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MEDICATION MANAGEMEMT FOR ELDERLY PEOPLE

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Abstract

Medication management is not only of relevance related to a specific therapy, but has also a high impact in every days life, especially for elderly people who are likely to be affected by major-polypharmacy. This often results in a low medication adherence, caused by low acceptance, low persistence, and low compliance. ICT based solutions can help to address the low compliance by reminding people and by recording the actual medication intake. In this paper we give a brief motivation for active medication management in the context of Ambient Assisted Living and present the results of a recently carried out study evaluating a personal drug reminder system. This study showed, that acceptance of such systems can be high, provided that usability and stability are high.

Keywords – eHealth, Ambient Assisted Living (AAL), Telemedicine, Medication Management, Near Field Communication (NFC)

1. Introduction

1. 1. Ambient Assisted Living

Ambient Assisted Living (AAL) includes technical systems and information and communication technology (ICT) to support elderly people and people with special needs in their daily routine. The main goals of AAL are to maintain and foster the autonomy of elderly people by supporting them through their environment and to increase safety in their lifestyle, therapy and home environment.

The necessity for AAL applications basically arises from the demographic change in industrialized countries where life expectancy rises and the birth rate declines. In 2020 the proportion of older people in Europe (EU15) will be 21% of the total population, which is almost doubled compared to 1960, where the elderly made up 11% of the total population. This situation requires innovative and cost-effective solutions to keep the health care expenditures within the bounds of economic possibility in the future [4, 6].

AAL initiatives and programs have already started in Europe and applications have already been developed to meet the demand in the future. Summarizing AAL applications include services, products and concepts to increase the quality of life, the wellbeing and the safety of elderly people

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in their daily lives. The major objectives of AAL are to achieve benefits for the individual (increasing safety & wellbeing), the economy (higher effectiveness of limited resources) and the society (better living standards) [4,7,9]. In more detail, the concept of AAL is understood as [9]:

- to extend the time people can live in their preferred environment by increasing their autonomy, self-confidence and mobility,
- to support maintaining health and functional capability of the elderly individuals,
- to promote a better and healthier lifestyle for individuals at risk,
- to enhance the security, to prevent social isolation and to support maintaining the multifunctional network around the individual,
- to support carers, families and care organisations,
- to increase the efficiency and productivity of used resources in the ageing societies.

The opportunities for applications in these fields are very expansive. For this reason AAL environments are structured in three levels: Hardware (sensing, wireless networks), Middleware (data capture, data safety, IT integration) and Services (biosignal processing, application-orientated processes, community services) [5].

One aspect, which can be allocated to "Services", is telemedicine. The treatment of chronic illnesses represents an important part in ensuring safety for elderly people. The so called "Closed Loop Healthcare" principle characterizes a telemedical approach, which enables treatment of a chronic ill patient in the right time through being able to look – for example - at the blood pressure curves regularly and being alarmed, if thresholds are exceeded [10].

Another aspect in the telemedical approach of AAL is medication management, which is supposed to simplify complex medication intake recommendations and avoid dangerous pharmacological interactions among different medications.

1. 2. Medication concordance in elderly people

Medication prescription is the most common healthcare intervention in industrialized countries. Especially elderly people (older than 65 year) have to take medicine regularly. 94% of older Swedes take at least one drug, either prescription or over-the-counter (OTC) [2]. Depending on the number of drugs, which have to be taken, minor (less than 4 drugs) and major (more than 4 drugs) polypharmacy can be distinguished [3]. Elderly people with multiple chronic conditions are most likely to be affected by major-polypharmacy [8].

The nomenclature concerning different aspects of medication adherence is unclear. Basically adherence is composed of:

- Acceptance: Not filing the prescription in the pharmacy is called non-acceptance
- Persistence: Not authorized stopping of medication intake is called non-persistence.
- Compliance: All other deviations of recommended medication intake are summarized by the notation non-compliance.

To not only accuse the patient with the word "non-compliance", today it is common to use the word "concordance", which implies that the health care provider and the patient communicate effectively to reach an understanding of all the factors related to the specific medication process [2, 3].

For elderly people taking medicine is a complex process that requires both cognitive and physical competences. The main processes to undergo are: Receiving the prescription with the correct dose, filing the prescription in the pharmacy, preparing the correct dose at home and administering the dose at the right time.

