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Home-care robots - attitudes and perceptions among older people, carers and care professionals in Ireland: A questionnaire study

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Abstract

Many countries face major challenges to ensure that their health and social care systems are ready for the growing numbers of older people. As a way of realising ageing in place, assistive technologies such as home-care robots are expected to play a greater role in the future. In Asia and Europe, robots are gradually being adopted as a public policy solution to the workforce shortage. Yet there is still a strongly held belief that such technologies should not be part of human and personal care services such as older people's care. However, there has been little research into attitudes and perceptions of potential users regarding home-care robots which can provide companionship and support with activities of daily living.

In order to explore these in more detail, a questionnaire study was carried out in Finland, Ireland and Japan. This study reports findings from the Irish cohort (114 Older People, 8 Family Carers and 56 Health and Social Care Professionals (HSCPs)). Seventy per cent of the total respondents (N=178) reported being open to the use of home-care robots, and only one quarter had a negative image of robots. People with care responsibilities in their

private capacity expressed more interest in, and readiness to use, home-care robots, while stressing the importance of “privacy protection” and “guaranteed access to human care”. Both older people and HSCPs identified observation and recording of older people’s mental and physical condition as desirable functions of such robots, whereas practical functions such as fall prevention and mobility support were also deemed desirable by HSCPs.

There is generally positive interest in home-care robots among Irish respondents. Findings strongly suggest that the interest is generated partly by great need among people who deliver care. Should such robots be developed, then careful consideration must be given to user-centred design, ethical aspects and national care policy.

Keywords: Ethics; Geriatrics; Technology; Surveys and Questionnaires; Community Health Nursing; Public Policy; Social Work

What is known about the topic:

- Assistive technologies such as home-care robots are expected to play a greater role in bringing about ageing in place.
- Previous opinion polls and surveys in Europe have highlighted generally negative attitudes towards robots in care and human services.
- The lack of familiarity with robots, social acceptance, violation of privacy and human dignity, and the absence of user-driven research and development have been given as challenges for social implementation of assistive technologies.

What this paper adds

- There is great and generally positive interest in home-care robots among potential users (older people, carers and care professionals) in Ireland.
- Familiarity, social acceptance and gender do not seem to affect the level of interest in and willingness to support research into and development of home-care robots.
- Professional ethics and the protection of human dignity and autonomy are strong drivers in decision-making among care

professionals regarding the use of home-care robots.

- **Introduction**

People worldwide are living longer than ever, and this is also true in Ireland where life expectancy has risen by several decades in the last 100 years. Life expectancy at birth in Ireland is 80.4 years for men and 84.0 for women (Eurostat, 2017). The number of people with dementia in Ireland is estimated to be 55,266 and is expected to grow at an average rate of 3.6 per cent per year over the next thirty years (O'Shea, Cahill and Pierce, 2017). Many advanced economies face major challenges to ensure that their health and social care systems are ready to make the most of this demographic shift (Ryburn et al., 2009; Kodate and Timonen, 2017; Sheehan and O'Sullivan, 2020) and to promote ageing in place, which is the preference of the majority (Donnelly, Begley and O'Brien, 2019).

Increasingly, more people would like to remain in the home and community of their choice as they age, and home care and support (e.g. with activities of daily living, self-care tasks) is what they need to help facilitate their independent living. In Ireland, people aged over 65 (who need support to continue living at home or return home from hospitalisation) are eligible for the publicly-funded scheme called Home Support Service. Home care support includes medication assistance, self-care, and domestic support. However, the shortage of carers and insufficient hours have been regularly reported (Finn, 2019).

In this situation, and in tandem with aims to realise ageing in place (Hawley-Hague et al., 2014), increasing attention is being paid to the role of technology in supporting healthy ageing and the lives of people with disabilities (Bennett, 2019). There have been growing expectations for development and social implementation of assistive technologies beginning with home-care robots that make use of technologies beginning with Information and Communication Technology (ICT) and sensing technology. Recent studies show promising signs that technological solutions could

support 'ageing in place' (Brims and Oliver, 2019; Krick et al., 2019; Mois and Beer, 2020; Pavolini et al., 2017).

Addressing the anticipated lack of formal care capacity in the era of global ageing, assistive technologies including robots are expected to play a greater role in the future. There is now the potential to provide a mix of human and technological applications to health and social care delivery, and the technologisation of care is high on the agenda for policy and practice (Share and Pender, 2018). Home-care robots have been developed as one of the assistive technologies, and the benefits and challenges of their use have been debated in many countries (Brims and Oliver, 2019).

However, assistive technologies have not yet been widely implemented in society, with some exceptions such as Denmark and Sweden (Alaiad & Zhou, 2014; Granja, Janssen & Johansen, 2018; Johansson-Pajala & Gustafsson, 2020; Liddy et al., 2008; Pirhonen et al., 2020; Postema, Peeters & Friele, 2012; Schreiweis et al., 2019; Wilson et al., 2020). Robotics has great potential for realising home care, and it is estimated that in Finland, 20 per cent of current nursing work could be replaced by robots (Kangasniemi & Andersson 2016). In particular, robots can take over and perform tasks such as delivery of medication and monitoring of patients. Robots can also give reminders to older people with mild to moderate memory impairment by presenting information by voice, illustration, or posture (e.g. Autominder). Of all the assistive technologies available for home care, devices (including robots) that support cognitive functions are the least used (Hammar, Mielikäinen & Alastalo 2018).

