Limitations and Implications

This study was limited to patients with long-term medication treatments. However, others such as relatives managing the medication for their children or parents, or people on short-time medication treatment (antibiotics), were mentioned as possible user groups. Of various reasons, the pharmacist found it difficult to implement the service as part of their normal workflow at the pharmacy. The introduction to the MediTake application was sometimes complicated and time-consuming due to limited technological knowledge among the users. This might certainly be a problem today, but considering the increasing number of people using smartphones and the technological development in this area, one can expect that such problems might diminish with time. The results of this study are limited to its qualitative approach, and the results can therefore not be generalized. The results might have been different if other participants, another setting, or other technology was studied. However, the findings show a number of implications relevant to similar service design projects. The usability issues, infrastructural, and workflow challenges identified in this study are aspects that need to be addressed for increased workflow integration in potential future projects.

5 Conclusion

The need to explore approaches to facilitate self-management and improved adherence is an important issue that becomes increasingly prevalent with the number of people suffering from chronic diseases and thus, who require medication treatment. The findings of this study show that a pharmaceutical service model involving patient counseling including introduction to a smartphone application has potential. However, there are a number of considerations that need to be undertaken when implementing such services in real life. The pharmacists reported a number of benefits of providing the service tool to their customers, but factors such as workflow integration, usability issues and user groups, influenced on how the service was carried out. Despite the limitations, adherence apps such as MediTake, represent a low-cost strategy that can be incorporated into a variety of healthcare services as means to promote self-care management and medication adherence.

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