Informatics for Health and Social Care

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/imif20

Promoting activity in long-term care facilities with the social robot Pepper: a pilot study

Kari Blindheim, Mads Solberg, Ibrahim A. Hameed & Rigmor Einang Alnes

To cite this article: Kari Blindheim, Mads Solberg, Ibrahim A. Hameed & Rigmor Einang Alnes (2022): Promoting activity in long-term care facilities with the social robot Pepper: a pilot study, Informatics for Health and Social Care, DOI: 10.1080/17538157.2022.2086465

To link to this article: https://doi.org/10.1080/17538157.2022.2086465

Published online: 14 Jun 2022.

INFORMATICS FOR HEALTH AND SOCIAL CARE
https://doi.org/10.1080/17538157.2022.2086465

Taylor & Francis
Taylor & Francis Group

Promoting activity in long-term care facilities with the social robot Pepper: a pilot study

Kari Blindheim[a], Mads Solberg[b], Ibrahim A. Hameed[c], and Rigmor Einang Alnes[b]

[a]Department of Health Sciences Aalesund, Norwegian University of Science and Technology (NTNU), Aalesund, Norway and Centre of Care Research, Steinkjer, Norway; [b]Department of Health Sciences Aalesund, Norwegian University of Science and Technology (NTNU), Aalesund, Norway; [c]Department of ICT and Natural Sciences, Norwegian University of Science and Technology (NTNU), Aalesund, Norway

ABSTRACT

About 40 000 individuals depend on assisted living in long-term care facilities in Norway. Around 80% of these have a cognitive impairment or suffer from dementia. This actualizes the need for activities that are tailored to individual needs. For some users, technology-assisted participation in communal activities can be an alternative approach to increasing their quality of life. To gain insight about the experiences of residents and healthcare professionals in long-term care facilities when interacting with the social robot Pepper. This is a qualitative pilot study. After a series of interventions with the robot in a long-term care facility, data were collected through individual interviews with healthcare professional and residents. These were analyzed through a qualitative content analysis. A thematic analysis identified three major themes: 1) Activity, joy and ambivalence, 2) challenges when introducing social robots in contexts of care and 3) thoughts about the future. Although employees and residents report that they enjoyed interactions with the social robot, highlighting opportunities for novel types of activities and action that differed from the daily routine, the subjects articulated several concerns and challenges. Developments in intelligent social robots is still in its infancy, despite much hype.

KEYWORDS

Social robot; long-term care facility; Qualitative approaches; activity; physical exercise

Introduction

On February 14th, 2018, the Norwegian Broadcasting Corporation aired a news story about an intervention with the social robot Pepper, in a long-term care facility on the Northwestern coast of Norway. The purpose was to investigate the potential of such robots for promoting physical activity among residents in a Norwegian long-term care facility. The event, which was the outcome of a collaboration between researchers at the local university and the municipal healthcare service, embodied a long-standing debate about the potentials and pitfalls of technologies like social robots in eldercare. As revealed by *Atekst*, a comprehensive database of print media in the Nordics, this is a topic that has received considerable public attention over the past decade (Figure 1).[1]

While the news segment highlighted several benefits of social robots for the future of municipal care, an increasingly pressing issue because of the demographic shift toward an aging society, it also accentuated major challenges with such technological applications. As the segment came to an end, an insight from a resident in the facility was given a place of prominence by the journalist: "If you get really ill, you need a hand to hold, and that is not the robot. That's a cold hand." In the ensuing weeks, spirited debates followed in both social media and regional newspapers about the proper scope of these technologies for care in an affluent welfare state with a single-payer system. In this study, we report on

CONTACT Kari Blindheim kari.blindheim@ntnu.no Department of Health Sciences in Aalesund, Norwegian University of Science and Technology (NTNU), Aalesund 6025, Norway

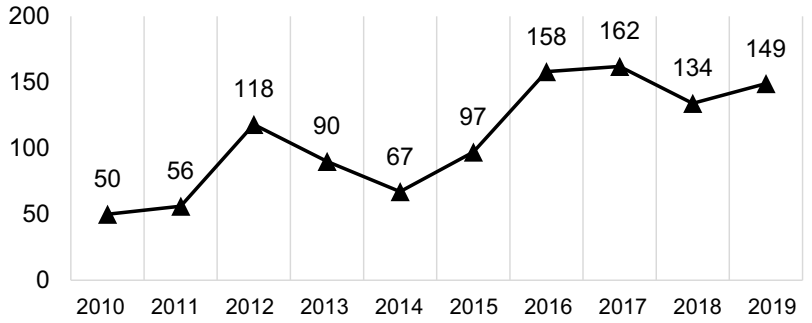

Figure 1. Number of articles per year in Norwegian print media from 2010 to 2019 with the terms 'robot' (robot) **and** 'health' (helse) **or** 'care' (omsorg). The total number of articles in Atekst Retriever from this period was 1081. The search was performed 14.9.2020, using the analytics feature on *https://web.retriever-info.com/services/archive?*.

how residents and healthcare professionals experienced this intervention with the social robot. We examine a variety of perspectives on how robotic systems like Pepper can stimulate individuals to participate in daily activity, as well as how the experience influenced communal relationships in the long-term care facility.

Long-term care and the need for activity

In Norway, roughly 40 000 individuals are receiving assisted living in long-term care facilities on a full-time basis. Around 80% of those living in these facilities have some degree of cognitive impairment or live with dementia, which actualizes the need for individually tailored activities and care.[2,3] According to the *Regulation on quality in care services*,[4] recipients of municipal care services are entitled to having their basic needs met, and this includes the need for companionship and community, as well as a varied selection of appropriate activities. A new quality reform for older persons, also stresses that residents in long-term care facilities should be offered the same level of service as those living at home.[5]

Previous research suggests that residents in long-term care facilities may experience loneliness,[6] and a reduction in their quality of life.[7,8] Participation in communal activities can be one way of increasing quality of life.[9,10] A study by Kjøs and Havig[11] found that the level of physical and social activities in long-term care facilities was relatively low, and with little increase, despite policy documents highlighting this as a focus area. Other studies have identified how daily life in long-term care facilities can be characterized by boredom and monotonous, daily schedules.[6] Furthermore, the kind of activities that are made available for residents does not always resonate with their individual preferences. According to a study by Haugland,[12] residents were mostly interested in activities where they could be active themselves, in contrast to the healthcare professionals, who believed that the residents preferred more passive activities, with observation rather than participation.

