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DOMESTICATION OF A ROBOTIC MEDICATION-DISPENSING SERVICE AMONG OLDER PEOPLE IN FINNISH LAPLAND

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Abstract: *This paper presents a case study on a robotic medication-dispensing service used in the everyday lives of older people in Finnish Lapland through the concept of domestication. The study took an ethnographic approach. A total of 11 service users, practical nurses, and other health-care professionals participated; the service users averaged age 81 years (*M *= 81.4,* SD *= 5.4). The data comprised semistructured interviews complemented by observations and photographs at service users' homes. We concluded that the domestication of the service was successful, although the service users sometimes felt that it limited their lives. The service users stated that learning and subsequently using the service was easy with social network support. The participants indicated their reasons for hesitation in using the service related primarily to concerns in trying new technology, the technical features of the robot, and cognitive or physical difficulties. The service supports "aging in place," which is in line with the Finnish care policy.*

Keywords: *ehealth, robotic medication-dispenser, domestication, older people, sparsely populated area, digital competence.*

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INTRODUCTION

We present in this paper a case study involving an ehealth robotic medication-dispensing service for older people living in sparsely populated areas of Finnish Lapland. The service includes a medication-dispensing robot at the service users' homes that assists home-care clients with long-term and multiple medications by reminding them when the medications should be taken. We explored the domestication of the service in the everyday lives of older people and their social networks. Ehealth provides various technological solutions in health-care (Black et al., 2011; Eysenbach, 2001). The robot in this study is defined, after Zafrani and Nimrod (2018), as an assistive technology with service and companion-like features.

In Finnish Lapland, the number of older people (aged 75 years and above) is expected to increase by 68% before 2040, while the working-age population will decrease (Statistics Finland, 2019). This demographic transition and the economic situation present many challenges in addressing the needs of older people, such as an increased demand for health-care services (Kröger & Bagnato, 2017; Schulz et al., 2015; United Nations, 2017). Technology-based solutions offer potential coping mechanisms for these societal challenges and may even improve the lives of older people. Ehealth services provide care beyond hospitals and within the client's own home (Kilpeläinen & Seppänen, 2014; Pols, 2012; Pruchno, 2019; Schulz et al., 2015). Research in the field of technology and aging has grown dramatically over the past few years. However, gaps remain in understanding older people's needs for ehealth services, and thus these health solutions require further exploration (Fang et al., 2018; B. Fischer, Peine, & Östlund, 2019; Pruchno, 2019).

Care policies for older people throughout Europe have emphasized deinstitutionalization and "aging in place" to reduce paternalistic care, which is described as the opposite of clients' autonomy (Murgic, Hébert, Sovic, & Pavlekovic, 2015), and to improve the quality of care (Kröger & Bagnato, 2017). Aging in place is defined as living in a familiar nonhealth-care environment and being able to remain there even as circumstances change when aging (see Chen & Powell, 2019). The Finnish care policy aims to maintain citizens' independence and to support living at home as long as possible. With digital services, equal access to social and health-care services can be provided in sparsely populated areas and for special groups, such as older people (Ministry of Social Affairs and Health and the Association of Finnish Local and Regional Authorities, 2015).

The European Commission's Digital Competence Framework for Citizens (DigComp 2.0; Vuorikari, Punie, Carretero, & Van den Brande, 2016) defined "digital competence" as the knowledge, skills and attitude to use technological information and communication tools in work, employability, education, leisure, inclusion, and participation in society. In this framework, key areas of digital competence include "safety." One competence focuses on "protecting health and well-being." This competence means that citizens should be aware of the available digital technologies for social well-being and social inclusion. (Vuorikari et al., 2016.) In our research, instead of understanding digital competences as the generic knowledge and skills of individual people, we understand them as distributed and situated competences within the contexts which people act (Airola, Rasi & Outila, 2020; Lipponen, 2010; Rasi & Kilpeläinen, 2015). In previous research, older people's technology use was found to be distributed among couples, family members, friends, and formal and informal caregivers in their everyday lives. In addition, peer support is a key principle when considering older users' digital competences and their processes for learning to use technical devices and services, especially for individuals living in sparsely

populated areas. Social networks assist and support older people—particularly those who are living at home in sparsely populated areas—to manage the technology learning and use (Airola et al., 2020; Heart & Kalderon, 2013; Ng, 2007; Rasi & Kilpeläinen, 2015.)

Two research questions guided this study. First, how do older people domesticate a robotic medication-dispensing service in their everyday lives? And, second, what kind of meanings do service users, practical nurses, and other health-care professionals assign to the robotic medication-dispensing service during the domestication?

Domestication of Technology

The concept of "domestication" focuses on technology users and nonusers and how they culturally and socially shape technologies within their everyday lives to make them their own (Bakardjieva, 2010; Haddon, 2007; Lie & Sørensen, 1996; Silverstone & Haddon, 1996). In most cases, this process takes place outside the user's consciousness or intentions.

"Digital technologies allow breaking down the conventional walls around the person" (Silverstone, 2006, p. 244) and that is why domesticating these technologies can be seen as important (Silverstone, 2006). The concept extends beyond the adoption and use of technology into representing what meanings and values people assign to technologies, how they experience them, and what roles the technology plays in their everyday lives and daily routines (Haddon, 2007; Pols, 2012; Silverstone, 2006; Silverstone & Haddon, 1996). Meanings are the silent part of a culture or context, reflecting individuals' own thoughts, feelings, and way to see the world (Gubrium & Holstein, 2000; Talsi, 2014). Based on this concept, we view the use and nonuse of technology as part of the wider picture of the user's everyday life. Household diversity is evident in the domestication of technology. For example, the domestication of technologies in complex single parents' households (Russo Lemor, 2006) can be much different from stable older people's households who spend the majority of their time at home. (Bakardjieva, 2010; Gitlin, 2003; Silverstone, 2006.)