Central to the debates over the use of socially assistive robots (e.g. robots designed for providing companionship and/or monitoring safety) in aged care has been concerns over the implications of robotics-aided care for the dignity of those using them (Bennett, 2019; Alzheimer Europe, 2010, p. 58). It has also been reported that the rate of older people's acceptance of wearable technology remains low despite technological improvements (Laitinen, Niemelä, & Pirhonen, 2016; Li et al., 2019; Rantanen et al., 2018; Turja & Oksanen, 2019).

The results of the recent public opinion poll concerning use of digital technology in Germany showed that over 80 per cent of people (N=1986) in Germany had “negative” impressions or “ambivalent feelings” about the use of care robots (Technik Radar, 2018). Furthermore, the latest Eurobarometer (European Commission, 2017) indicates that while 61 per cent of the respondents have a positive view of robots and artificial intelligence (defined as systems that display intelligent behaviour by analysing their environment and taking action – with some degree of autonomy – to achieve specific goals (European Commission, 2018)), 88 per cent agreed that robots and artificial intelligence are technologies that require careful management. In Ireland, 26 per cent (the same as the EU average) of the respondents answered that they are comfortable with robots providing them with services. One finding from this EU-wide questionnaire was that men are more likely to have a positive attitude to robots and artificial intelligence. Previous literature suggests differences in the way that men and women approach the use of robots. The results of a European study indicate that gender, age, and education are all independent variables correlated with the individual's opinions on the use of robots in caring for older people (Hudson et al., 2017). Another study, conducted in Russia, also found remarkable differences in how men and women perceive the acceptability of tasks that robots may do in the hotel industry (Ivanov et al., 2018). The Eurobarometer questionnaire also found that respondents with a positive view of robots and artificial intelligence were more likely to have used a robot, compared to those with a negative view (European Commission, 2017: 60). Familiarity and lived experience may create a different perception. While these findings are illuminating, these questionnaires were targeted at the public at large, and no care-specific questions were asked.

There has been little research targeted at potential immediate users, including older people in receipt of care, and carers and care professionals on the frontline. It is essential to ask not only about their willingness to use home-care robots, but also about their readiness to participate in research and development of such technologies. Co-design and co-production have to be adapted from the initial design stage in order to address certain issues such as a low level of acceptance, infringement of privacy and insufficient

involvement of the public and patients (Robinson, MacDonald and Broadbent, 2014). A recent study suggests that ethical perceptions based on professional ethical principles affect home-care staff members' willingness to use robots (Suwa et al., 2020a, Suwa et al., 2020b). The questionnaire study elucidated the principal factors affecting home-care staff perceptions, which included 'respect for older person's autonomy', 'non-maleficence', and 'beneficence'. This means that industry-oriented research must respect the wishes of older adults and ensure that home-care robots are low-risk. Considering this, it is essential to ask not only about their willingness to use home-care robots, but also about their readiness to participate in research into and development of such technologies.

In recent years, some progress has been made in policy-making for older people's care in Ireland, particularly with the National Positive Ageing Strategy (Department of Health, 2013) and the National Dementia Strategy (Department of Health, 2014). However, the care sector has been underfunded for many years, and the care burden for professionals and family carers has been a major issue (Donnelly, Begley and O'Brien, 2019). The demand for and interest in assistive technologies is likely to increase.

Against this background, the aim of the questionnaire study was to test the following three hypotheses.

Hypothesis 1: (1-A) Irish people are not generally familiar with home-care robots, and (1-B) the majority would have negative views towards the use and development of home-care robots for older people.

Hypothesis 2: Personal profiles (e.g. gender, residence, living arrangements) affect users' attitudes towards and perceptions of home-care robots.

Hypothesis 3: Occupation and care duties affect people's attitudes and perceptions. For example, people who currently provide care would have greater demand for and expectations of home-care robots than those without such duties.

The data was collated from three groups: Older People (OP); Family Carers

(FC); and Health and Social Care Professionals (HSCP) in Ireland. While the survey was carried out in three countries (Finland, Ireland and Japan), this article reports solely on the Irish aspect of the study.

- **Methods**

- **Study Design**

The study used a cross-sectional survey design.

- **Participants**

The targeted participants in this study were potential users of home-care robots (OP, FC and HSCP) in Ireland. HSCP respondents were working across a variety of settings, including the acute and voluntary hospital sector, home care, private home care agencies, primary care and others. Potential users were approached (see 2.4.), and 283 participated in the questionnaire either online or by post. The findings are analysed with a particular focus on responses from 114 OP, 8 FC and 56 HSCP (N=178) who completed the questionnaire. A number of older people filled out only the first few sets of questions, and 105 were deemed invalid.