Social robots in long-term care

The framework of person-centered care speaks to the importance of identifying technology-assisted practices that produce improvements in quality of life, tailored to individual preferences.[13,14] Social robots can, in principle, be designed to facilitate person-centered interactions. As of yet, studies on the use of robots in long-term care facilities, such as the robotic seal Paro, have not identified any adverse effects from their use, although our current state of knowledge suggests that it can be hard to measure and quantify tangible benefits from their application.[15–17] Some studies have indicated that activity patterns among residents in public areas may increase after introduction of a social robot.[18,19] A study by Jøranson, Pedersen,[20] for instance, saw an increase in smiling behavior and laughter toward both

other residents and the healthcare professionals who staged communal activities with Paro. In another study, older persons who participated in group sessions of robot-assisted therapy, twice per week over four weeks, showed significant improvements in communication, the level of social interaction, and participatory activity.[21] The researchers concluded that engagement in activities involving the robot had health promoting effects for older persons in long-term care facilities.

Systematic reviews indicate that interactions with robots can have beneficial effects on outcome measures like loneliness, anxiety, agitation, medication consumption and quality of life for older adults.[22] But applications of robots in contexts of care are in a very early stage, based around exploratory interventions, with small sample sizes, many potential confounding variables, and lacking strong experimental designs. A significant knowledge gap therefore remains concerning the application of social robots in current practices of care, and their associated ethical challenges.[23–26] Arguably, future developments in the field also require closer integrations between research fields, including collaborations between technologists and healthcare professionals, to address various user needs.[27]

Currently, there are few published studies on how healthcare professionals experience the use and assistive-potential of humanoid or animal-like robots.[28] A mixed-methods study by Hebesberg et al.[29] examined social acceptance and the experiences of providers and recipients of elderly care with the STRANDS robot, which was based on a mobile robotic platform known as SCITOS. Here, researchers found that the machine's lack of interactional modalities, lacking functionalities, as well as fears of failure and breaking the machine, were key concerns among healthcare professionals. Still, observations made throughout the intervention suggested that residents, healthcare professionals and visitors displayed interest in the robot and its workings. For instance, the group made frequent observations of residents laughing while interacting with the robot. But although encounters with the machine were often positively laden, participants were also disappointed and quickly lost interest when their interactions with the robot did turn out as expected.[29]

Pepper was introduced in 2014 as the first programmable social humanoid robot that can recognize faces and basic human emotions and interact with people through conversation and his touch screen.[30] Studies on interactive social robots like Pepper are limited and, to the best of our knowledge, this system has not been tried out in a Norwegian long-time care facility before. We therefore need more knowledge about how healthcare professionals and residents experience such interventions, and whether use of humanoid robots can promote person-centered care by enabling social and physical activity.

Aim

The aim of this exploratory study was to gain insight about how residents and healthcare professionals in a Norwegian care facility experienced interacting with the robotic system Pepper and investigate its potential contributions to communal activity and physical exercise.

Method and materials

The study is descriptive and qualitative, based on a content analysis of semi-structured interviews,[31–33] exploring the informants' experiences of interacting with the robot for social and physical activity in the common room.

Intervention

Pepper is a programable semi-humanoid robot with a white plastic casing. It has a height of 120 cm, and is assembled by Softbank Robotics.[30] Like other social robots on the commercial market, Pepper is not fully autonomous, and the intervention in this study was therefore based on the Wizard of Oz-principle.[34,35] A human interlocutor (usually a member of staff) engaged with an interface on a Linux computer through a specially designed software known as *Pepper for Health* (Figure 2). The

Figure 2. Line drawing of the social robot engaging residents in care-facility's communal area. Based on original photos by Ragnhild Vartdal, with permission from the Norwegian Broadcasting Corporation.

application used by the operator consisted of an interface with a selection of options for movement and exercise control, scripted dialogs in Norwegian and English for feedback, jokes, and an assortment of conversational topics (including the daily menu, the weather, a selection of greetings, questions, answers, and compliments), as well as a text to speech-function where the operator could enter appropriate text for short dialogs. Additionally, the interface had a transport controller to move the robot remotely, using keyboard arrows (see Figure 3(a–d)).

Each intervention with Pepper consisted of the robot guiding residents through a training program, lasting between 15 and 30 minutes in the facility's common room. Additionally, the robot would communicate to residents about the daily dinner menu, provide a weather forecast, and tell a selection of jokes. The activity was executed daily, five days a week, for a period of four weeks. Between four to six residents, accompanied by one to three healthcare professionals, participated in each session. Healthcare professionals were always present to create a calm and safe environment for the residents. Residents were seated in a semi-circle with Pepper leading the activity in front of the group. Healthcare professionals were also given training about how to operate the social robot by engineering students and one of the authors, who had programmed the robot for the implementation. The ward's manager was responsible for following up healthcare professionals at the site.