The domestication process has four dimensions: appropriation, objectification, incorporation, and conversion (Hynes & Rommes, 2006; Scheerder, van Deursen, & van Dijk, 2019; Silverstone, 2006). Appropriation addresses the acquisition (or not) and possession of the technology. This dimension concerns motivations and intentions for the technology and focuses on the process of getting to know the technology; the user starts to transform the public meaning of the technology into a personal meaning. In objectification, the spatial aspect of the process is essential: The technology is given a place at home or other environment; in our study, we focus on the home. When exploring the space for the technology, the user becomes aware of its features and possibilities. During incorporation, the temporal aspect is more central. This dimension focuses on the technology's place in the user's everyday routines and how it influences them, particularly when and for how long the technology is used. The conversion phase concerns the relations between the households' internal affairs and cultural and social resources. Achieving the phase involves the user developing skills, competences, and literacies. At this point, the technology has become familiar, and the meanings and values assigned to the technology—which may have changed during the domestication process—stabilize. (Hynes & Rommes, 2006; Lie & Sørensen, 1996; Scheerder et al., 2019; Silverstone, 2006; Silverstone & Haddon, 1996.)

The domestication theory was chosen as the primary concept of this study because of its multidimensional approach and because it enabled us to better "understand media technology

use in the complex structures of everyday life settings" (Hynes & Richardson, 2009, p. 486). Other approaches used on the adoption and use of technology studies have lacked the everyday life and household settings (Hynes & Richardson, 2009). On the other hand, the domestication theory has been criticized for being too home-centric, disregarding wider networks beyond the home (Haddon, 2011; Lie & Sørensen, 1996; Pierson, 2006). In addition, domestication studies often lack reflection on the cultural context, although according to Haddon (2011) there is scope for reflecting more on that (Haddon, 2011). On the other hand, in domestication literature, the concept of culture is opened narrowly. What we know about technology domestication among older people in the Lappish culture is that the role of digital competences is rather minimal in their everyday lives. However, they are willing to develop their skills (Rasi & Kilpeläinen, 2015) in conjunction with being able to follow familiar cultural practices. For example, sitting in a rocking chair and having coffee while using an ICT supports the domestication of technology (Airola et al., 2020).

Previous Research

Kamimura (2019) investigated automatic medication-dispenser (AMD) use among older adults with Alzheimer's disease living at home for at least 3 years. The AMD technology is different from the robot in our study. The results of Kamimura's study indicated that, for some older people with a memory disorder, the device could be useful for managing long-term medication needs. Three of four service users' medication adherence improved during the experiment, but continued support from family caregivers was necessary because the caregivers are responsible for filling the device and monitoring the service user's condition, including taking medications. Nevertheless, the caregiver's burden was reduced from the level prior to device use. Earlier similar case reports also suggested that AMDs could be beneficial for older people with cognitive impairment or in management of their medication if support is provided (Kamimura & Ito, 2014; Reeder, Demiris & Marek, 2013). Kamimura's 2019 study was a follow up to Kamimura & Ito (2014). By the time the second study began, three patients had stopped using the ADM. According to the caregivers' reports, reasons for rejections were forgetting frequently "to retrieve the medication from the device or patient's embarrassment about a warning alarm due to misuse of the device" (Kamimura, 2019, p. 128). Ligons, Mello-Thoms, Handler, Romagnoli, and Hochheiser (2014) tested older people's ability to use an electronic medication-delivery unit (also different from our technology) without any help. Older people with cognitive difficulties had the most errors. Commands from the delivery unit that caused the most failures were "Manual drop," which is the command to predeliver medications for use during travel, and the command "Load blister card or new prescription pills."

Two recent literature reviews investigated ehealth access and usage by older people from the perspectives of health equity (Fang et al., 2018) and perspectives on barriers and facilitators (Spann & Stewart, 2018). Similarities can be identified in the results of these studies. Fang et al. (2018) found four means to enhance older people's ehealth access: (a) maintain a low cost for the service user, (b) improve the self-efficacy of the service user and provide social support for the use, (c) remain mindful of the cultural appropriateness in the ehealth design, and (d) create user-friendly devices that older people feel comfortable and confident using. Spann and Stewart (2018) found the following factors affecting older people's mhealth (mobile health technology) usage: (a) perception of usefulness, (b) user requirements, (c) self-efficacy, (d) sense

of self and control, (e) privacy and confidentiality, and (f) cost. Researchers in both studies called for the developers, providers, and responsible policymakers to address these essential features in their decision making, service providing, and technology development.

