Social Robots for Elderly Care

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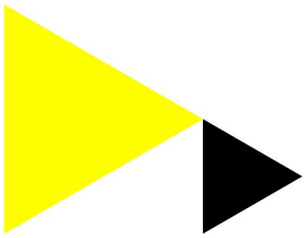

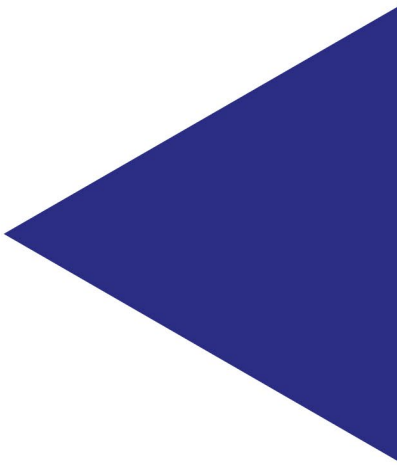

Digital Personalized Health and Medicine
L.B. Pape-Haugaard et al. (Eds.)

doi:10.3233/SHTI200321

Social Robots for Elderly Care: An Inventory of Promising Use Cases and Business Models

Somaya Ben ALLOUCH[a], and Lex van VELSEN [b]
[a]*Amsterdam University of Applied Sciences, Amsterdam, The Netherlands*
[b]*Roessingh Research and Development, Enschede, The Netherlands*

Abstract. This paper discusses a study that aimed to elicit promising application areas and potential business models for social robotics in healthcare. For this goal, we conducted focus groups with care professionals and the management of elderly care organizations in the Netherlands and Germany. Three use cases were mentioned as the most promising: the robot as a ubiquitous aid, the robot as a helper in the room, and the robot as a guide. Finally, we discuss the implications of the medical device and privacy legislation for these three use cases.

Keywords. Social robots, healthcare, use cases, elderly care, business models, GDPR, legislation

1. Introduction

It is well known that large parts of Europe, including the Netherlands, must address growing challenges in the current health system. The number of elderly people is increasing, as is their demand for care, and Europe is struggling with a shortage of professionals in the care sector to cope with the increasing demand. To keep healthcare costs under control, it is important for older people to live independently at home for as long as possible and, where possible, to support professionals in their daily work activities to reduce the high workload. Social robots, which can be defined as robots that aim to foster "close and effective interaction with a human user for the purpose of giving assistance and achieving measurable progress in convalescence, rehabilitation, learning, etc." [1, 2], can be of value here. For example, they can monitor the health of elderly adults and help improve or maintain elderly adults' physical and cognitive health (e.g., by offering personalized training programmes) [3]. In addition, social robots can also be used by professionals for tasks and activities that they feel are less urgent. In this way, they can focus on the clients who need care at that moment.

The use of social robots for healthcare purposes is far from commonplace in Europe due to various issues, such as the current reimbursement system for the use of robotics in healthcare, a lack of familiarity with the possibilities of social robotics among healthcare professionals, and a lack of clarity among companies as to how they can and may use robots in healthcare institutions. This reluctance among companies is fuelled by uncertainty about privacy legislation and medical device regulations regarding robotics. To gain better insight into the role that social robotics can play in

elderly care, we created an inventory of promising use cases, potential business models and relevant regulations. To this end, we conducted a range of focus groups among care professionals and care management in the Netherlands and Germany.

2. Methods

To identify promising use cases for social robots in elderly care, we conducted three focus groups with care professionals. Two focus groups took place in the Netherlands (with six and seven participants) at care organizations that focus on elderly care in the broadest sense of the word (home care, nursing, rehabilitation, etc.). A German focus group included five participants and was held at a rehabilitation centre that treats many elderly people. The focus groups consisted of the following parts:

- Introduction of participants and the goal of the focus group;
- Moments of frustration during a workday. Here, we inventoried problematic situations about working in elderly care;
- Improvement for work activities. Here, we inventoried which solutions the participants saw for improving the problematic situations;
- Introduction of social robots. At this point, we introduced social robots and explained to the participants what they are and can generally do;
- Potential roles for social robots. Participants were asked to indicate for what type of activity (consultation, diagnosis, monitoring, training, social, lifting and carrying people or things) they thought social robots were most useful;
- Promising use cases. Together, participants looked at the problematic situations and linked these with the potential roles for social robots to identify the most promising use cases.

To uncover potential business models for the use cases we identified in the first round of focus groups and to discuss relevant legislation. We conducted focus groups with the management of elderly care organizations. Two focus groups were held with a Dutch (n=6 in both focus groups) institution and one with a German (n= 4) healthcare institution. The employees who participated in this focus group consisted of Information and Communication (ICT) managers, policy-makers, training managers, innovation and care policy-makers, purchasing managers and members of the management team. During these focus groups, we presented the results of the sessions with care professionals, repeated the introduction of social robots and the inventory of potential roles, and added discussions on potential business models, implementation strategies, and applicable legislation.

3. Results

3.1. Care Professionals

During the focus groups, the participant ranked the six potential roles for social robots. They are as follows (from high to low): 1) social interaction; 2) monitoring; 3) training; 4) lifting and moving; 5) consultation; and 6) diagnosis. The professionals indicated that they would like to use the robots so that the client has “someone” to talk to because they felt that they did not always have enough time for this activity due to tight

work schedules. They also indicated that they wanted to use the robots so that they could monitor and reassure clients. A third point was that the robots could help to train the clients. A robot could perform the right exercises more often and help motivate people to perform permanent exercises so that their health could improve. It was also mentioned that robots could be used for lifting and moving clients. Finally, it was mentioned that robots could make diagnoses, but the general tendency was that people can still do this better than robots and that healthcare professionals found this function the least attractive.