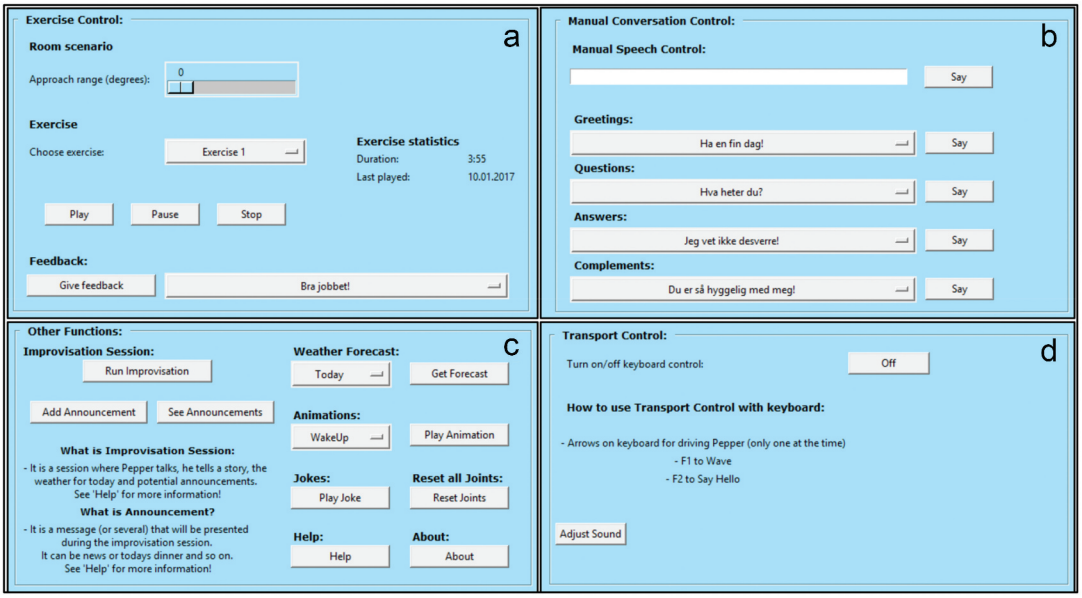

Figure 3. Graphical User Interface of Pepper for Health software application.

Sample and sampling

A purposively sampled group of residents and healthcare professionals in a long-term care facility in Northwestern Norway participated in the pilot study. The inclusion criteria for the residents were that they had engaged with the robot three times or more in the past. For employees, the criteria were that they had administered and operated the robot three times or more. The ward's manager was responsible for recruiting participants and was given information about the inclusion criteria, as well as documentation for providing informed consent. Additionally, the manager handed out information to residents, next of kin, and staff and forwarded consent forms to the project leader.

Interviews were performed with three residents in the long-term care facility with cognitive decline (dementia) and four healthcare professionals who worked at the institution and participated in the intervention.

The residents were between 79 and 93 years of age, and all had engaged with the robot more than four times before. Among the interviewed healthcare professionals were three licensed practical nurses and one registered nurse. The residents were interviewed in the living room, immediately after participating in the activity, to compensate for challenges that residents might have with their memory. Healthcare professionals were interviewed in a suitable room at the institution for around 30 minutes, while the residents were interviewed for around 15 minutes.

Before the intervention began, the university held an information meeting for next of kin and healthcare professionals, facilitated by the manager of the ward. Here, the project manager informed about the project and what it would entail for participants. Since there were few healthcare professionals participating in this specific meeting, information to staff was also disseminated in internal meetings. As a member of the project's working group, the manager was familiar with the project, and could relay needed information to the other healthcare professionals in the ward.

To obtain data for answering the research questions a thematic guide was developed for the semi-structured interviews.[31,33] This served as a checklist of key question related to the overarching research agenda and gravitated around their perceptions of the robot, its current features, and future applications. Interviews were carried out by the first and last author, and informants were encouraged to talk freely. Follow up questions were asked when needed. All the interviews were carried out in Norwegian and digitally recorded.

Analysis

Audio recordings were transcribed by the first and last author,[36,37] and each interview was closely examined for meaningful content and thematic patterns. Salient patterns were given a code and organized according to the interview's thematic focus. The coding scheme worked as a translation device, organizing data from the conversations into meaningful categories.[37] The definition of each code and the selection of themes emerged from discussions between the first and last author. Nvivo 12, a software for handling and analyzing qualitative data, was used to support the analysis. See Table 1 for an example of the analysis process.

Three key themes emerged from the interpretation and latent content analysis of the interview transcripts: 1) activity, joy, and ambivalence, 2) challenges when introducing social robots in contexts of care, 3) thoughts about the future.

Ethical considerations

The project followed guidelines for research with human subjects and vulnerable populations, and was reviewed by the Data Protection Official at the Norwegian Social Science Data Service (Project number 58230). Participants (staff, residents and their next of kin) received verbal and written information about the project and signed a consent form. They were informed that participation was voluntary, and that they could withdraw from the study at any time, without consequences. Note that Pepper did

Table 1. Examples of units of meaning, sub-themes and themes.

Units of meaning	Subtheme	Theme
It has been nice, it does not take much to get a change, it does not. Yes, he (the Pepper robot did), we should not sit here and stiffen.	Robot as "spice" in an active everyday life	Activity, joy and ambivalence
Yes, they sit and laugh together and discuss a little. Some of it because he talks so low [sound] that somebody have to ask what he is saying.	Increased sense of community and shared joy	Activity, joy and ambivalence
I have always said that sufficient staffing is needed for dignity. If a robot comes in, it seems a bit odd, I feel. You really have to think about how you would want it yourself [care].	Ambivalence	Activity, joy and ambivalence

not, under any circumstance, record or register any audiovisual, or other kinds of information, about the participants via its sensors and capacitors, nor did the robot transmit any such information outside of its use context (cloud-based storage etc.). The only information that was recorded by the research team were digital recordings of the interviews.

Results

Three key themes, with subthemes listed in Table 2, emerged from the analysis.

Activity, joy and ambivalence

Robot as "spice" in an active, everyday life

Compared to other activities that the residents were used to participate in, a different social dynamic emerged when the social robot was used in the common area. In general, residents expressed satisfaction with Pepper, welcoming him as a 'funny guy.' When questioned about whether Pepper's presence increased the activity level, one resident recalled the following: "Yes, he did, we should not sit here and stiffen." But while the machine was considered novel, attention-grabbing, and exciting for many residents, healthcare professionals also experienced that some were reluctant about engaging with it.

Several residents emphasized a desire for more physical activity on a regular basis, than what could be accommodated. At the same time, others stressed that they neither demanded, nor expected, a lot of activities in the facility anyway. Generally, healthcare professionals and residents were pleased that the exercise-program worked well. For example, some residents who rarely participated in physical activity, joined the exercise when Pepper guided them through the program. They also found the level and speed of movement in the program to be well-adjusted to their abilities, which could explain the high level of participation. Healthcare professionals also observed that residents seemed to enjoy the activity more as they learned the routine, although some participants were clearly more engaged than others. As one healthcare professional framed the intervention, the robot was a "spice" in everyday life. Given the different physical condition of the residents, it was also reported that variation in the exercise program would be necessary in the future, as some residents experienced the activity as repetitive and too slow for them.