- **Questionnaire development**

Based on the questionnaire previously carried out in Japan (Suwa et al., 2020), the interdisciplinary teams (nursing, medical engineering, public policy, social work and public health education) in three countries iteratively developed the questionnaire. The questionnaire consisted of basic attributes (background, age, gender) and familiarity with robots, willingness to use a home-care robot, thoughts about the risks and benefits when participating in the development of a home-care robot, viewpoints regarded as important when considering the use of a home-care robot, opinions about (assisted) decision-making for those with cognitive impairments, privacy and dignity when using a home-care robot, and functions expected from a home-care robot. Questions and selection items relating to basic attributes were modified and adapted to reflect the specific context of each country, although core questions were standardised across the three country sites.

The content of the questionnaire survey is summarised in Table 1.

Table 1. Summary of questionnaire content

Category of questions	Illustrative questions
Personal information (Area of residence, age group, gender, use of technologies, care responsibility)	[1] Please indicate your gender and age in years [2] Where do you live? (Please select your county) [3] Are you yourself receiving care? [4] Do you provide care? [5] What are your hobbies/interests? [6] Do you have access to, and can you use the Internet?
Living arrangements	[1] Do you live with someone who is 65 years old or older? [2] Do you plan to continue living in your community? 3-[3] If you have someone (outside your family) whom you can rely on when in need of help or care, how far is s/he living from you?
Familiarity with (home-care) robots	[1] How familiar are you with robots? [2] Are you interested in news about robots? [3] Have you seen an animation/manga in which a robot appeared? [4] Do you have a negative impression of robots?
Views and perceptions about home-care robots	[1] To what extent are you open to using a home-care robot? [2] Would you like to use a home-care robot at home when providing care for your family? [3] To what extent are you open to using a home care robot, including during the research and development stage? [4] To what extent do you place importance on the following items (e.g. safety, convenience – see Table 3) in regard to home care robots? [5] What are your views on decision-making and privacy protection in the use of home care robots?
Views regarding the desirable functions of home-care robots	To what extent do you think it would be desirable for home care robots to provide these types of support indicated below (e.g. medication alert – see Table 4)?

For questions regarding views and perceptions, a four-point Likert scale (e.g. strongly agree, somewhat agree, somewhat disagree, and strongly disagree) was used so that the respondents in Ireland, Finland and Japan could clearly indicate the degrees of their perceptions.

A pilot study was conducted in Japan among 13 individuals (older people, family carers, and home-care staff aged between 40 and 80 years; nine females and four males) to refine the questionnaire. Corrections were made to the questionnaire based on the results, and on subsequent discussions held among the tri-country research team.

- **Data Collection Methods**

Data was collected from the following three participant groups:

- 1) Older people (OP) aged 65 years or older who are/may be using health or social care services;
- 2) Family caregivers (FC) of older people aged 65 years or older who are/may be using services related to nursing care; and
- 3) Health and social care professionals (HSCP)

For the inclusion and exclusion criteria, we adopted the chronological age of 65 years or older, which is the WHO's definition of older people. We excluded older people or family caregivers who have impaired cognitive ability, in line with the Assisted Decision Making Capacity Act 2015, although the capacity to participate was presumed for those who completed the survey questionnaire.

A different data collection strategy was adopted for OP and FC on one hand, and HSCP on the other, reflecting the data protection rules and the results of the research team's negotiation with two supporting organisations (Table 2). These two organisations are: one non-governmental, charitable body (Age Action Ireland, AAI); and another professional academic society (Irish Gerontological Society, IGS). The AAI (established in 1992) is an advocacy group for older people, and acts as a network of individuals, including older people and carers.

Founded in 1951, the IGS is one of the oldest multidisciplinary societies in the world concerned with gerontology. The Ireland-based Society consists primarily of physicians in geriatric medicine, nurses and professionals associated with care of older people, psychiatry of old age, psychology of ageing, social gerontology, the therapies associated with rehabilitation of older people, and professionals involved in social and built environments and technology.

Table 2. Recruitment and data collection for the three cohorts

Older People & Family Carers	<ul style="list-style-type: none"> • The AAI agreed to act as a gatekeeper organization, and distributed the questionnaire to their membership (N=1,154). The diverse membership of Age Action facilitated the recruitment of both older people and family caregivers. • The respondents were invited to fill out the survey questionnaire and place it in the enclosed stamped and self-addressed envelope.
Health and Social Care Professionals	<ul style="list-style-type: none"> • The IGS facilitated the distribution of the HSCP questionnaire. Members of the IGS (N=430) represent professions involved in areas such as health and social care, economics, social and built environments and technology. • In order to comply with the General Data Protection Regulation (GDPR) in the European Union, the IGS agreed to forward a briefing out to those on their own mailing lists, with an option for those interested in participating in the study to join a separate mailing list (which would be held and managed by the research team). Once the IGS shared the email list of interested participants with the research team, a link to an online version of the questionnaire was administered to HSCPs via SurveyMonkey® • Participants completed the online version of the questionnaire.

Regarding the process of obtaining consent from each participant, the supporting organisations agreed to forward a briefing out to those on their own mailing lists, with an option for those interested in participating in the study to join a separate mailing list (which was held and managed by the research team). The questionnaire form also clearly stated that completion and return of the questionnaire would be viewed as consent to participate.