Acceptance is an important factor in older people's adoption of telecare, which is computer-supported care at home and one type of ehealth technology. Usability, functionality, design, costs, ethics, and privacy can influence the overall likelihood of telecare acceptance (Turner & McGee-Lennon, 2013). Yusif, Soar, and Hafeez-Baig (2016) had similar findings in their systematic review of older people, assistive technologies, and the barriers to adoption. In a previous acceptance and attitude study concerning home robotic devices for older people, researchers discovered that healthy older people prefer that robots not handle their personal care tasks (Smarr et al., 2014). Other older people approved of interaction with a robot as long as the robot did not fully replace human care (Moon, Danielson & Van der Loos, 2012). Older people are more willing to accept home robotic devices if the robot has a meaningful function in their everyday lives. The robot also should be small enough to fit into the older people's home environments, and verbal communication used only to support the robot's main functions, not as an attempt to create an artificial companion (Deutsch, Erel, Paz, Hoffman & Zuckerman, 2019).

Studies have shown that some older people are not ready to adopt health-related technologies (Heart & Kalderon, 2013; Liu, Stroulia, Nikolaidis, Miguel-Cruz, & Rincon, 2016). However, previous research also suggested that older people generally have positive feelings and attitudes toward technologies (S. H. Fischer, David, Crotty, Dierks, & Safran, 2014; Yusif et al., 2016), and some older people expressed that they want and need to learn new things such as technology (Boulton-Lewis, Buys, & Lovie-Kitchin, 2006). Boulton-Lewis et al. (2006) reported that general health, transportation, and previous learning experiences could prevent individuals older than 74 years from learning new things. However, their research does not detail the ways in which learning is prevented in later life. Furthermore, the research also does not reveal how prior learning differs among respondents from various educational levels, even though the research described that a higher educational level provides a significant positive factor for future learning. Based on the review of Fang et al. (2018), interest in and use of ehealth applications decrease with age, and people over 70 years old are much less interested in ehealth than those who are younger. Nevertheless, age cannot be considered a barrier for ehealth technology use.

Previous research showed that home-based consumer health technologies support older people's dignity, autonomy, and independent aging at home (Garçon et al., 2016; Reeder, Meyer, et al., 2013; Sparrow & Sparrow, 2006) and do not interfere with their ability to move around or leave home (Reeder, Meyer et al., 2013). Access to and support for technology use provided to older people, especially in the early weeks of its domestication, may be the most important factor in successful technology adoption (Kamimura, Ishiwata, & Inoue, 2012; Mitzner et al., 2018). However, other studies have found that older people prefer face-to-face contact with health-care professionals and that the use of ehealth services may create in older people a fear of losing that contact (Fang et al., 2018; Spann & Stewart, 2018; Sparrow & Sparrow, 2006).

Older people's care networks often consist of numerous people, namely family members and formal and informal help from various health-care providers (S. H. Fischer et al., 2014; Fortunati, 2018; Gitlin, 2003; Hirvonen, 2018). Discussions continue for and against the use of robots in a care network comprising feeling and caring actors (Eurobarometer, 2012; Shaw-Garlock, 2019; Sparrow & Sparrow, 2006; Taipale, Luca, Sarrica, & Fortunati, 2015). For instance, Pols' (2012, pp. 34–35) ethnographic study introduced the concept of "love for the device," which

described a friendship between the care technology and the client. Additionally, in Pu, Molyle, Jones, and Todorovic's (2018) research, interaction with social robots can improve, for example, medication compliance.

Caregivers have different needs for, attitudes toward, and barriers to health-related technology adoption than those of older users (Alaiad & Zhou, 2014; S. H. Fischer et al., 2014; Savela, Turja, & Oksanen, 2017). Older people are more willing to accept robots in elder care than working-age adults (Savela et al., 2017; Taipale et al., 2015). In fact, previous investigations suggested that care providers and caregivers themselves often are the most significant barrier to the implementation of technology in health care (Whitten & Mackert, 2005). According to an online survey in the Finnish home-care context, most practical nurses felt very competent in using various technologies at work but were not yet ready to adopt robotic assistants in home care. Participants in that study felt that robots decrease equality among workers because of different digital competences and feared the technology would replace human workers (Pihlainen, Kärnä, & Tukiainen, 2016).

To summarize, the previous research about health-related technology and aging is comprehensive, but also a bit scattershot, leaving multiple gaps in understanding older people's need for ehealth services. Our research particularly extends the prior research about ehealth technology and learning. In addition, by using the domestication theory, our research binds together many of the areas about the ehealth use and adoption that have been fragmented in previous research.

METHODS

In the present study, we looked at a robotic medication-dispensing service in the everyday lives of older people in Finnish Lapland through the concept of domestication. Older people's digital competence and social network played an important role in the study. The Ethical Review Committee of the Lapland University Consortium evaluated and approved the research plan for the project.

Robotic Medication-Dispensing Service

A robotic medication-dispensing service is the program considered in this study. The word *service* in the paper refers always to the robotic service unless otherwise noted. The service includes a medication-dispensing robot at the service users' homes (see Figure 1).The service is offered by a public home-care service that assists at-home clients with their long-term and multiple medications by reminding the clients when the medicine should be taken. Before our study, the service was already on the market and in use in Finnish Lapland. A pilot period of the service had just ended before we contacted the home-care services to investigate it. Before clients started to use the robotic medication-dispensing service, they took all their medicines independently or with assistance of a practical nurse from home-care services by using manual dispensers.

Practical nurses helped clients learn to use the service and facilitated that use; they also refilled the robot with preloaded medication bags every 2 weeks. The robot is designed to dispense only tablet medicine on a regular basis, and thus cannot dispense liquid medicine or medicine taken only "as needed." The home-care service monitors the robot remotely and both service users and the home-care service can exchange messages through the robot. However, we

Figure 1. This photo was taken at a service user's home as part of the data collection. The medication-dispensing robot is visible on the client's kitchen table, near the window.

did not actively investigate the message feature in this study. As part of the home-care service, the robotic medication-dispensing service was offered free of charge to the clients.