Table 2. Overview of themes and subthemes.

	Themes	Subthemes
1	Activity, joy and ambivalence	- Robot as "spice" in an active everyday life - Increased sense of community and shared joy - Ambivalence
2	Challenges when introducing social robots in contexts of care	- Clarify expectations - Training staff - Collaboration between engineers and healthcare professionals
3	Thoughts about the future	- The future of social robots in contexts of care

Increased sense of community and shared joy

Another consequence of the scheduled encounters with Pepper, were a higher frequency of communal gatherings in the common room than what normally occurred. This increased the degree of social interactions, between the residents themselves, and between residents and healthcare professionals.

The healthcare professionals appreciated how the robot could be displayed in a way that spurred conversation and joking about its behavior in the common area. One healthcare professional framed the residents' encounters with Pepper, and their expectations about the machine, in the following terms: "They watched him closely, and I think they expected him to answer them back." The robot's embodiment also afforded a different use of humor. They could tell jokes about Pepper, and these small, joyful remarks were a source of positivity and laughter among residents and healthcare professionals, bringing the participants together as a group. When these humoristic events occurred, they were also understandable for residents with dementia. As one healthcare professional recalled:

> Yes, they sit and laugh together, and discuss a little. Some of it because he talks so low [sound] that somebody must ask what he is saying. For the sake of community, I think the way they sit together and participate in this activity instead of being spread around, is positive.

Another healthcare professional framed these joint events involving Pepper as follows:

> He created action, he was very cute and had a nice laughter. He reached out when he started and had very charming sounds which was conducive to bursts of laughter. He was very nice to watch, he really was.

Some healthcare professionals believed the robot could supplement the activity of the staff, since not all staff were comfortable doing performances of this sort in front of an audience. Some residents also enjoyed his infectious laughs, which drew others in. Laughing together was expressed as an important value. In the words of one resident: "Yes, he looks at you in such a way that you feel he gazes into your soul," a statement that was accompanied by a hearty laugh.

Ambivalence

Another resident was more critical, wondering whether it was a good idea to spend resources on this kind of activity, and why the robot was needed. This resonated with healthcare professionals, who recognized that they could have spent their time on performing the exercise program with the residents themselves, but that prioritizing this was challenging given their hectic daily schedules.

Pepper also highlighted the temporal constraints that staff were working against, and some considered the robot to be a time sink, as he was scheduled to appear in the living room at a fixed time before noon. As recalled by one healthcare professional: "We were locked to using it at this and that time, so now we have to make it work. But sure, it was a project." In other words: the fact that some healthcare professionals had to be present to control Pepper, was not always easy to accommodate within the staff's hectic schedule.

One resident also expressed a sense of anxiety about the motivation for placing the robot in long-term care, and whether there was some ulterior motive of letting the robot take over some of the work, a topic which the resident had overheard in a conversation between the staff. One healthcare professionals asked whether use of social robots in contexts of care aligned with the principle of dignified care:

"I have always said that sufficient staffing is needed for dignity. If a robot comes in, it seems a bit odd, I feel. You really must think about how you would want it yourself [care]."

By framing the use of the robot to tackle systemic problems of understaffing by competent professionals in elderly care, the informant raised the question of whether social robots in this context represents an undignified development in caring practices.

Challenges when introducing social robots in contexts of care

Clarify expectations

Above, we saw how residents expected the robot to be more interactively engaged in conversation. But healthcare professionals also reported that introducing the social robot into the ward set up a series of expectations that the robot did not live up to. Some expected that the robot could be introduced into the common area as an autonomous agent, and that it would then initiate activity on its own, freeing up capacity for them to do other things:

> I was disappointed and expected the programs to last a while longer. As it was, the robot *demanded* a hand, while our expectation was that it would free up hands, which it did not. Somebody had to control him, which led to us spending more time initiating and controlling the robot than we would have if [for example] I used myself for another activity.

There was also an unfulfilled expectation among staff that the robot would be more mobile and wander the hallways of the ward, and thus socialize with the residents, thereby relieving stress among the healthcare professionals due to understaffing. In addition, another expectation surfaced in the interviews: healthcare professionals wished the engineer responsible for programming the machine would be more available for the duration of the project, to add activities and speech functions as was needed. Some staff also lamented that they had received too little information in advance about the project, so that it was somewhat unclear what the purpose of the intervention was, resulting in unfulfilled expectations about the capacities of the robot.

Training staff

Healthcare professionals underscored the necessity of dialogue, adequate training, and clear instructions before introducing the robot to the ward. Getting to know the programmers, in addition to options for operating the machine, as well as its key constraints, was of great importance for how staff handled the encounter. For instance, one healthcare professional was so worried about handling the robot that she brought her son to work so that he could assist her: "I came here in my leisure time to get to know the robot better, so that he could show me." She emphasized the need to feel confident when engaging with the technology. Insecurity and fear about making mistakes could potentially make some of the staff negative about engaging with the robot. Another illustrative statement suggests that sentiments of pride in their professional work and identity issues were at stake:

> [. . .] now we just went right at it. Then they were sitting there [the residents], waiting, while we were supposed to learn, and all this insecurity can give us a different picture of ourselves.

This comment reflects a lack of confidence about how to competently operate the robot, and it speaks to the importance of trust and communication between managers and workers when introducing new and complex technologies to the ward.

Collaborations between engineers and healthcare professionals

Close collaborations between healthcare professionals and the engineers responsible for programming the robot, is essential for future developments of these systems in contexts of care. Of particular relevance, was the fact that healthcare staff experienced insecurity and a lack of knowledge about the robot's functionality and operational constraints, despite that information and feedback about the robot's performance was shared between different actors who were present at the site of intervention. Additionally, a lack of hotkeys for frequently used functions was a sorely missed feature in the control interface. Staff also pointed out that there was a problematic delay from the time when someone asked the robot a question, until a response could be given. According to one healthcare professional, hotkeys were one possible remedy: "With the technology itself, there are small, simple things, such as being able to give feedback and replying faster, that were my biggest frustrations." There were also concerns that the sound volume on the machine was too low. Because many residents had hearing impairments, it was difficult for them to follow the dialogue.