For all participants, the front page of the questionnaire provided several pictures (Figure 1), and a definition of home-care robots, as follows: The term "home care robot" used in this survey is a general expression for devices and systems that perform functions such as monitoring of older people and their surroundings, and provision of support for older people and/or their caregivers (including communication that enables interactive conversation, assistance with activities of daily living or managing medications).



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Figure 1. Sample images of home-care robots shown in the questionnaire

The response rates for OP and FC on the one hand and those for HSCPs on the other were 10.6 per cent and 13.0 per cent respectively. While we aimed to collect data from 150 respondents in total, we did not perform a power analysis, given that this study was conducted with one of the ‘hard to reach’ groups in a relatively small sample population (4.76 million in total, 19.1 per cent of whom are 65 years old and over, 2016 Census Data). The data collection period was from November 2018 to February 2019.

- **Data Analysis**

Following the completion of data collection, data was entered into Excel format, which was then imported into the Statistical Package for the Social Sciences (SPSS Version 19.0). Quantitative survey data was analysed using

SPSS statistical software to produce descriptive and bivariate results. Chi square test was employed for the analysis. The significance level for this study was set to 5 per cent.

- **Ethical approval**

Ethical approval for the Irish study was granted by University College Dublin's Human Research Ethics Committee – Humanities (HS-18-81-Kodate) on 25th October 2018. The information sheet was enclosed with the questionnaire in the envelope, or for the online survey, it was included in the questionnaire. The sheet explained the purpose of the study, possible benefits to science and society, and the voluntary nature of participation.

- **Results**

- **Familiarity with and willingness to use home-care robots**

Hypothesis 1 consists of two sub-sets: (1-A) Irish people are not generally familiar with home-care robots; and (1-B) the majority would have negative views regarding the use and development of home-care robots for older people.

With regard to the first subset (1-A), as predicted, 43.8 per cent (n=78) of 178 respondents answered that they have never seen a robot, and 20.2 per cent (n=36) have rarely seen a robot. When it comes to use of robots, 144 respondents (80.9 per cent) answered that they have never used robots. Therefore, Hypothesis 1-A was accepted. For the second subset (1-B), however, while the majority of the respondents were not familiar with robots, 125 (70.2 per cent) stated that they are 'open to the use of home-care robots' (Figure2). Hypothesis 1-B was negated by the fact that the majority of the respondents in Ireland answered that they are willing to use home-care robots.

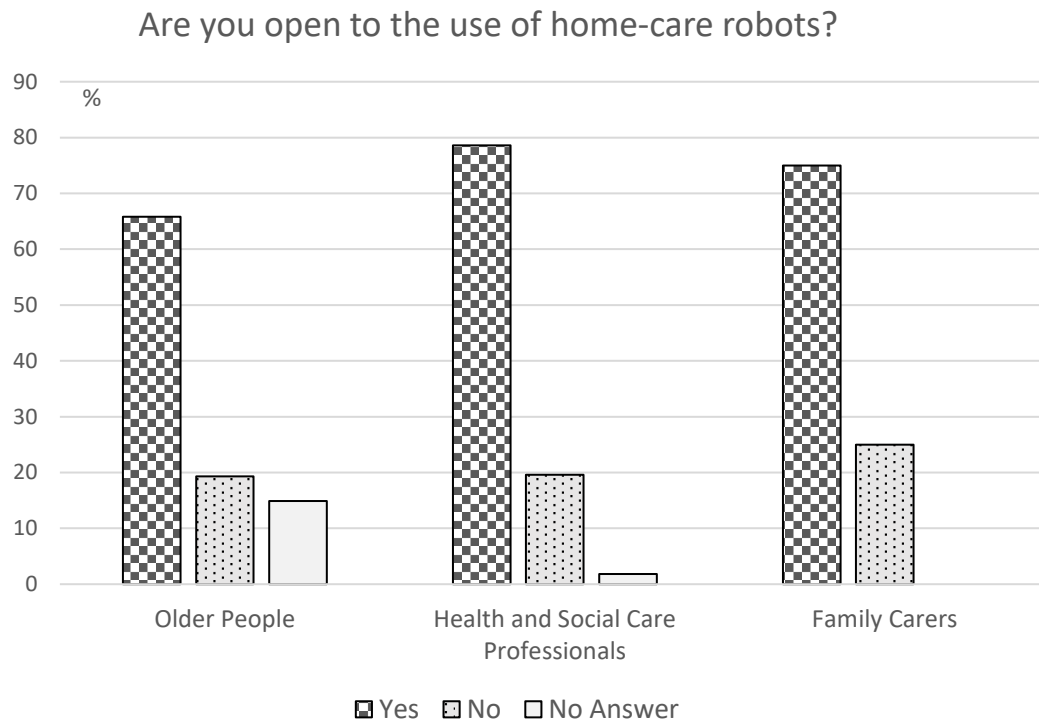


Figure 2. Openness to the use of home-care robots by category (older people, health and social care professionals, and family carers, N=178)

Although there was less support among older people, compared with the other two groups combined, the overall positive attitude to the use of home-care robots negates Hypothesis 1.