The robot is about 38 cm by 38 cm by 24 cm and it has a curved shape with a flat base, suitable for placement on a table, and is white in color. The robot alerts the service user when it is time to take a medication, and, when activated by the service user, it dispenses preloaded medication. The service user requests the dispensing by pushing a large button on the front of the robot. The robot communicates with the service user in prerecorded sentences with a human-sounding male or female voice per the user's preference. For example, the voice reminds the service user to take the medicine with water. In addition, there is a short alert voice, light signals, and messages on the touchscreen positioned on the front of the robot. If the service user does not respond to the command to take the medication within 2 hours, the robot stores the medication bag and sends an alarm to the home-care security team, which is included in the service.

In autumn 2019, 17 older people were using the robotic medication-dispensing service in one Lapland municipality. However, based on the assessment of one professional involved in the service, not all of the service users were capable of participating in our study.

Participants

All participants (N = 11) were recruited from a public home-care unit in a municipality in Finnish Lapland. The participants comprised clients (n = 5; henceforth "service users"), practical nurses (n = 4), and other health-care professionals (n = 2; henceforth "professionals") who were not practical nurses but organized the robotic medication-dispensing service within home-care services. The clients in this study were using the robotic medication-dispensing service for at least 2 months, and the practical nurses had filled the robot at least once, before our study commenced. The professionals were familiar with the service, but they had not

necessarily used it. We selected the practical nurse participants from recommendations from other practical nurses in the field and a professional who was participating in the study.

One professional proposed a group of service users whom she saw as capable of participating in a study. In total, seven service users agreed to participate in and began the study. However, one service user died, and one's condition deteriorated before an interview was possible. Thus, five service users remained in the study until the end. The service users were 73–89 years old (M = 81.4, SD = 5.4). All lived alone and had impaired memory. Service users either described their memory as impaired or issues related to impaired memory were observable in their behavior. They lived near a city center but still in a sparsely populated area. Before retirement, three service users had used technical devices related to their career, one was not sure if she had, and one had never used technical devices in her work life.

In addition to the five active service user participants of our study, we considered as an aspect of our data those service users who refused the service or who had begun but later rejected the service. They are older home-care clients who potentially could have benefited from the robotic medication-dispensing service; only the practical nurse and professional participants of our study have met them. The authors of the study did not interview or observe them and we have no detailed demographics on them.

Not all participants participated in all of the ethnographic actions presented in the next section. For the practical nurses, their work schedules did not allow all of them to participate all the actions, while one service user did not want a researcher to observe her so early or so late in the day when she was prescribed to take her medication from the robot. Thus, four practical nurses participated in the study but only three of them were interviewed and two of them were observed; specifically, only one practical nurse was both interviewed and observed. To protect all the participants' privacy, we will not indicate gender and will refer to all participants as *she*.

Ethnographic Approach

The present study is an ethnographic case study. The ethnographic approach provides an opportunity to examine subjects in their own social and cultural context, thus providing a better understanding of the domestication process (Fetterman, 2010; Pols, 2012). At the time of this research project, the literature provided very few ethnographic studies of older people and ehealth services.

The empirical data were collected from February to June in 2019. The data included semistructured interviews complemented with observations and photographs. The interviews included participating service users (n = 5), practical nurses (n = 3), and professionals (n = 2). The first author interviewed the practical nurses either on the phone or face-to-face at their offices, depending on their work schedules. Both authors participated in the professionals' face-to-face interviews in the professionals' offices. Service users were interviewed by the first author face-to-face twice in their homes. Service users also were asked to keep a diary during a 2-week period between the interviews. Unfortunately, two participants refused and three did not remember to do it. The purpose of the diary was to function as a resource for the second interview, but because the service users had not filled the diaries, we conducted the second interviews without that resource.

The first author also observed service users (n = 4) and practical nurses (n = 2). Each of these service user was observed as she took her medication from the robot. The practical nurses, however, were observed during the entire home-care visit, which included filling of the robot with medicines. The first author served as "a complete observer" (Junker, 1960) with the goal of

not participating in the any activities or interacting with the participants while observing. However, the participants knew they were being observed and could see the observer; some of the participants did communicate with the observer during the action. The observer did take field notes by hand related the robot use. The author also snapped a series of photographs of the robot's location in each service user's home after the interview or observation with the goal of securing at least a few usable images that could contribute to the data analysis. For the final data, one photo from each home ($n = 5$) with the widest view of the space were chosen (see Figure 1).

The first round of interviews with the participants lasted from 29 to 64 minutes, and the second interviews with the service users lasted from 14 to 46 minutes, with only one being longer than 30 minutes. The first interview was the main interview and included more themes and questions than the second interview, which focused on themes that we did not cover adequately in the first interview. The observations of service users and practical nurses lasted from 1 to 60 minutes, and field notes totaled 2,139 words. The time variation resulted because observations of the practical nurses lasted longer than those of the service users.