Thoughts about the future

The future of social robots in contexts of care

Healthcare professionals who participated in the study imagined a future with a lot more use of welfare technology in eldercare than today, seeing the technology as something that would be a permanent fixture in contexts of care, a development that they had to accept and cope with. At the same time, they stressed the need for healthcare professionals to actively participate in the development of new technology. While they were adamant that robots could never replace human beings, they could perhaps be a valuable supplement. Also, they stressed a moral imperative, namely that older persons also had the right to participate and enjoy technological developments. For instance, the robot could be highly useful in the future as a source of information and for answering questions from residents:

> [. . .] it is something you can engage with because there are hands, feet, a face, a head and such. I think it is something we should aim towards. But whether we are ready, that is a different thing. If the system is ready, something completely different. I definitely think that a robot in the ward could be of use for many things.

One requested feature was future personal customizations for each resident, making the robot capable of recognizing that person's face, its name, and recognizing their favorite song, for instance. One staff member described her vision for future personalization as follows:

> It would be exciting if he could, on his own, recognize a user. To be able to say, 'there's Anne, how are you today', instead of us having to sit here and enter it [feed the machine information through the console]. It would be exciting if he could learn different things about the residents.

Staff also reported that the robot could be useful for some residents if it could give reminders about dinnertime, cultural events, and such. Future applications should accommodate verbal feedback from the robot (without the answer having to be manually given by an interlocutor), as well as a shorter response time. Development of a more varied exercise protocol was also seen as necessary, given the different levels of movement among residents in the care facility.

Discussion

The aim of this pilot study was to explore how residents and healthcare professionals in a long-term care facility experienced activities in the common room with the social robot Pepper. A key finding was that the robot's presence generated spontaneous social interactions. Despite the scripted character of the machine's physical actions, these scripts were also a source of humor and joint laughter. Although interactions with the robot were a source of wonder, there was also ambivalence about the motives and ethics of introducing robots in contexts of care.

Social robots for increased social and physical activity

Healthcare professionals reported an increase in communal activities involving the social robot in terms of physical exercise, joint interaction and social stimulation, and communication between residents, and between residents and employees. Their observations align with those of Sung and Chang,[38] who describes a four week program of robot-assisted therapy with the seal-type robot Paro influenced participants' communicatory and interactional skills, as well as their involvement in joint activity. Interestingly, residents who did not usually want to participate in communal activities in the past, joined the exercise program with the robot, as something novel and attention-grabbing. This novelty effect is also a prominent theme in other studies on social robots.[29]

Residents were especially satisfied by the pace (rate of change) in the exercise protocol, and the timing of the robot's movements, which made it possible for them to partake in the activity, and to coordinate their actions jointly with the robot. The ability to demonstrate proficiency in physical tasks can be of significant value for persons with cognitive disabilities, since many can no longer partake in activities they performed effortlessly in the past.

Coping refers to actions, affects and cognitive processes that are involved in how people assess and modify reactions to stressful situations, and «unfolds in the context of a situation or condition that is appraised as personally significant and as taxing or exceeding the individual's resource».[39] During training sessions with the robot, healthcare professionals helped the residents who were present to recognize that they could, in fact, master the activity they were joining. As such, they assisted residents in coping with the robot's presence, and the interactions it afforded. Staff also ensured the safety of residents when they engaged with the robot, for instance by making sure they did not fall when participating in the activity. The robot's presence also highlighted the value of physical activity so that residents did not, in the words of one interlocutor, "stiffen." There were even additional requests for *more* activity than what was offered through the scheduled exercise program.

Participation in physical activities are crucial for experienced quality of life in long-term care facilities,[40] and national guidelines emphasize increased activity and social interaction.[5] Crucially, activity options should be based on the preferences of each residents, so that they can make use of their own resources for as long as possible, and experience security, wellbeing and coping while doing so.[14,41]

According to Gustafsson, Svanberg and Mullersdorf[42] staff who work in dementia care need an array of different tools to increase quality of life among patients. Social robots can be one supplement in this toolkit, in addition to other activities and care services. The participants in our study found that activities with Pepper increased their sense of community, as they rallied around the robot and enacted its social agency in the common room,[43] rather than being scattered around the facility by themselves. By convening in a joint interaction with the robot in a shared space, there were novel opportunities for conversation and discussion not only with the machine, but also between the residents. As observed by Alač et al.,[44] the spatial arrangements of human-robot interactions play a critical role in generating these new forms of sociality. Interactions with the robot was a common good, in a concrete situation that appeared manageable for people with dementia, despite often suffering from impairments of short-term memory. The fine-grained structure of these interactions should be investigated in future studies.

Despite, or perhaps because of, the robot's limitations, laughter and so-called "joking relationships,"[45] were a salient feature of these encounters, supporting a sense of community based around the fact that the participants were doing something together, in a very specific situation. As a central aspect of human interaction, humor provides a critical coping mechanism in long-term care facilities. Described by Erving Goffman as "total institutions,"[46] long-term care facilities are places where groups of people live closely together over long time-periods, and where their daily affairs are subjected to bureaucratic logic and control. Among its many functions, humor helps individuals to construe their identity, to express and maintain personal autonomy, and it can be a vehicle for building enjoyable relationships to others.[47]

A capacity to engage in humoristic behavior has been linked to positive assessments of robots as attractive social agents.[48,49] These observations about humor's significance in human-robot interactions, also resonates with the findings of Jøranson and Pedersen,[20] who not only found an increase in smiling and laughing behaviors toward the seal-like robot Paro, but also more of such behaviors directed at other participants in joint sessions of robot-assisted therapy.