Those familiar with robot-related cartoons were more willing to use home-care robots. In total, 96 respondents (54 per cent) answered that they have never or not rarely seen “an animation/manga in which a robot appeared”. On the other hand, 70 respondents (39.3 per cent) stated that they have seen or occasionally seen one before. The difference between OP on the one hand and HSCPs and FC on the other was statistically significant. While only 30 per cent of the OP group have seen such an animation/manga, almost 60 per cent of both HSCP and FC groups have seen one.

Among those who have seen “an animation/manga in which a robot appeared”, there was more openness to the use of home-care robots. The difference was statistically significant ($\chi^2 = 11.91$, $df = 4$, $p = .018$)

The respondents who have not seen a robot-themed animation/manga

were more cautious towards the use of home-care robots for their family. Overall, 62.5 per cent (60 out of 96) were open to the use of such robots for themselves, while 53.1 per cent (51 out of 96) were open if such robots were to be used for their family.

On the other hand, among the people who have seen a robot-themed animation/manga, almost an identical proportion (68.6 per cent, 48 out of 70; and 65.4 per cent, 46 out of 70) responded that they were open to the use of home-care robots for themselves and their family respectively (i.e. 68.6 per cent for themselves and 65.4 per cent for their family).

- **Personal profiles and willingness to use home-care robots**

Hypothesis 2 was that individual profiles such as gender, residence and living arrangements would affect users' attitudes towards and perceptions of home-care robots.

First of all, regarding gender, this questionnaire did not yield similar results to previous studies which state that women are more reluctant to engage with assistive technologies. There was no difference here between males and females, as nearly 70 per cent of both groups returned positive results to the question of whether they are open to the use of home-care robots (men: 69 per cent, 29 out of 42; women: 72.4 per cent, 89 out of 123). A total of 13 out of 178 did not reveal their gender. In terms of news about robots, the majority of both men and women (men: 76.2 per cent, 32 out of 42; women: 74.8 per cent, 92 out of 123) expressed interest.

Concerning the use of technologies in other areas, 97.6 per cent of men and women use mobile phones. A higher ratio of users was found among women when it comes to Email (male: 78.6 per cent, 33 out of 42; female: 84.6 per cent, 104 out of 123), and Internet (male: 85.7 per cent, 36 out of 42; female: 88.6 per cent, 109 out of 123).

This study found that people living in larger, urban cities are slightly more open to the use of robots than those living in rural areas, although the difference between the two groups was not statistically significant.

Among OP (n=114), we examined whether their living arrangements have any correlations with their openness to use home-care robots. The vast majority of the respondents (85.1 per cent, 97 out of 114) answered that they would like to continue living in the community ('ageing in place'). Only 23 OP stated that they have someone to rely on in need of help, living close-by, but the fact that many do not have anyone did not increase older people's willingness to use home-care robots.

Forty-four out of 114 respondents (38.6 per cent) are living with someone who is also 65 years old or more, and 58 (50.9 per cent) are not living with another older person(s) (12 did not answer). The results show that when they are living with another older adult, they are more likely to say yes to the use of home-care robot, which was statistically significant ($\chi^2 = 51.28$, $df = 4$, $p = .000$). Hypothesis 2 was partly upheld by the findings.

- **Occupation and care duties**

It was hypothesised (Hypothesis 3) that those who provide care in their private capacity and those who do not would have different perceptions of and attitudes towards home-care robots. Since it is possible for OP and HSCPs to provide care in their private capacity, a separate question ("Do you provide care (in your private capacity as well)?") was posed, and 38 respondents out of 170 belonged to that category of carers.

While there was no difference between carers (n=38) and non-carers (n=140) in their openness to the use of home-care robots, carers' attitudes towards the use of home-care robots for their family members were significantly more open than non-carers (Figure3).

Among carers, 76.3 per cent (29 out of 38) stated that they are open to the use of home-care robots for their family members, whilst only half (51.4 per cent, 72 out of 140) of those who are currently not providing care in their private capacity answered positively. On the other hand, when it comes to the use of such robots for themselves, there was no difference between the two groups. The fact that nearly 20 per cent of the respondents who do not provide care left a blank answer indicates a sense of reservation.