Our interview protocol specified the topics in advance. The first round of interviews for all participants addressed the topics of medical dispensing robot and remote care, older people as service users, learning to how to use the robot, and use experiences of the robot. In addition, service users' interview topics included detailed demographics. The interview topics for the practical nurses and professionals focused on the use of the robot related to their own work as well as their assessment of domestication from the service users' perspectives. Examples of interview questions were as follows: "How has the robot changed the work of home care?" and "How does the use of the service support older people living alone at home?" During the second interview with service users, the questions focused on practical topics related to their everyday life and use of the service. Those interviews included, for example, the following questions: "What did you do yesterday?" "What do you do to obtain the medicine bags that you get from the robot?" and "If you had a problem with the robot, what would you do?"

The participants gave informed consent to participate in the study. We conducted the interviews in Finnish, which all participants spoke fluently. Interviews were audio-recorded and transcribed verbatim by a transcription service. Only the data extractions presented as analysis support later in this article were translated into English by a professional translator from the University of Lapland. No changes to the meaning of the participants' comments were made during the translation. In total, 67,166 words were transcribed.

Data Analysis

We analyzed the data from the semistructured interviews and observations deductively, using a qualitative thematic approach guided by the concept of domestication and previous empirical research. The photographs were analyzed using Barthes' (1977) semiological analyses and the concepts of denotation and connotation. Denotations describe obvious meanings of the photograph that the viewers can see. Connotations are more complex and abstract meanings of the photo; we analyzed these using a qualitative thematic approach and guided by the concept of domestication. Experiential knowledge and cultural associations are related to connotations. In this study, this means that connotations were analyzed not only based on what was seen in the photos, but also based on what the respondents expressed in the interviews (Bouzida, 2014; Penn, 2007). The photo

analysis, as such, did not result in any new data subcategories, but this analysis was consistent with and supported the subcategories created in the analysis of the interview data.

For the coding, we used the NVivo 12 qualitative data analysis software. First, the authors analyzed the first interview together and created the preliminary coding categories. Next, the first author analyzed the rest of the data and created new subcategories as needed to describe the data better. The first round of thematic analysis produced 46 subcategories. In the second round, we clustered the categories into higher level categories according to the four dimensions of the domestication process: appropriation, objectification, incorporation, and conversion. In the following section, we present the results according to these dimensions. All the data quotes are from the interviews.

RESULTS

Appropriation

The data categories and instances concerning the appropriation of the robotic service are presented in Table 1. Appropriation of the service took place in agreement among the home-care service, the service user, and her family. Two service users themselves initiated the start of the service. All participating service users had impaired memory, and the need for the service was precipitated by the older persons forgetting to take their medication entirely or at the right time. One service user expressed that she saw the service as needed also because of the alarm sent to the security team if the service user did not take the medication at the indicated time; she noted that this also alleviated some of her son's concern. In addition, the service reduced the practical nurses' work pressure and promoted efficiency of their work. These represent the initial meanings of the service.

The service users expressed that they felt that learning to use and using the service right away were easy, regardless of their previous experience with digital technology. Ease and routine use of the service were also evident from the observations.

> '*Cause it's so easy to use. You just press the button and that's it.* (Service user 1)

In the beginning, practical nurses visited service users regularly at the time to take medication to ensure they used the robot properly. The practical nurses reported that some service users needed more support than others at the start of the robot service. One professional pointed out that, in her view, the best time for older people to start using the robot would be when the memory has started to deteriorate just a bit but the ability to learn is still preserved. In such situations, the service user still would be capable of learning and internalizing the use of the robot.

Based on the practical nurse and professional interviews, only a few service users who agreed to use the robotic medication-dispensing service rejected on their own its use later. The service users referred to in these comments are different from the active participants of the study. This robot rejection happened once because a service user found the sound of the robot irritating; the other reasons are unknown. The practical nurses and professionals also reported cases where older people did not want to start the service use at all. The reasons for the rejection were related primarily to the technical and aesthetic features of the robot; the cognitive and physical difficulties of the older people, such as impaired vision or poor health condition; situations in which older people were not willing to learn something new because they preferred the old way of

Table 1. Summary of the Results Concerning the Clustered Category Appropriation.

Subcategories	N = number of instances from all interviews, observations, & photographs	n = number of instances from service users' interviews, observations, & photographs at service users' home	n = number of instances from interviews & observations of practical nurses	n = number of instances from interviews with professionals
Easy to use	55	32	13	10
Needed service	36	15	16	5
Nonuse and rejection of use	16	0	10	6
Safety	13	5	4	4
Instructions given by the robot	10	4	6	0
Positive attitude	10	9	0	1
Previous digital technology experience	10	10	0	0
Makes work easier	7	0	4	3
Efficiency	2	0	0	2
Negative attitude	2	0	1	1

dispensing medication; or worry over the cost of the service. Some practical nurses also expressed their own uncertainty toward the robotic service, for example, in terms of how easy it is to use, how useful it really can be, or if it has the potential to replace them. The practical nurses in our study had official training or informal induction with work colleagues before they started working with the service.

Objectification

We present the data categories and instances concerning the objectification of the robotic service in Table 2. The location for the medication dispensing robot was decided together by the service user and the home-care service. The most popular location for the robot was the kitchen area. The general rule seemed to be that the most practical place for the robot was close to the water faucet because, according to the instructions given by the robot, the medicines should be taken with water. One service user participant at first felt that the robot was big and ugly but got used to it quickly. Based on the comments from the practical nurses and professionals some potential service users, but not the active participants of the study, had refused to take the robot home because of its size.

