

Evaluation of a Medication Robot Through Participatory Design Methods - A Case Study in Denmark

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Abstract. The demographics in Denmark are changing. People's life expectancy is increasing, which puts a strain on the home care resources. The aim of this article is to get a deeper insight to how a specific medication robot in elders' homes can be further developed and modified to create more independence. An insight to the end users is created through the use of participatory design methods. The methods illuminate the fact that the medication robots design is gawky, its alarm volume is too low, the robot itself is too big and that it lacks the functionality of being transportable.

Keywords. Medication Robot, Participatory Methods, User Participation, Home care, Elderly

1. Introduction

As in most western countries, the average life expectancy has increased in Denmark which has resulted in more elderly people living in their own homes and receiving help from a home carer. Unfortunately the resources concerning home care have not been able to follow the increasing demand for help, which in some cases has led to poor working conditions, medications errors [5] and large financial expenses.

To overcome these issues, several technologies have been introduced to the home care market, including technologies that seek to make medication administration more secure and economically affordable. Among the many technologies on the market, medication robots have emerged, such as the MedimiSmart robot from TIM [1], Dosecare from Dosesystem [2] and the medicine dispensing robot from Evondos [3].

To clarify whether medication robots actually help with the mentioned issues, and how these robots potentially should be modified, to succeed user session [6], is used. Additionally the user involvement creates an environment where people like the elderly and home carer, are given more active roles, and thereby become co-creators in the process, instead of being passive participants. Reinforcing and expanding people's roles can eventually give them a higher sense of ownership of the process, resulting in a higher commitment and their answers not being based on what they believe others want them to say, but what they actually think.

This participatory design study is organized as a case study focusing on a specific medication robot. The medication robot from Evondos contains software that among other things [3] controls an alarm, which starts whenever it is time to take the medication

and the alarm continues until the user presses the green button. When the patient presses the button the robot dispenses the medicine in a small plastic bag. A home carer fills the robot, with rolls of plastic bag packed medicine, approximately every second week. By using the medication robot, the patient is thereby secured timely treatment.

The aim of this article is to produce new insight into how the medication robot can help the patient and how the robot might be further developed to become more beneficial for the end users.

2. Methods

Insight into users' behaviors and their context can best be achieved by the participatory design methods. However, the COVID-19 situation and complying with the appertaining restrictions, physical user contact was impossible to practice and consequently the participatory design methods have been altered, in order to conduct user sessions in an online setting. The reason for using these methods is due to the fact that they to a high extent, involve the primary and secondary users, which in this case are elderly people and the home carer.

2.1. Participants

Two informants participated in the user sessions, one home carer and one student who acted in the role of a persona [8]. Due to the COVID-19 restrictions it was not possible to visit the elderly in their own home and hence a university student was acting as a persona. She acted the role of Oda, an 82 year old woman, living in her own private home and receiving daily help from the home carer that helps her to remember to take her medicine. The home carer is employed in the public health care system in Denmark. She has daily interaction with elderly people which among others include assisting in medication administration. The COVID-19 restrictions also led to the interviews having to be held online via Zoom [4]. The online interviews were video recorded via Zoom, making it possible to see the video multiple times, and thereby pay attention to different or missed details.

2.2. The user session

In the sessions the participants were interviewed following a semi-structured interview guide and distribution of roles was made beforehand. The questions asked were formulated on the basis of the research questions, to ensure that the interview questions were directed towards the research area. The questions were, about design, user friendliness, sense of security, ethical issues and social status. Furthermore, the health professional was asked whether she would feel comfortable installing the medication robot and the persona was specifically asked about her personal opinion and perception of the medication robot.

The user session with the persona made use of pictures [7]. The pictures had been chosen on beforehand by the project members and were shown on the informant's screen. The pictures chosen all illustrated a specific topic in relation to the medication robot, in order to ensure that the participant's reflections, would be significant and relevant. The topics were different kinds of home technologies, like an activity watch, medication

robot, and other topics were different rooms like kitchens, bathrooms, living rooms and so on. The pictures were chosen with the purpose of getting information from the participants regarding where to place the robot and what the medication robots optimal design would be. The pictures were included in the interview by asking the informant to verbalize what reflections came to mind when looking at the illustrations. The reason for including visual imaging is that it can give a different perspective and new reflections.

3. Results

The user sessions led to results divided in two sections, the first is what was learned from the users who participated in the interviews, and the second is based on the gained experiences from using the specific participatory design methods.