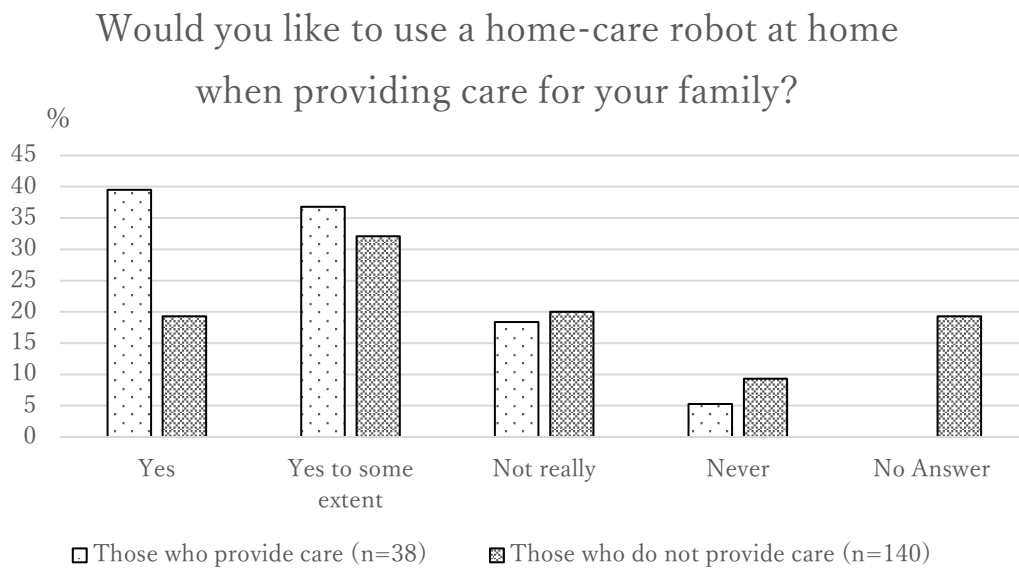


Figure 3. Willingness to use home-care robots for family members: those who provide care and those who do not (N=178).

Questions also reviewed the factors that respondents consider as important in their decision-making concerning home-care robots (Table 3).

Table 3. Items regarded as important in decision-making concerning the use of home-care robots

- Convenience (e.g. ease of use)
- Entertainment value (e.g. fun to use)
- Economic efficiency (e.g. low running cost)
- Safety (e.g. warranty, after-service)
- High performance & capability
- Confidentiality (e.g. privacy protection)
- Social credibility (e.g. government-accredited device)
- Durability (e.g. resistant to breaking, upgradable)
- Size
- Design (e.g. appearance, colour, shape, materials)
- Popularity & reputation
- Opinions of people close to you
- Information & instructions (e.g. special features, users' manual)
- Law & regulation (e.g. responsibility in case of accidents)
- Capacity to increase mental and physical wellbeing and comfort
- Guarantee of entitlement to receiving human care, irrespective of

the use of home-care robots

With reference to Table 3, those who provide care place a greater emphasis on “Guarantee of entitlement to receiving human care, irrespective of the use of home-care robots”, “Size”, and “Law and regulation”, compared with those who do not provide care. Those who do not currently provide care consider “Popularity and reputation” to be more important than the group of carers. These findings indicate that carers see the possibility of using home-care robots favourably, while displaying a cautionary attitude, looking for warranty of safety protection and a minimum level of human care.

Lastly, the two groups OP and HSCPs (N=170) were compared. Amongst HSCPs, 69.6 per cent (39 out of 56) answered that they would like to use a home-care robot at home when providing care for their family. On the other hand, just under half of OP (48.2 per cent, 55 out of 114) were willing to use a home-care robot for their family. The difference was statistically significant ($\chi^2 = 11.19$, $df = 2$, $p = .004$).

With the exception of one statement (“The user should decide whether to use a home care robot”), statistically different results were found between the two groups (OP and HSCPs). A very high proportion of both groups (OP: 69.3 per cent, 79 out of 114; HSCPs: 76.8 per cent, 43 out of 56) stated that they “want to help other people and society by participating in research into and development of home-care robots”.

The second set of questions (“To what extent do you think it would be desirable for home-care robots to provide these types of support?”) listed 15 functions (Table 4).

Table 4. Functions expected of home-care robots

- | |
|---|
| <ul style="list-style-type: none">• Notifying family members and support personnel when an unexpected change occurs in an older person• Informing an older person of the things he/she should be doing at the scheduled time or date (for example, taking medications)• Providing support for the movements/mobility that older people regularly carry out in their daily lives |
|---|

- Accompanying an older person on outings, from the time he/she departs until the time he/she returns home
- Observing and recording matters that affect the mental and physical condition of an older person
- Observing and recording dementia-related symptoms
- Observing and recording the status of an older person at night
- Confirming that an older person has taken his/her medication as prescribed by a physician
- Conversing with an older person about his/her concerns, and providing companionship
- Informing family members and support personnel of an older person's concerns
- Taking care of pets (e.g. feeding, cleaning litter boxes)
- Notifying the older person as well as family members and support personnel about food that has expired
- Detecting obstacles on the floor to prevent falls
- Notifying family members or support personnel of a home intrusion by one of more suspicious individual(s)
- Implementing cognitive function training (e.g. brain training)

As Figure 4 shows, ratings given by HSCPs were higher for all the listed functions. (OP: 72.9 ± 7.5 , HSCP: 86.2 ± 8.9).

To what extent do you think it would be desirable for home care robots to provide the types of support?

