
Opportunities to Support Medication Intake across Boundaries of Care

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Abstract

This paper depicts findings from a project focusing on designing medicine management support for non-clinical settings. In particular, we discuss how we can support older adults across boundaries of care in planning, informing, reminding and documenting activities. Additionally, we present opportunities when designing for everyday medication management. We use *MediFrame*, a tablet based app that supports older adults in their medicine intake at home and findings from its Participatory Design process to support our argumentation.

Author Keywords

Medication management, older adults, healthcare, self-care, home-based technology

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Human Factors; Design; Management

Introduction

Lack of adherence to prescribed medication exists in both clinical and private settings and burdens the economy in both developed and developing countries.

This challenges the general population and current healthcare systems around the world.

In a clinical setting, the administration and intake of medicine can be supported through mobile technology assisting nursing staff in their medicine administration routines [1]. Moreover, a prescribed medicine is measured, administered, ingested, evaluated and adjusted by healthcare professionals. Nursing notes have for example been used to support physicians to generate patient's medicine overview [2].

In a home setting, people are expected to engage in self-care activities such as self-diagnosis, self-management, self-medication and self-monitoring [3]. Self-management support can facilitate the move across boundaries (e.g. when an individual moves between the clinic (i.e. being a patient) and the home (being a citizen)) to defeat identified physical, psychological, cognitive, economic, social and cultural barriers in self-care [4]. Today people use diverse strategies to support their home-based medication regimen such as: reminders, tablet-holders, dosing aid, automatic dispensers, software applications, pill boxes (both 'normal' and those augmented with technology), and paper-based medication list [5]. However, different levels of illness and age-related symptoms challenge a successful intervention [6] and these aids might not be sufficient to sustain a successful home-based regimen.

In our project, we have been investigating older adults' requirements regarding medication management activities and how they can be supported in their daily medication intake at home. This is important as shown in a quantitative study with 316 participants, where 75% had a high need of medicine related information,

58% were actively looking for information, and 79% did something to remember the medication intake [5]. During fieldwork, we found that the lack of knowledge about medicines, forgetting the medication intake, complexity of medication regimen, taking medicine outside the home, lack of support for caregivers, and substitution of medicine are equally important challenges for older adults [5]. To support home-based medication management across care boundaries, a number of challenges and opportunities emerged through our project work and its user-studies.

Designing across Boundaries of Care

To explore challenges and opportunities in un-supervised medicine management we implemented MediFrame. It is a tablet-based App that aims to enhance individual's everyday medication management activities at home. It facilitates people to 1) plan their medicine intake according to their daily activities; 2) provide information about prescribed medication; 3) remind their medication intake; and 4) document and support communication between patient/citizen and their health professional. Indeed, MediFrame facilitates the transition between clinic and the home through its support to manage individual's medicine intake. We will now describe strategies used by MediFrame to bridge the gap between clinical and home settings in supporting older adult's medicine management.

Planning and reminding the medication intake at home

MediFrame aims to help individuals to plan their medication intake by combining information across boundaries. First, it uses data from the Shared Medication Record [7] to access people prescribed medicines- information generated in a clinical setting. Second, it uses data from people's scheduled activities

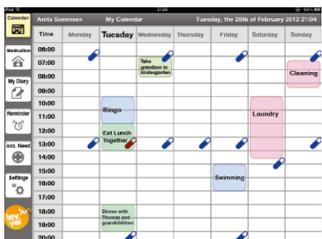


Figure 1. The Calendar Interface

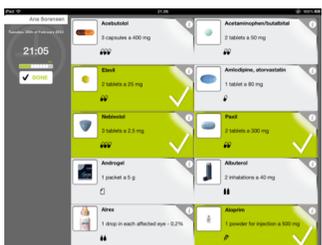


Figure 2. The Take Medicine Interface

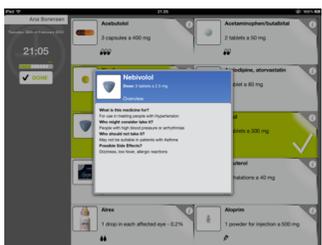


Figure 3. The More Information Interface

– information generated in the home setting. Figure 1 illustrates one view of MediFrame; a Calendar interface. It provides an overview of the medication intake combined with people’s scheduled activities. This mash-up allows citizens to plan and identify activity-medicine conflicts and hence move their medication intake (according to some given rules) to suit their everyday lives. In addition, specific reminders can be configured.

Documenting and Providing an overview and knowledge about medicine at home

MediFrame supports the communication between citizen and health professional by documenting people’s medication intake and providing knowledge about medicine. Figure 2 illustrates our “Take Medicine” interface that registers 1) the medication intake or 2) information why a user might have skipped a dose. This can inform a later dialogue with a healthcare professional. During our evaluations, medicine experts expressed the necessity of presenting additional information such as “do not crunch the pill” or “shake the bottle before use”. Therefore, MediFrame integrates a medicine information service that provides images of each commercially available medicine in Denmark and information such as a medicine’s effect and side effects, and when and how it should be taken (see Figure 3).