An exploration of possible application areas led to three scenarios that were widely supported by the various healthcare professionals and that can already be realized with the current technology:

The robot as a ubiquitous aid. This robot records questions from clients/patients (e.g., questions about daily activities, requests for help with nausea), prioritizes the importance of these questions and only forwards a question to a professional in case of high urgency (as healthcare professionals indicate that they are overwhelmed by all the care questions they receive). The robot can also pick up objects from the ground (such as cutlery). In this way, the robot can reduce the workload of healthcare professionals and remove uncertainty from clients/patients. This use case was particularly helpful in helping clients in the common room of a care facility.

The robot as a helper in the room. This robot can look into the home of a client when an alarm goes off to determine whether an alarm is false or not. The privacy of a client is unnecessarily harmed if a professional must enter the home/room of a client at night for no reason; such a situation can be avoided by using a social robot. The robot can also set up a speech connection between the client and the healthcare professional to discuss whether help is needed. Finally, the robot can provide spoken memories (for taking medication, help with a regular daily routine). This reduces the workload of the professional, reduces unnecessary help and improves the daily rhythm of the client.

The robot as a guide. This robot reminds patients who are staying in a healthcare facility about an upcoming appointment (e.g., with a physiotherapist) and guides them to the location of this appointment (currently, patients often get lost, which is detrimental to the care provider's timetable and efficiency). In addition, the robot can guide visitors to their destination within a healthcare institution.

3.2. Management

The most important result of these focus groups was that with regard to a sustainable business case of social robots in healthcare, the majority of the participants stated that social robots should, above all, have added value for clients rather than for care professionals. The great potential that the participants saw to use social robots for patients and employees was partly reduced by many unresolved questions about the use of social robots. These questions relate to data security and liability, reliability during use by patients, quality management and integration into existing structures in the healthcare system, as well as their financing.

Interestingly, themes such as the replacement of personnel by social robots and the possible lack of human contact did not play a major role. The participants saw the possibility of relieving staff both physically and organizationally (e.g., taking over logistic tasks by a robot, completing customer surveys) and giving them more time to stay in touch with the patients.

An important barrier mentioned by participants was that they encounter problems with the implementation and use of social robotics in relation to relevant legislation and regulations, such as those that have been established for medical devices. The three user scenarios that emerged from the focus group with professionals were then used to map out relevant legislation and regulations with regard to social robots and current legislation and privacy.

3.3. Medical Device and Privacy Legislation

In the discussion with management, two main sets of legislation were discussed: the Medical Device Regulation (MDR) and the General Data Protection Regulation (GDPR). The MDR states that a device should be considered a medical device when it is used for one or more of the following purposes (limited to those that are applicable to the case of social robotics): the diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease; and/or the diagnosis of, monitoring of, treatment of, alleviation of, or compensation for an injury or disability. Key in this definition is the so-called 'intended use', which is stated by the manufacturer. For medical devices, the use of the device for purposes other than the intended use is prohibited, since the CE certificate is not valid when the device is not used for the intended purposes. Only in specific cases, e.g., during clinical investigations, may a device be used for purposes other than those intended, but only when this is allowed by the manufacturer.

Research into these regulations shows that robots in use cases 2 and 3 are not regarded as medical devices. After all, the robot is a means of communication (use case 2) or does not have a medical purpose (use case 3). The robot in use case 1 is regarded as a medical device, class IIa, but depending on the monitoring purposes for which the robot is used, it can also be classified as class IIb or III.

The General Data Protection Regulation (GDPR) has been in force in Europe since 25 May 2018 [4, 5]. A user of the robot (or its representative) will have to give permission for the storage and use of personal data. In addition, the supplier must provide information about the reasons for storage, how the user can influence this, and how data are exchanged. Since users will also be profiled in use case 1, the supplier will have to explain why this is done and in what way and will have to give the user the option not to use these profiling services. For use cases 2 and 3, the same rules apply (although the rules on profiling will probably not apply).

4. Discussion

In this study, we have identified the most promising use case for using social robots in elderly care and have explored potential business models. These use cases are the robot as an ever-present helper, the robot as an aid in the room, and the robot as a guide. Next, we mapped potential business cases with elderly care management and discussed related legislation. This study is one of the first to take such an approach towards social robots in elderly care or even healthcare. However, insights such as these are instrumental for developing social robotics applications, implementation plans, and exploitation plans and, as a result, are a prerequisite for successful and durable implementation.

As in any study, ours has some limitations. First, the identified use cases and insights regarding potential business models are highly influenced by the Dutch and German context and care systems. Therefore, caution should be exercised when generalizing these results beyond these two countries. Finally, elderly care has an extremely wide range of functions, involved professionals, and care protocols. To cover all of them in a study such as this one is impossible. It is possible that we missed a potential use case. However, we feel that we have generally identified the most important use cases.

The use of social robotics can be of tremendous added value for healthcare practice. However, we will have to experiment, deploy and collaborate more frequently and in an increasingly informed way, especially with professionals and clients, to determine the contexts in which the use of social robots in the healthcare sector will be most sustainable.

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