> *She does not approve of the device because of its size. She thinks that the size is the problem, that she does not want to have it in her home. Her apartment is pretty small.* (Practical nurse)

Overall service users adapted well to the robot being in their home. However, one service user did not want to wipe the dust off the robot, and one did not want to move the robot by herself. Based on the pictures taken, the latter service user did not place objects near the robot in the kitchen. In these cases, the robot can be described as a foreign object. Only one participant was worried

Table 2. Summary of the Results Concerning the Clustered Category Objectification.

Subcategories	*N* = number of instances from all interviews, observations, & photographs	*n* = number of instances from service users' interviews, observations, & photographs at service users' home	*n* = number of instances from interviews & observations of practical nurses	*n* = number of instances from interviews with professionals
Placement at home	31	22	7	2
Design	28	9	13	6
Adopted object	22	15	5	2
Foreign object	7	3	4	0
Privacy	2	2	0	0

about privacy issues. The concern was with the preloaded medication bags because the service user's name could be seen (based on the client interview). She took special care to dispose the bags carefully so that her name would not be visible.

Incorporation

The data categories and instances concerning the incorporation of the robotic service are presented in Table 3. Incorporation of the service in the service users' everyday lives was successful. Service users incorporated the service as part of their daily routines, even if they sometimes felt that the robot limited their lives because they had to schedule their day around taking the medication. Negative feelings identified in the service user interviews related to the stress of needing to be at home when it was time to take medications. If the service user misses the medication, an alarm is sent to the home-care security team. It is possible for the service users to take their medicines with them if they leave the home, but a practical nurses needs to help with that.

According to the observations, all service users had an established routine for using the robot and the order in which they performed various activities. Because of the instructions given by the robot, the routine did not vary much across service users. Service users took the medication from the robot one to three times a day. The medicine dispensing did not require much time, but the more often the service users needed to take medication, the more the service users felt the robot limited their lives. Even if the robot did not change the timetable for medication service users already had, some service users raised their concern about that the robot's alert voice woke them up in the morning, and one service user sometimes had to delay her bedtime because of the robot's schedule.

> Interviewer: *You said that you wake up rather early.*
> Service user 4: *I guess so, between 5 and 6.*
> Interviewer: *When do you get the first doses of medicine?*
> Service user: *Around 7:30. Yeah, that's about right.*
> Interviewer: *You've been awake for a while when the medicine arrives.*
> Service user: *Yes. When the medicine comes, I grab a quick coffee and go for a walk.*

For some service users, the robotic service reduced the number of times practical nurses visited their home, and, in other cases, the practical nurse visited as often as before. One service user was

Table 3. Summary of the Results Concerning the Clustered Category Incorporation.

Subcategories	N = number of instances from all interviews, observations, & photographs	n = number of instances from service users' interviews, observations, & photographs at service users' home	n = number of instances from interviews & observations of practical nurses	n = number of instances from interviews with professionals
Everyday routines	40	40	0	0
Everyday routines related to service	35	32	3	0
Names given	31	20	7	4
Self-efficacy	25	22	3	0
Limiting or controlling life	17	16	0	1
Companion	16	13	2	1
Unneeded service	16	8	4	4
Routine	15	11	4	0
Price	11	3	5	3
Reduce contact with practical nurses	10	2	4	4
Sparsely populated area	8	0	6	2
More personal care	5	0	0	5
Not time-consuming	4	4	0	0
Activities, structure	4	4	0	0
Interaction about the service with the service user	2	0	2	0
Filling takes a lot of time from the visit	1	0	1	0
Works reliably	1	0	0	1
Easily approachable	1	0	0	1

sorry that the service reduced contact with practical nurses but expressed her happiness that the service was less expensive than the cost for the practical nurse's visit. A few service users and practical nurses reported that, in some cases, despite the robot, practical nurses were coming to clients home multiple times a day to address some other aspect of client's health care than medication. In those cases, the robotic service can be defined as unneeded, excluding cases where the timing of the medication must be exact. One service user stated in the interview that she could do without the service in her everyday life, even if she would not like to.

The service users in our study described the robot as a companion or a friend, and one service user even called it "pal." Other names given by the service users for the robot in the interviews and observations were gizmo, computer, contraption, rollator (a walker on wheels with a seat), bucket, cannikin, clunker, cask, and memory. Practical nurses and professionals did not want to call the device "a robot" in front of the clients because they were afraid it would frighten them. They mainly called the device the "medication dispenser" or by its trademark.

Conversion

Table 4 provides the data categories and instances concerning the conversion of the robotic service. Conversion has been characterized as the last phase of the domestication process, and it can be seen that the participants reached the phase with the present service. Overall, service users were satisfied with the service and would recommend it to a friend. During the observation, one service user was very proud of the robot and was pleased to show it to visitors. Practical nurses and professionals also felt that service users were satisfied with the service, and two practical nurses and two professionals stated that they would like to have more service users of the service in the future.

Technical challenges related to learning and using the service were reported mostly by the practical nurses. Additionally, observations confirmed that the practical nurses' interaction with the robot (e.g., filling it) was more complicated than the use of the service was for the service users simply because there were many different steps for the practical nurses. Based on the observations, the practical nurses benefited more from the instructions given by the robot than the service users did. Routine filling of the robot was seen as a challenge, especially for practical nurses who seldom filled the robot. A further technical challenge was the limitation that the robot cannot be used for liquid medicines and irregular medication needs, which was confirmed within the service user interviews and photographs.

Service users and practical nurses were satisfied with the technical support available or accessed through the service. For practical nurses, a paper guide with pictures and/or a phone call to the service's technical support were the primary ways of getting help. One practical nurse

Table 4. Summary of the Results Concerning the Conversion of the Clustered Category Conversion.