A Swedish study (n=492) examined the cognitive, visual and physical abilities related to the above mentioned processes when taking medicines in the elderly population. The results showed that 9.4% could not read the instructions on a medicine container and 14.6% had difficulty opening a plastic flip-top medicine bottle. The cognitive tests resulted in 30.7%, 47.4% and 20.1% errors. A combination of all tests revealed that 66.3% of the sample had at least one limitation of competences related to taking the medicine [2].

Other studies also prove that the main reason for non-concordance among elderly people is a lack of cognitive competences, i.e. forgetfulness [1, 3].

1. 3. Medication concordance increase through ICT

The approaches to support elderly people with taking their medicine and thus increasing the therapy compliance are of a wide variety both organizational and technical. Approaches include the use of specialized packaging such as blisters, medication reminder charts, pill counting techniques and pill-boxes and approaches for patient medication feedback or direct observation of therapy [1].

Since forgetfulness is the most common reason for non-concordance, the elderly have to be supported both technical and cognitive. The application of Information and Communication Technology (ICT) through a mobile phone in this context is reasonable for reminding the patient at the proper time to take the right medication. The feasibility of ICT support in medication management for elderly people was evaluated in the Personal Drug Reminder Evaluation study (PDR-Eval).

2. Methods

The project PDR-Eval [11] examined the acceptance of an ICT solution for supporting elderly people in their medication management. The hypothesis of the examination was that the application of a personal drug reminder eases the complexity of medication intake for elderly people and increases the accuracy of medication intake frequency.

The project applied a reminder system for medication intake – Personal Drug Reminder (PDR) – which was adapted to the needs of the elderly. Since mobile phones became a very flexible tool for various applications in recent years and mobile phones became increasingly popular with elderly people, they offer a good platform for personal ICT systems, like the PDR system. To increase the usability of the system, the so called KeepInTouch – KIT technology was used to record the actual medication intake. KIT uses technologies such as NFC (Near Field Communication) and RFID (Radio Frequency Identification) to access information from objects or symbols just by bringing them close together (i.e. “in touch”).

Figure 1: PDR-Eval mobile phone and ID card

Another aim of the project was to investigate the problems concerning medication management and the application of new technologies, e.g. NFC technology, for elderly people. In this context the following problem areas were identified, arising from the special needs of the target group. These problem areas built the background for the examination of acceptance and usability:

1. Prescription by the physician and information flow to the patient
2. Visual recognition of (small) fonts
3. Overview and orientation concerning dosage
4. Reminder of intake at the right time

The study was accomplished partly by qualitative methods of data acquisition and data analysis. Before the start and after the end of the evaluation personal structured interviews with the participants were carried out.

Prior to the planned evaluation an already existing test application was adapted for the special problem. The evaluation of the PDR system was carried out in two groups with 6 and 8 persons, respectively. The target group consisted of elderly people, older than 55 years. Each group was initially informed about the goals and the procedures of the project during a workshop or a personal conversation, if they could not attend the workshop.

For each person, up to four drugs were entered in the system together with the recommended dosage for morning / noon / evening and night in the initial workshop. At the same time the users were introduced to the handling of the mobile phones and obtained NFC based identification cards and tags (NFC tags), which contained tags about the actual dose taken (as prescribed / more / less) and wellbeing (good / ok / bad) (see *Figure 2*).

The participants were reminded via an acoustic signal at defined times of the day (9am, 1pm, 6pm and 10pm) to take the recommended drug and to record the dosage of the drugs actually taken. The start of the application and the login were carried out by touching the NFC ID card (*Figure 1*) with the mobile phone. The information about medication intake and wellbeing were captured by touching the symbols on the NFC symbol card with the mobile phone. One part of the group obtained bar type mobile phones and the other part clamshell style ones.

3. Results

The study included a total of 14 persons. The average age of the participants was 66,8 +/- 9.4 years. Altogether 603 data transmissions were carried out, which conforms to a compliance of 80 +/- 16 %. A significant correlation between age and transmission compliance could not be detected (correlation coefficient 0.0425).