Critical challenges for the early phase of healthcare robotics

In a poignant remark, characterized by a sense of wonder and ambivalence about the robot, one of the residents asked about the motivations behind placing the robot in the care facility. Was this part of a schema to reduce labor costs in the future, as she had overheard in a conversation between members of staff? A general fear about robots possibly replacing healthcare professionals in some unspecified future has also surfaced in other studies in similar settings.[29] At the same time, the staff was vocal in their assessment of the machine's limitations, stressing that the robot is hardly capable of replacing a human worker for even simple tasks outside a few selected domains, being highly restricted in terms

of locomotion and general cognitive and communicative ability necessary to provide individually tailored services for residents in a care facility. It is therefore central that any future developments in this domain takes seriously the principles of person-centered care. This is a philosophy of care based on supporting the needs of individuals, acquired through interpersonal relationships, which require service providers that are capable of adapting their activities to individuals, in ways that mitigate and compensate for cognitive challenges, while also scaffolding and promoting those cognitive resources that remain intact.[14] Currently, social robots lack the necessary flexibility and creativity to achieve these effects. This means that their situated use require constant monitoring and interactional maintenance by healthcare professionals or other operators to sustain the encounters over longer timespans.

Ethical considerations surrounding the introduction of service robots in contexts of care are of central importance, as we are dealing with a vulnerable population that require special considerations compared to other user groups. As we saw, some interlocutors asked whether use of these devices in contexts of care may represent a kind of undignified practice in some situations. Standards of nursing ethics must be maintained to protect and promote the dignity of vulnerable people as much as possible.[50] As many scholars have now argued,[51–53] recent developments in social robotics raises concerns that map onto several ethical dimensions. These include the potential for reductions in human social contact if caregivers are replaced by machines, objectification and loss of control, reductions in privacy and personal liberty, deception and infantilization, and whether older persons should be allowed to control robots themselves.

It is therefore vitally important that any testing and application of social robots happens in a secure environment, with familiar staff, informed consent, and without any pressure to participate. One should also take seriously the concern voiced by O'Brolcháin,[54] that using social robots in contexts of dementia care, may alter our social relationships to those under care in profound and unforeseeable ways.

While Pepper is a humanoid robot with some human-like features and an appealing design, there were no indications that it left the impression of being anything other than a machine for those who interacted with it. This is important, given that users with reduced cognitive capacity may have a limited ability to make critical judgments about the capacity of the technologies they interact with.

This pilot study also accentuates that active engagement with social robots in healthcare can present a challenge for some healthcare professionals, again underscoring the importance of clarifying expectations and the purpose of such interventions in specific institutions. Despite information being provided in staff meetings along with written information, it can be difficult to build a common understanding about the scope and limitations of novel technologies. One reason for this may be the fact that many members of staff work in the care facility part-time and were not present on the job when information meetings took place. Another reason is that the written information that was provided to all was not read thoroughly or was difficult to comprehend.

Some healthcare professionals expected that when the robot interacted with their patients, they would have more time for other assignments. But in their experience, this was not the case. Due to Pepper's low level of autonomy (a general feature of this technology), staff experienced interactions between the robot and residents in the common room as something that to be continuously maintained and repaired, and this work was demanding. When the robot's social character was animated in the common room, staff had to be physically present to monitor the situation, at the expense of other tasks. This was time-consuming. Their views about the robot's lack of functionality and operational constraints, also went beyond the robot's usability in the narrow sense. For instance, the healthcare professionals who operated the console, called for hotkeys that would facilitate use and reduce delays in response time, and they were frustrated that these features were unavailable. While clearly, some degree of interactional maintenance is always necessary when introducing novel technologies into new work contexts, even in the case of more mature technological practices, these limitations raises serious questions about the potential sustainability of social robots in the future of eldercare.[55]

Still, while healthcare professionals underscored these critical issues, they were also positive about using robots in caring practice at some point in the future. Similar expressions of ambivalence about using social robots in healthcare has emerged from other studies. Currently, few robotic systems appear to offer healthcare professionals actual relief from their regular working routines, and the user friendliness and functionality of these systems is low.[29,56] In this case, the healthcare professionals appeared to have rather high expectations about the machine's behavioral repertoire, and therefore had to recalibrate their presuppositions about the robot's value and applications, as they got more experience with it.

Notably, the interlocutors in this pilot study argued that instead of opting out from technology, healthcare professionals should instead participate in its development and influence this trajectory in professionally responsible ways. While they were adamant that robots could never replace human beings in contexts of care, it could become a supplement to current practices. They also saw a moral obligation to include elderly citizens in this maturation, so they also could benefit from future advancements in technology, instead of 'shielding' them from this course. Rather than resigning when faced with the expansion of robots to ever new domains of social life, they should instead actively engage with these systems as healthcare professionals, by adapting and paying attention to their potential use, along with the new problems they generate.

Conclusion

This exploratory study suggests that both residents and healthcare professionals may enjoy and appreciate interactions with social robots like Pepper in the context of long-term care facilities. However, human-robot encounters were also characterized by ambivalent attitudes, raising critical questions about future use-domains and benefits of applying these technologies at a larger scale. As humanoid social robots are currently in an early developmental phase, there are still major concerns about their communication capabilities, autonomy, and user-friendliness, as well as how standardized systems of this kind can be tailored to individual preferences and the situated requirements of each use-context. In this setting, staff had to be always present to manage the activity and create a safe environment for residents, and due to the nature of this technology, supervision of robots in wards where users are cognitively impaired will likely be necessary in the foreseeable future. It should, however, be noted that these machines provide opportunities for new kinds of actions different from the daily routine and monotony characterizing life in long-term care facilities. We should also not be misled into believing that healthcare professionals have absolute control over the social dynamics generated by robots when they are facilitating their use. Instead, as work by Alač et al. (44: 919) suggests, we can say that healthcare professionals become "interactionally implicated" in the robot's performance, rather than "intentionally organizing" it. This means that the machine's affordances in contexts of care can be a source of novel, significant and creative forms of mutual social engagement for cognitively impaired individuals and those caring for them. Still, strategies for managing ambivalent sentiments about these machines must be an area of focus in future research and development projects.

Strengths and limitations

This qualitative study involved a very limited sample of healthcare professionals and residents from a long-term care facility in a specific Norwegian context, and the application was conducted over a limited time-period. Additionally, it should be noted that due to their cognitive impairments, it was challenging for residents to maintain a focus on questions about their experiences with the robot for prolonged stretches of time. It is, however, a strength that the engineers responsible for programming the robot, collaborated closely with domain experts from healthcare when executing the intervention, which was carried out as planned without obstacles.