Subcategories	*N* = number of instances from all interviews, observations, & photographs	*n* = number of instances *from service users' interviews, observations, & photographs at service users' home*	*n* = number of instances from interviews & observations of practical nurses	*n* = number of instances from interviews with professionals
Technical support	66	24	30	12
Technical challenges	64	16	33	15
Social practices	57	25	20	12
Satisfied	47	30	13	4
Negative feelings	21	8	5	8
Remain independent	19	4	4	11
Positive feelings	19	14	2	3
Neutral meaning	14	9	5	0
Neutral feelings	9	7	2	0
Rare occasions	6	0	6	0
Able to use independently	4	4	0	0
Home as long as possible	4	3	0	1
Many different steps	2	0	2	0

used the paper guide during the observation. If, on the rare occasions that service users would experience challenges with the service, they stated they would rely or had relied on their children or home-care professionals for assistance.

Interviewer: *If something went wrong, what would you do?*
Service user 5: *I'd have to contact the people at home care.*
Interviewer: *Right, you've got their number, don't you?*
Service user: *Yeah, I've got it alright. But I haven't needed it yet.*

During the observations, all service users were able to use the robot independently by following the instructions provided by the robot; no service user required further support during the observation. One practical nurse reported that, for one service user, the home-care service had placed a sticky note on the robot to support use of the device. Figure 1 shows the note glued to the right side of the robot. The note says, "Drugs can be obtained between 7 and 10 by pressing the green button. The device reminds you to take medication by beeping and speaking."

The digital competences of the service users, which reflects one's knowledge, skills, and attitude toward digital technology (Vuorikari et al., 2016), were distributed among the practical nurses and other home-care professionals, the children of the service user, and the robot itself. Even if service users defined the service as "easy to use," the use would not be successful without practical nurses filling the robot and the voice and other signal instructions given by the robot. Participants, especially professionals, saw the service as useful for older people who want to remain independent, which can be seen one of the stabilized meanings of the service.

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate the use of a robotic medication-dispensing service using a robot in the everyday lives of older people in Finnish Lapland through the concept of domestication. According to this study, a robotic medication-dispensing service provides a potential approach for managing the medication intake of older people with impaired memory who are living at home. In reality, however, support from a client's social network is needed for learning and using the robotic service. This finding is in line with previous studies (Kamimura, 2019; Kamimura et al., 2012; Kamimura & Ito, 2014, Ligons et al., 2014; Reeder, Demiris et al. 2013).

In the current study, service users were satisfied with the robotic medicine-dispensing service and felt, even from the introduction of the machine into their homes, that the robot was easy to learn and use. Their education level or previous experience with digital technology did not affect their ability to learn to use the service, which is contrary to what has been reported previously (see Boulton-Lewis et al., 2006). Barriers for not starting or continuing to use the service were related to technical and aesthetic features of the robot and cognitive and physical difficulties, such as impaired vision or poor health condition of the older people. Previous studies also identified some technical features (Kamimura, 2019; Ligons et al., 2014) and design elements (Deutsch et al., 2019; Fang et al., 2018; Turner & McGee-Lennon, 2013) of an ehealth service as barrier for its acceptance and use. Additionally, the robotic medicine-dispensing service users who were not willing to learn this new technology or who were concerned with the cost of robot service noted these aspects as barriers. Several previous studies found that older

people prefer not to change their current care to an ehealth service (Fang et al., 2018; Moon et al., 2012; Smarr et al., 2014; Spann & Stewart, 2018; Sparrow & Sparrow, 2006).

In previous medication dispensing service studies, older people with cognitive difficulties, such as a memory disorder, have been the typical subjects (e.g., Kamimura 2019; Kamimura & Ito, 2014; Ligons et al., 2014). Cognitive challenges can increase the difficulty of some tasks related to a technological service use but not the actual drug taking (Ligons et al., 2014). In our study, all participating service users had impaired memory. Based on our results, cognitive impairment did not affect the daily independent use of the service. However, the health-care support team took into account the impaired memory by facilitating the robot use, when needed, with a note glued to the robot. In addition, the aim of home-care services was to domesticate the robot to service user's home before impaired memory complicates the learning process.

The social aspect of the domestication process (Bakardjieva, 2010; Haddon, 2007) of the robotic medication-dispensing service was important. According to Mitzner et al. (2018) and Kamimura et al. (2012), personal support—provided particularly in the early weeks in the domestication process—produces a smoother adoption process, which was seen to occur during the present research. Practical nurses provided support for the service users in the beginning, according to service users' needs. During the domestication process, digital competences (Vuorikari et al., 2016) of the service users were distributed (Airola et al., 2020; Lipponen, 2010; Rasi & Kilpeläinen, 2015) among the practical nurses and other home care professionals, children of the service user, and the robot itself (S. H. Fischer et al., 2014; Fortunati, 2018; Gitlin, 2003; Heart & Kalderon, 2013; Hirvonen, 2018). Even when service users defined the service as "easy to use," the use would not have been successful without the practical nurses filling the robot and the instructions given by the robot. Based on our findings, and in line with previous research (Eurobarometer, 2012; Pols, 2012; Shaw-Garlock, 2019; Sparrow & Sparrow, 2006; Taipale et al., 2015), we do see the medication-dispensing robot as part of the care and social network of older people. Peer-to-peer support did not exist in our findings, even though the literature suggests it is a key principle when considering older users' digital competences, especially for those living in sparsely populated areas (Heart & Kalderon, 2013; Ng, 2007; Rasi & Kilpeläinen, 2015).