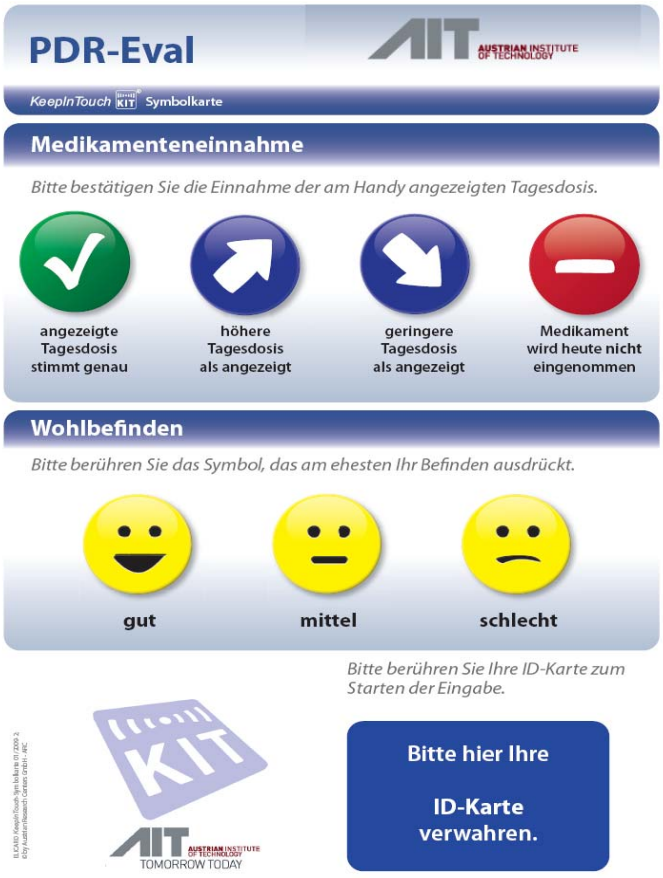

Figure 2: PDR-Eval symbol card with NFC tags

The handling of the problem setting was evaluated as good to very good by 10 of 14 persons. The handling of the mobile phone and the NFC symbol card was assessed as (rather) easy by 11/14 persons. 9/14 persons saw (rather) advantages in an electronically supported medication management via mobile phones. Only 6/14 persons – less than half of the target group – saw alternative application areas of the reminder functionality (e.g. GP appointments) as reasonable.

When asked for their experience in detail, some persons mentioned that they could not capture medication intake in all instances. Reasons for this were having been on journeys or having experienced technical problems. In detail the static allocation of transmitted data to specified time intervals (morning/noon/evening/night) turned out to be problematic, because measures were sometimes transmitted with a delay. This problem and the request to supplement data afterwards was mentioned several times in the interviews at the end of the evaluation phase. In this context the participants also asked for an individual and repeated reminder after half an hour or an hour.

The data capture concept via NFC symbol card was rated to be easy to learn and easy to use. In some cases, the size of the symbol card and the possibility to capture a wrong tag was mentioned.

The main problem in handling the mobile phone was the limits associated to the readability of text on the display because of small fonts. Participants with bar type mobile phones had problems with unlocking the key lock of the mobile phone (clamshell type mobile phones unlocked automatically when opened). As expected, younger participants used the mobile phones regularly in their daily routine and could solve appearing problems on their own.

4. Discussion and Conclusion

The input of the participants revealed important requirements for further development of the PDR system. The suggestions and criticisms can contribute essentially to create a personal medication reminder with increased usability and acceptance.

The original hypothesis (see chapter 2) can be held under following boundary conditions:

- An appropriate user interface is available (e.g. an easy to use mobile phone or using the own mobile phone with adequate font size, contrast, etc.)
- Technical problems are solved (e.g. no silent text messages, possibility to repeat the data capture process, reasonable error messages, etc.)
- Adaptation to user requirements (e.g. auto repeated acoustic signals, no signals if medication was taken in time, input of new drugs, mobility of the whole system)
- Clarity about who is responsible for adaptations of the basic settings (Involvement of the prescribing doctor)

The user feedback during the PDR-Eval project can be summarized as follows:

1. A system that reminds people to take their medication and helps them in identifying which medication to take is highly needed and welcome
2. Usability and stability of such a system is a major criteria for a broader acceptance

In the context of usability, major improvements might be possible by using new technological achievements, like touch-screen based mobile phones, where the pills to be taken can be shown more easily, or by integrating electronic blisters or medication boxes.

Thus, our further research will focus on different approaches to increase usability and to integrate this approach a mobile medication management system into other applications, like AAL environments and monitoring of chronic diseases.

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