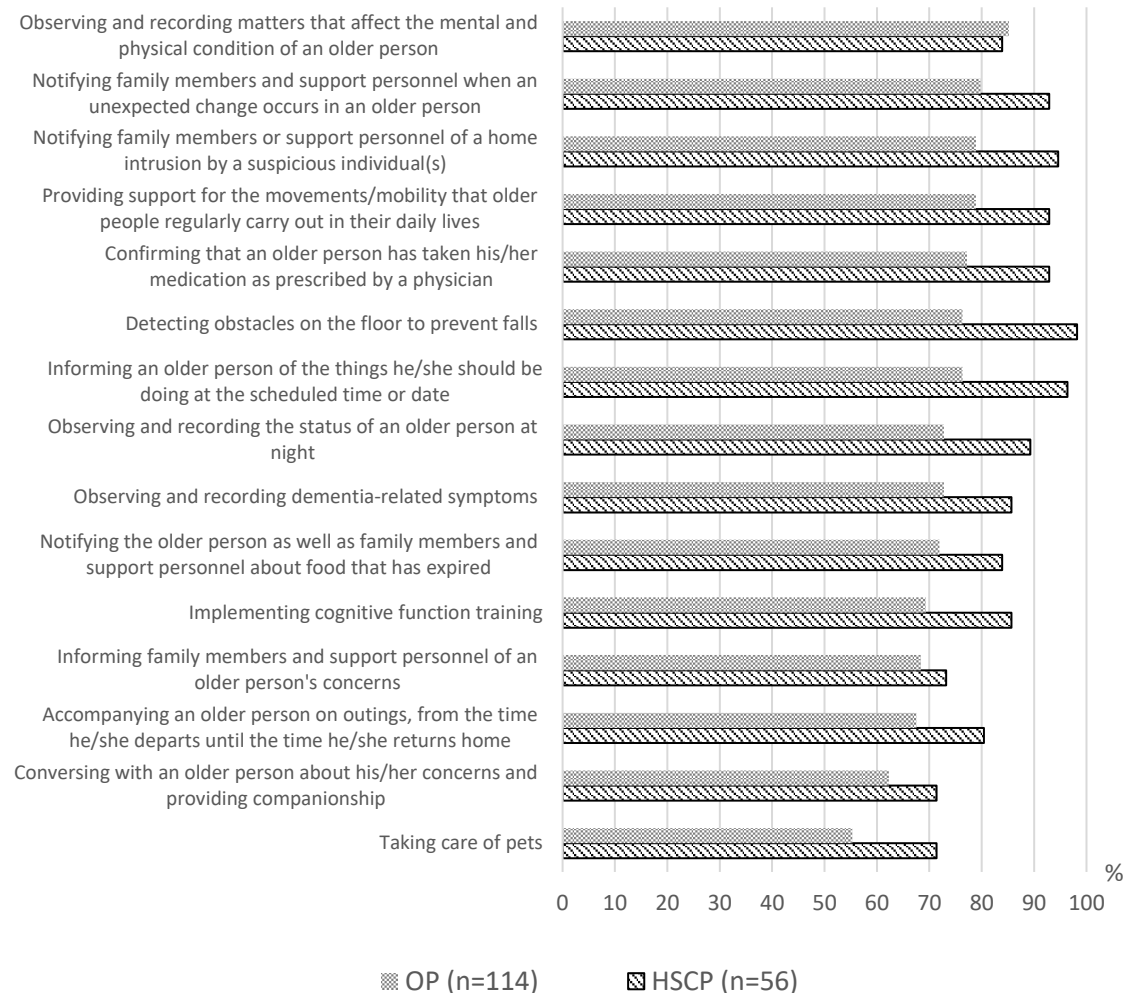


Figure. 4. The proportion of Older People (OP) & Health and Social Care Professionals (HSCPs) who answered ‘absolutely desirable’ and ‘somewhat desirable’ for the listed functions of home-care robots (N=170).

As Figure 4 shows, more than 90 per cent of the HSCP group provided positive answers for the following six items. These are: “Detecting obstacles on the floor to prevent falls”, “Informing an older person of the things he/she should be doing at the scheduled time or date”, “Notifying family members and support personnel when an unexpected change occurs in an older person”, “Confirming that an older person has taken his/her medication as prescribed by a physician”, “Providing support for the

movements/mobility that older people regularly carry out in their daily lives”, and “Notifying family members and support personnel when an unexpected change occurs in an older person”.

On the other hand, the top three items highly rated by OP were “Observing and recording matters that affect the mental and physical condition of an older person”, “Notifying family members or support personnel of a home intrusion by one or more suspicious individual(s)” and “Notifying family members and support personnel when an unexpected change occurs in an older person”. The only item that received a higher proportion of positive answers than from HSCPs was “Observing and recording matters that affect the mental and physical condition of an older person”. The observation and recoding of mental and physical conditions by robots is deemed desirable by both Older People and HSCPs in equal measure. Hypothesis 3 was strongly supported by the findings.

- **Discussion**

The results are broadly in line with those of previous studies, although much more positive attitudes towards home-care robots were found amongst the participants in this study. The Eurobarometer results (European Commission, 2017) showed that less than 30 per cent of respondents were comfortable with robots providing them with services. In sharp contrast to this, a positive attitude was found particularly in the way in which our study’s respondents showed a willingness to take part in research into and development of such robots. As Hypothesis 1 was negated, familiarity with such devices or users’ gender and living arrangements did not have a significant influence over attitudes towards the use of home-care robots. Interestingly, those who have seen robot-themed animation/manga show more willingness to use home-care robots for both themselves and their family. The results clearly demonstrated that there is curiosity about and openness to the use of home-care robots.