Some service users felt that the service limited their lives, which caused negative feelings. This result is inconsistent with previous research, which claimed that home-based health technologies support older people's autonomy and do not interfere with their ability to leave their home (Garçon et al., 2016; Reeder, Meyer, et al., 2013; Sparrow & Sparrow, 2006). However, it must be borne in mind that the nature of different home-based health technologies varies, which in turn impacts users' perceptions of and domestication of the various devices. Additionally, in our study, one service user held negative feelings about the service reducing contact with the practical nurses, which is in line with previous findings that older people prefer face-to-face contact with health-care professionals (Fang et al., 2018; Spann & Stewart, 2018; Sparrow & Sparrow, 2006). However, the same participant felt happy of that the service was less expensive than the practical nurse visits (see Turner & McGee-Lennon, 2013; Yusif et al, 2016). Practical nurses and professionals also felt a level of personal uncertainty toward the robotic service. Moreover, they chose not to call the device a robot because, in their own words, they did not want to frighten the service users. Our supposition is that it might also be because of their own attitude toward the meaning of this technology in use, as previous research suggested that older people are more willing to accept robots in elder care than working-age adults (see Pihlainen et al., 2016; Savela et al., 2017; Taipale et al., 2015; Whitten & Mackert, 2005).

The cultural context in the domestication process (Bakardjieva, 2010; Haddon, 2007) relates to the area where the study is situated, Finnish Lapland, and the culture and history of the participants. Both use and nonuse of the robotic medication-dispensing service were related to how it fit in with the participants' existing technology-related cultural understanding. On the other hand the robotic medication-dispensing service was a good fit for older people in Finnish Lapland because, despite their previous digital competences (see Rasi & Kilpeläinen, 2015), it was easy to use. On the other hand, older people were used to coming and going more freely, which made some of them think the service was restrictive and, in that way, did not follow the familiar cultural practices of older people in that region (see Airola et al., 2020). Additionally, the rather large size of the robot was inconsistent with the compact size of some older people's apartment, as one practical nurse expressed in her interview.

The final meanings of the service within this study are linked to Finnish and European care policy (Kröger & Bagnato, 2017; Ministry of Social Affairs and Health and the Association of Finnish Local and Regional Authorities, 2015). Participants, especially the professionals, saw the service as useful for older people who want to remain independent. However, the results of this study did not suggest that the robotic medication-dispensing service users would feel more independent as compared to home care visits. Additionally, although the Finnish government's goal of aging in place or living home as long as possible were feasible given the results, service users did not seem to connect the service and the possibility of remaining at home. Moreover, based on the results, we disagree with the premise that older people are not ready to adopt health-related technologies (see Heart & Kalderon, 2013; Liu et al., 2016) if these technologies are well designed for the target group (Deutsch et al., 2019) and social network support is available.

The present study had limitations. The authors had to rely on the help of health-care professionals when recruiting participants, and this may have caused some selection bias. The ethnographic approach would have been richer with more frequent, longer observations, and more visual research material, such as videos of the robot's use as part of a client's everyday life. Such additional avenues to collect data would make it possible to gain an even better understanding of the domestication process. In addition, diary material would have improved information on the everyday-life perspective, although how to gather that information from people with cognitive and/or memory issues needs to be more clearly investigated. Using interviews as the primary means of data collection for older people with impaired memory can also be seen as a limitation, as such a condition may have affected the service users' answers to questions. Study reliability would have been improved if the analysis process had been carried collaboratively by both authors, compared to the authors analyzing only the first interview together to create the preliminary coding categories and then the first author analyzing the rest of the data by herself.

IMPLICATIONS FOR RESEARCH, APPLICATION, AND POLICY

The results of this study can be used to develop and/or improve home-care services in sparsely populated areas and to increase people's understanding of ehealth services such as medication dispensers. From a research perspective, our findings did not replicate the findings of other research in their entirety. Thus, future research into the role of culture and history in encouraging older persons to agree to use ehealth technologies and in lowering the various barriers is needed toward that goal. In addition, in line with our research approach, further

strengthening of ethnographic research practices in the field of ehealth services would help establish a fuller understanding of the domestication process of health-care technologies among older people in sparsely populated areas. More specifically, our findings have provided areas for future clarifications needed regarding (a) the role of peer-to-peer support when domesticating ehealth technologies at home of older people in sparsely populated area, (b) understanding whether older people in sparsely populated areas are ready to adopt ehealth technologies, and, (c) the willingness of practical nurses, nurses, and other health-care professionals to bring ehealth to Finnish Lapland. From an application perspective, our research surfaced two primary concerns that service users raised: the aesthetics of the technology and the perceived constraints the service users felt in regarding the robot (inflexibly) dispensing medicines at specific times. Acknowledging these concerns could be useful not only for technology designers but also the health-care support personnel in helping service users manage conflicting expectations for technology use. Finally, our study results align with the Finnish and European care policy and the service supports independent living and aging in place. Therefore, we encourage the municipality in Finnish Lapland to roll out the service on a wider scale, including for rural areas, so that the Lappish can grow old at home. However, such a goal also would require policy makers to investigate the significant concerns of the potential service users while simultaneously addressing these concerns to lower or eliminate the barriers to adoption of ehealth technologies.

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