Acknowledgments

The authors would like to express their gratitude to the residents and healthcare professionals who participated in the project, and who shared their experiences with us. We would also like to thank the project's reference group from the Center for Development of Institutional and Home Care Services in Møre og Romsdal and ALV Møre og Romsdal.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The study received funding from the Regional Research Fund - Central Norway.

ORCID

Kari Blindheim http://orcid.org/0000-0002-3861-3000

References

1. Research/Atekst [Internet]. Retriever Norway. 2021. https://web.retriever-info.com/services/archive Accessed 14 September 2020.
2. Daatland SO, Otnes B. Skandinaviske trender i eldreomsorg. Institusjon eller omsorgsbolig?. 2015;(3):15–22. https://www.ssb.no/helse/artikler-og-publikasjoner/institusjoneller-omsorgsbolig Accessed 6 June 2020
3. Reneflot A, Aarø LE, Aase H, Reichborn-Kjennerud T, Tambs K, Øverland S Psykisk helse i Norge. 2018.
4. Ministry of Health and Care Services. Forskrift om kvalitet i pleie -og omsorgstjenestene for tjenesteyting. Oslo 2003.
5. Norwegian Ministry of Health and Care Services. Meld.St 15 (2017-2018) Leve hele livet. En kvalitetsreform for eldre. 2018.
6. Mjørud M, Engedal K, Røsvik J, Kirkevold M. Living with dementia in a nursing home, as described by persons with dementia: a phenomenological hermeneutic study. BMC Health Serv Res. 2017;17(1):93. doi:10.1186/s12913-017-2053-2.
7. Barca ML, Engedal K, Laks J, Selbæk G. Quality of life among elderly patients with dementia in institutions. Dement Geriatr Cogn Disord. 2011;31(6):435–42. doi:10.1159/000328969.
8. Nikmat AW, Hawthorne G, Al-Mashoor SH. The comparison of quality of life among people with mild dementia in nursing home and home care—a preliminary report. Dementia. 2015;14(1):114–25. doi:10.1177/1471301213494509.
9. Moyle W, Fetherstonhaugh D, Greben M, Beattie E. Influencers on quality of life as reported by people living with dementia in long-term care: a descriptive exploratory approach. BMC Geriatr. 2015;15(1):50. doi:10.1186/s12877-015-0050-z.
10. Moyle W, Venturto L, Griffiths S, Grimbeek P, McAllister M, Oxlade D, Murfield J. Factors influencing quality of life for people with dementia: a qualitative perspective. Aging Ment Health. 2011;15(8):970–77. doi:10.1080/13607863.2011.583620.
11. BØ K, Havig AK. An examination of quality of care in Norwegian nursing homes–a change to more activities? Scand J Caring Sci. 2016;30(2):330–39. doi:10.1111/scs.12249.
12. Haugland BØ. Meningsfulle aktiviteter på sykehjemmet. Sykepleien forskning . 2012;7(1):40–49.
13. Edvardsson D, Petersson L, Sjogren K, Lindkvist M, Sandman PO. Everyday activities for people with dementia in residential aged care: associations with person-centredness and quality of life. Int J Older People Nurs. 2014;9(4):269–76. doi:10.1111/opn.12030.
14. Brooker D, Kitwood T Dementia reconsidered, revisited: the person still comes first Open University Press; 2019.
15. Broadbent E, Kerse N, Peri K, Robinson H, Jayawardena C, Kuo T, Datta C, Stafford R, Butler H, Jawalkar P, et al. Benefits and problems of health-care robots in aged care settings: a comparison trial. Australas J Ageing. 2016;35(1):23–29. doi:10.1111/ajag.12190.
16. Koh WQ, Ang FXH, Casey D. Impacts of low-cost robotic pets for older adults and people with dementia: scoping review. JMIR Rehabil Assist Technol. 2021;8(1):e25340. doi:10.2196/25340.
17. Mesquita AC, Zamarioli CM, de Carvalho E. The use of robots in nursing care practices: an exploratory descriptive study. Online Brazilian J Nursing. 2016;15(3):404–13. doi:10.17665/1676-4285.20165395.