Based on our experience, we will now describe challenges and opportunities to support older adults medication intake activities across care boundaries

Challenges and Opportunities

Supporting the Shared Responsibility

Clinicians are in charge of defining a specific care plan based on their expertise and treatment goals. However, this care plan is sometimes given to patients without

discussing their consequences or without knowing what is happening outside the clinical setting. This can result in negative (see Figure 4a) or little (see Figure 4b) health improvement. Moving from a patient compliance to a medical adherence strategy evokes shared responsibility that requires an active participation from both settings. On the one side, health care providers should promote, motivate, encourage and follow up citizens according to mutual goals. On the other side, citizens should take responsibility to perform self-care activities and to report back to their health providers. This can result in moderate health outcomes (see Figure 4c). Lacking knowledge about a patient’s home and everyday life can challenge a successful treatment; Knowledge between consultations about what is happening in the home is necessary. A care plan can be improved gathering citizen’s expertise regarding the home context, obstacles, facilitators, implications and feelings. Technology should support this communication across care boundaries to promote and increase health provider’s awareness and knowledge about the home, with the aim to improve care outcomes (Figure 4d).

Simplicity is the key

Simplicity should be addressed from different perspectives: technical, physical, informative and contextually. Identified barriers of Personal Health Records systems such as privacy, security, accuracy and trust of data should be considering as important technical factors to avoid medical errors [8]. Understanding the home (e.g. noise, family, caregivers) and whether or not technology can fit into patients homes [9] are important physical factors. An informative issue regards the clinical expertise needed to interpret medicine data. Since citizens might not want or need too much medical information about their

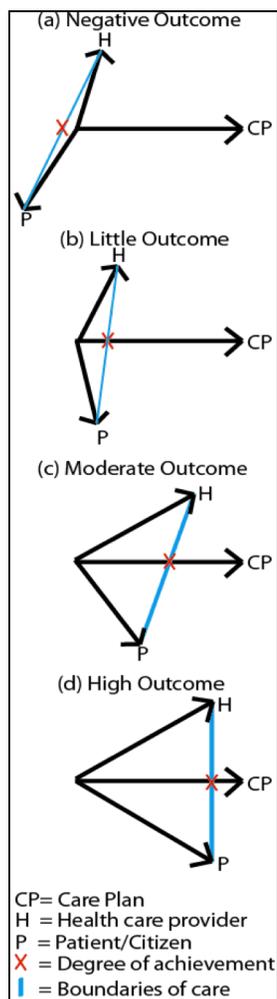


Figure 4. Possible Health Outcomes and degree of accomplishment

medicines, the visual representation and terminology are important to consider. Finally, understanding and getting information from a situated context is essential. This can provide a complete citizen's medicine overview considering what is happening at home in connection to a care plan involving all care actors. Supporting and giving communication channels between settings can avoid misinterpretations during the care plan.

From Medical Adherence to Integrated Adherence

The home it is not designed as a place for care and citizens might have different roles and activities at home compared with clinical settings [9]. Thus, it is important to support citizens to insert the medication activity into their daily routines and their available space at home. MediFrame aims to support this insertion considering a person's other everyday activities. Monitoring, planning and supporting a shared understanding of everyday activities at home are necessary to achieve a successful treatment.

Ecological Integration

During our fieldwork, some participants discussed the possibility of linking our tablet-based design to other devices within the artifact ecology of medication management. For example, the integration with an intelligent pillbox could automate the registration process when the pills have been taken from it. Designing for an ecological use can support medication management activities at home.

Conclusion

Our work with healthcare professionals, medicine experts, and older adults revealed the necessity to support older adults' medication intake in a holistic manner taking into account their daily activities and the

interplay between care boundaries. It is important to recognize the expertise, activities and level of control from both home and clinical settings [9]. An active participation and related information from both settings are needed to achieve a better health outcome (see Figure 4d) and enrich the citizen's medicine overview.

Acknowledgements

We thank all project participants and all older citizens involved in our project. The project is part of 'Lev Vel' and funded by The Danish Council for Technology and Innovation and The Capital Region of Denmark.

References

- [1] Pablllo, C., R. Soto, and J. Campos, *Mobile medication administration system: application and architecture*, in *Proc. of EATIS2008*, ACM. p. 1-4.
- [2] Vikkelso, S., *Subtle redistribution of work, attention and risks: Electronic patient records and organisational consequences*. *Scandinavian Journal of Information Systems*, 2005. 17(1): p. 3.
- [3] Rijken, M., et al., *Supporting self-management*. *Caring for people with chronic conditions*, 2008: p. 116.
- [4] Dang, T.T.N., *Helping patients with chronic conditions overcome barriers to self-care*. *Heart Failure*, 2011.
- [5] Verdezoto, N. and J. Wolff Olsen, *Personalized medication management: towards a design of individualized support for elderly citizens at home*, in *Proc. IHI 2012*, ACM. p. 813-818.
- [6] Siek, K.A., et al., *Designing a Personal Health Application for Older Adults to Manage Medications: A Comprehensive Case Study*. *Journal of Medical Systems*, 2011: p. 1-23.
- [7] NSI. *NIS: Video about FMK*. 2012; Available from: <http://www.nsi.dk/sitecore/content/Nsi/Eng/English/englishFMK.aspx>.
- [8] Liu, L.S., P.C. Shih, and G.R. Hayes. *Barriers to the adoption and use of personal health record systems*. 2011. Grönvall, E. and M. Kyng, *On participatory design of home-based healthcare*. *Cognition, Technology & Work*, 2012: p. 1-13.