3.1. *From the informants*

The user sessions produced an insight into the specific and general perceptions of a home care staff and a persona and thereby providing knowledge and inspiration to how a medication robot, like the Evondos, could be improved. From the interviews, the most important lesson learned was that the robot itself is rather gawky in its design and that it lacks the functionality of being transportable. With a non-transportable medication robot is it not possible to hear the alarm when not at home, which results in the end user not being reminded about taking their medicine by the medication robot. It also became clear that a general issue of the robot was that it took up a lot of space, suggesting that the design and dimensions of the robot should be modified and changed. Furthermore, the volume of the robot's alarm was mentioned as a concern. The reason being that it seems unlikely that a person would be able to hear the alarm, if the robot is located in the kitchen, and you are in the bedroom, taking a nap. The fact that the robot dispenses the medicine in small plastic bags, was also a concern since the bags were seen as a challenge to open for elderly people with possibly crooked arthritis fingers.

The robot was seen as an invention that could replace some of the home carer's work tasks, making it beneficial to the municipality. Another lesson learned was that the primary end user could be people below the age of 75 without dementia since they are assumed to be more confident about technology than the ones with an age over 75. Thereby younger elderly will get a better outcome from the medication robot and become independent from the home carer. The reason why the medication robot is not the optimum solution for demented is that they need human contact and the medication robot could cause confusion.

Despite the challenges regarding the medication robot, it is still seen as a technology that can assist elderly in becoming more independent, and thereby be less in need of having home carers visiting several times a day. A fact that also can create beneficial economic advantages for the Danish municipalities, since the robot helps by saving time and money.

3.2. *From application of methods*

With the online user sessions, it can be difficult to detect the informant's body language it is only possible to see part of the informant, so it is not always possible to see their

gesticulation when they explain something. During the user sessions, the facilitator was interrupted in note taking, due to the complexity of having to write and keep eye contact with the informant at the same time. The tendency with the online interviews was that they were shorter than expected.

Including images in the user session resulted in giving the informant new reflections. In the beginning of the interview, the participant was shown a collage of pictures, which she referenced to later in the session. The pictures were also shown individually which gave the informant more specific reflections. During the session, the facilitator had at some points difficulties in asking questions in relation to the picture. Furthermore, it was difficult for the facilitator to keep an overview of how many and which pictures there are left if the facilitator does not share the screen that shows the images.

4. Discussion

Since the user sessions were conducted online, this might have influenced the results and the time consumption. During the online sessions, there was a focus on having eye-contact with the informants. This can have led to the informant being more focused on answering short and precisely, in relation to what the interviewer might want to hear, instead of prioritizing taking time to reflect on personal perception and considerations. An advantage by performing the session online is that it saves transportation time.

A way to prevent the potentially precipitated interview is by allowing the informant to have their camera turned off during the interview. This would relieve them from having to make eye contact and focus on how they physically represent themselves online and thereby make it easier to get in touch with their perceptions. As an alternative, the method Transect walk [9], could have been used. The method is overall based on interviewing while walking, which enables the informant to focus on where they are going and what they see, instead of having constant eye contact while speaking.

Using photos during the user sessions gave rise to many reflections but these reflections might have been stirred in a specific direction. The reason for this being that the pictures were chosen beforehand, so it was already decided from which images the informant had to reflect on, causing fewer diverting reflections. An alternative to this aspect could have been to let the informant choose themselves among many different pictures, which ones to reflect upon, in relation to the medication robot. This also might have helped in the process of creating a better coordination between discussing with the user and showing pictures.

The qualitative approach and the COVID-19 situation limited the participation to only two informants, which means there is limited generalized information about how the whole of a potential target group perceive the use of medication robots. For a study with higher external validity, a quantitative questionnaire [10], could have been included to give a broader understanding of what the majority of people think. Furthermore, none of the sessions included true primary users, which could have affected the results, since the gathered reflections and thought thereby are based on estimations and interpretations by the home carer and younger students in the role of a persona. To see the product in the right context it could have been beneficial to make a simulation [11] with an elderly person in the target group. This method could have shown if some of the mentioned problems, for example, the dosed bags, is an actual and realistic problem.

In spite of the methods having some downsides, they made it possible to get a new insight from a user perspective of how the elderly and health professionals perceive the medication robot.

5. Conclusion

Through participatory methods it is revealed that the issues: increase in the demand for help, poor working conditions and medication errors, can be solved with the medication robot. The issues being an increase in the demand for help, poor working conditions and medication errors. Elderly under 75 years old can be more independent with a medication robot and it can relieve the home carer's workload. But introducing a new technology is not without causing new challenges as well. For the Evondos medication robot to succeed it has to be modified to what the target group needs and wants. According to this study, the robot has to be smaller and have more functionalities, for example, to bring the medicine with you when you leave the home. The conclusion is that the medication robot is a technology that with adjustments can be an integrated technology resource in the home care market.

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