18. Robinson H, Broadbent E, Macdonald B. Group sessions with Paro in a nursing home: structure, observations and interviews. Australas J Ageing. 2016;35(2):106–12. doi:10.1111/ajag.12199.
19. Peri K, Kerse N, Broadbent E, Jayawardena C, Kuo T, Datta C, Stafford R, MacDonald B. Lounging with robots – social spaces of residents in care: a comparison trial. Australas J Ageing. 2016;35(1):E1–E6. doi:10.1111/ajag.12201.
20. Jøranson N, Pedersen I, Rokstad AMM, Aamodt G, Olsen C, Ihlebæk C. Group activity with Paro in nursing homes: systematic investigation of behaviors in participants. International Psychogeriatrics. 2016;28(8):1345–54. doi:10.1017/S1041610216000120.
21. Sung HC, Chang SM, Chin MY, Lee WL. Robot-assisted therapy for improving social interactions and activity participation among institutionalized older adults: a pilot study. Asia-Pacific Psychiatry. 2015;7(1):1–6. doi:10.1111/appy.12131.
22. Pu L, Moyle W, Jones C, Todorovic M. The effectiveness of social robots for older adults: a systematic review and meta-analysis of randomized controlled studies. The Gerontologist. 2019;59(1):e37–e51. doi:10.1093/geront/gny046.
23. Lu LC, Lan SH, Hsieh YP, Lin LY, Lan SJ, Chen JC, Pak R. Effectiveness of companion robot care for dementia: a systematic review and meta-analysis. Innov Aging. 2021;5(2):igab013. doi:10.1093/geroni/igab013.
24. Scoglio AA, Reilly ED, Gorman JA, Drebing CE. Use of social robots in mental health and well-being research: systematic review. J Med Internet Res. 2019;21(7):e13322. doi:10.2196/13322.
25. Góngora Alonso S, Hamrioui S, de la Torre Díez I, Motta Cruz E, López-Coronado M, Franco M. Social robots for people with aging and dementia: a systematic review of literature. Telemed J e-Health. 2019;25(7):533–40. doi:10.1089/tmj.2018.0051.
26. Moyle W, Arnautovska U, Ownsworth T, Jones C. Potential of telepresence robots to enhance social connectedness in older adults with dementia: an integrative review of feasibility. Int Psychogeriatr. 2017;29(12):1951–64. doi:10.1017/S1041610217001776.
27. Mesquita AC, Zamarioli CM, de Carvalho E. The use of robots in nursing care practices: an exploratory descriptive study Online Brazilian Journal of Nursing . 2016;15(3):404–13.
28. Papadopoulos I, Koulouglioti C, Ali S. Views of nurses and other health and social care workers on the use of assistive humanoid and animal-like robots in health and social care: a scoping review. Contemp Nurse. 2018;54(4–5):425–42. doi:10.1080/10376178.2018.1519374.
29. Hebesberger D, Koertner T, Gisinger C, Pripfl J. A long-term autonomous robot at a care hospital: a Mixed Methods Study on social acceptance and experiences of staff and older adults. Int J Social Robotics. 2017;9(3):417–29. doi:10.1007/s12369-016-0391-6.
30. Pepper [Internet]. 2021. https://us.softbankrobotics.com/pepper Accessed 26 January 2021.
31. Polit DF, Beck CT. Nursing research: generating and assessing evidence for nursing practice. 9th ed. Philadelphia (PA): Wolters Kluwer Health; 2012.
32. Britten N. Qualitative research: qualitative interviews in medical research. Bmj. 1995;311(6999):251–53. doi:10.1136/bmj.311.6999.251.
33. Malterud K. Qualitative research: standards, challenges, and guidelines. The Lancet. 2001;358(9280):483–88. doi:10.1016/S0140-6736(01)05627-6.
34. Dahlbäck N, Jönsson A, Ahrenberg L, editors. Wizard of Oz studies: why and how. Proceedings of the 1st international conference on Intelligent user interfaces Florida, USA; 1993.
35. Riek LD. Wizard of oz studies in HRI: a systematic review and new reporting guidelines. J Human-Robot Interact. 2012;1(1):119–36. doi:10.5898/JHRI.1.1.Riek.
36. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Educ Today. 2004;24(2):105–12. doi:10.1016/j.nedt.2003.10.001.
37. Hsieh H-F, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res. 2005;15(9):1277–88. doi:10.1177/1049732305276687.
38. Sung HC, Chang SM, Chin MY, Lee WLJAPP. Robot-assisted therapy for improving social interactions and activity participation among institutionalized older adults: a pilot study. Asia-Pacific Psychiatry: Official Journal of the Pacific Rim College of Psychiatrists. 2015;7(1):1–6. doi:10.1111/appy.12131.
39. Folkman S, Moskowitz JT. Coping: pitfalls and promise. Ann Rev Psychol. 2004;55(1):745–74. doi:10.1146/annurev.psych.55.090902.141456.
40. Tak SH, Kedia S, Tongumpun TM, Hong SH. Activity engagement: perspectives from nursing home residents with dementia. Educ Gerontol. 2015;41(3):182–92. doi:10.1080/03601277.2014.937217.
41. Norwegian Ministry of Health and Care Services. Demensplan 2020 - Et mer demensvennlig samfunn. 2015.
42. Gustafsson C, Svanberg C, Mullersdorf M. Using a robotic cat in dementia care: a pilot study. J Gerontol Nurs. 2015;41(10):46. doi:10.3928/00989134-20150806-44.
43. Alač M. Social robots: things or agents? AI Soc. 2016;31(4):519–35. doi:10.1007/s00146-015-0631-6.
44. Alač M, Movellan J, Tanaka F. When a robot is social: spatial arrangements and multimodal semiotic engagement in the practice of social robotics. Soc Stud Sci. 2011;41(6):893–926. doi:10.1177/0306312711420565.
45. Madden T. Joking relationships. J R Coll Gen Pract. 1986;36:197.

46. Goffman E Asylums: essays on the social situation of mental patients and other inmates. AldineTransaction; 1968.
47. Martin RA, Ford T. The psychology of humor: an integrative approach. Cambridge, Massachusetts, USA: Academic press; 2018.
48. Tay BT, Low SC, Ko KH, Park T. Types of humor that robots can play. Comput Human Behav. 2016;60:19–28. doi:10.1016/j.chb.2016.01.042.
49. Niculescu A, van Dijk B, Nijholt A, Li H, See SL. Making social robots more attractive: the effects of voice pitch, humor and empathy. Int J Social Robotics. 2013;5(2):171–91. doi:10.1007/s12369-012-0171-x.
50. Gastmans C. Dignity-enhancing nursing care: a foundational ethical framework. Nurs Ethics. 2013;20(2):142–49. doi:10.1177/0969733012473772.
51. Sharkey A, Sharkey N. Granny and the robots: ethical issues in robot care for the elderly. Ethics Inf Technol. 2012;14(1):27–40. doi:10.1007/s10676-010-9234-6.
52. Ienca M, Jotterand F, Elger B, Caon M, Scoccia Pappagallo A, Kressig RW, Wangmo T. Intelligent assistive technology for Alzheimer's Disease and other dementias: a systematic review. J. Alzheimers Dis. 2017;60(1):333. doi:10.3233/JAD-179005.
53. Ienca M, Wangmo T, Jotterand F, Kressig RW, Elger B. Ethical design of intelligent assistive technologies for dementia: a descriptive review. Sci Eng Ethics. 2018;24(4):1035–55. doi:10.1007/s11948-017-9976-1.
54. O'Brolcháin F. Robots and people with dementia: unintended consequences and moral hazard. Nurs Ethics. 2019;26(4):962–72. doi:10.1177/0969733017742960.
55. May C, Finch T. Implementing, embedding, and integrating practices: an outline of normalization process theory. Sociology. 2009;43(3):535–54. doi:10.1177/0038038509103208.
56. Stafford RQ, MacDonald BA, Jayawardena C, Wegner DM, Broadbent E. Does the robot have a mind? Mind perception and attitudes towards robots predict use of an eldercare robot. Int J Social Robotics. 2014;6(1):17–32. doi:10.1007/s12369-013-0186-y.