With regard to living arrangements and respondents’ wish for ageing in place, the willingness to use a home-care robot did not have a strong correlation with whether or not they would like to continue living in the

community or whether they currently have someone to rely on for help. However, this only reflects the fact that the majority of respondents expressed generally positive views. In addition, ageing in place is still a preferred option for many in this study. Therefore, Hypothesis 2 was also negated, when gender, location of residence and living arrangements were considered.

Respondents were unanimous in recognising the value of home-care robots. However, positive attitudes and a greater level of interest appear to be associated with people's status as a carer, both in a private and professional capacity. The results can be interpreted as a reflection of a need for support and assistance in care delivery, partly created by chronic underfunding in the care sector in Ireland. There were clear differences between the groups, particularly OP and HSCPs. People with care duties in their private life, and those without, show differences in their attitudes towards home-care robots. While Hypothesis 3 was strongly supported by the findings, the reasons behind these differences in preferred functions of home-care robots need further research.

While it is beyond the scope of our study to explain the reasons behind these differences, it can be safely argued that HSCPs were eager to see practical functions (e.g. fall prevention, medication reminder, mobility support, emergency alert) in home-care robots. Their positive attitudes can be partially understood by high levels of need for care support in the current care settings, both in care facilities and communities. Some positive impacts of companion and communication robots on older people in residential care homes (e.g. reduction in social isolation, monitoring of their safety and enhanced autonomy) have been reported (Moyle et al., 2018; Obayashi, Kodate & Masuyama, 2020; Robinson, Broadbent & MacDonald, 2016). In fact, in Ireland, a cat-faced robot called Mylo has been designed and developed to support those who provide care for older people with cognitive impairments living independently at home. Mylo is said to have functionalities such as remote monitoring, fall alert, and safeguarding, and is commercially available for monthly rental, although its effectiveness has not yet been scientifically tested. The impact of the robotic bio-monitoring function requires further attention and research (Dorronzoro Zubiete et al.,

2016).

While there was generally a positive perception of the use of home-care robots among Irish HSCPs, respondents were less open when usage related directly to them, or their family members. Cautious attitudes were also evident in the areas of decision-making and privacy. Respondents placed significant importance on entitlement to human care regardless of the usage of home-care robots while recognising the potential of robots to increase mental and physical well-being.

In addition, Irish HSCPs' attitudes to home-care robots appear strongly influenced by their ethical positioning (Suwa et al., 2020). However, in order to validate this, issues of autonomy, control and the professional identity of care professionals need to be examined further (Share & Pender, 2018).

The results have many implications for different stakeholders. For policymakers, robot manufacturers and researchers, stronger engagement with users (older people, family carers and care professionals) should be sought by way of needs analysis, co-design and co-production. There is greater curiosity about the use of home-care robots than anticipated, and for professional associations, there should be additional open and frank discussions about ethics, regulation of risks, and safeguarding of dignity as well as the potential merits of using assistive technologies such as home-care robots.

- **Limitations**

The study unearthed new findings in a timely manner, thereby adding to the body of literature, particularly as the new coronavirus infectious disease (COVID-19) pandemic has renewed a strong policy focus on the role of e-health, telemedicine and robotics-aided care as countermeasures for the spread of the virus and the protection of older adults and care professionals. Nonetheless, the study had some limitations. The majority of respondents had little or no exposure or familiarity with care/animal/humanoid/cleaning robots, suggesting that responses are based on attitudes rather than direct experience. Several respondents did not complete the questionnaire, as some of the questions were incomprehensible to them. As a result, the

study relied on a relatively small number of participants, particularly family carers. Other methods such as focus groups and interviews could have provided a better forum for visually demonstrating existing home-care robots and explaining what they currently can and cannot do.

- **Conclusions**

This was the first country-wide questionnaire survey in Ireland that targeted potential users of home-care robots. By discovering a great interest in and willingness to take part in the use and development of home-care robots, the study underscored the potential for developing a more comprehensive integrated care with the aid of assistive technologies such as home-care robots. On the flipside of this general enthusiasm, the results can be interpreted in a different way. In Ireland, there may be great need for better understanding of under-resourced care in the community and insufficiently developed policy on integrated health and social care.

However, moving beyond the dichotomy of human care and technology-based care, practitioners need to develop an informed and critical orientation towards emergent technologies, so that they can be part of the social shaping of technology (MacKenzie and Wajcman 1985) rather than being socially determined by it (Share & Pender, 2018). The technology could be better utilised in supporting living and ageing at home by developing national framework models which include service process models combined with a general framework of technology. Social and health care professionals, users and other stakeholders should be given an opportunity to participate in the research and development process. (Lähteenmäki et al., 2020)

This field of enquiry will become of more importance and of broader interest for all those involved in the education of health and social care professionals in the years to come. It would appear therefore, that there is a need to establish educational and continuing professional development (CPD) supports for HSCPs and to develop pedagogical approaches in the areas of homecare and social care robots.

Further research needs to be conducted in order to develop a better strategy for co-designing and co-producing assistive technologies which could enhance the quality of care and life for older people and carers in the future.

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