Received: 16 September 2022 | Revised: 30 November 2022 | Accepted: 22 December 2022

DOI: 10.1111/jjns.12523

ORIGINAL ARTICLE

JAPAN JOURNAL OF NURSING SCIENCE WILEY

Socially assistive robots in health and social care: Acceptance and cultural factors. Results from an exploratory international online survey

Irena Papadopoulos[1] | Steve Wright[2] | Christina Koulouglioti[3] | Sheila Ali[4] | Runa Lazzarino[4] | Ángel Martín-García[5] | Cristina Oter-Quintana[6] | Christiana Kouta[7] | Elena Rousou[7] | Katalin Papp[8] | Radka Krepinska[9] | Valerie Tothova[10] | Maria Malliarou[11] | Paraskevi Apostolara[12] | Małgorzata Lesińska-Sawicka[13] | Małgorzata Nagorska[14] | Miroslava Liskova[15] | Line Nortvedt[16] | Lise-Merete Alpers[17] | Sylvia Biglete-Pangilinan[18] | Ma. Florinda Oconer-Rubiano[19] | Wireeporn Chaisetsampun[20] | Nutchanath Wichit[20] | Akhtar-Ebrahimi Ghassemi[21] | Ezzat Jafarjalal[22] | Akile Zorba[23] | Andrea Kuckert-Wöstheinrich[24] | Rabin Malla[25] | Tomiko Toda[26] | Özlem Akman[27] | Candan Öztürk[28] | Teresa Puvimanasinghe[29] | Tahereh Ziaian[30] | Orit Eldar-Regev[31] | Sara Nissim[32]

Correspondence
Irena Papadopoulos, Research Centre for Transcultural Studies in Health, Department of Mental Health and Social Work, School of Health and Education, Middlesex University, The Burroughs, London NW4 4BT, UK.
Email: R.Papadopoulos@mdx.ac.uk

Abstract

Aim: This study explored the views of an international sample of registered nurses and midwives working in health and social care concerning socially assistive robots (SARs), and the relationship between dimensions of culture and rejection of the idea that SARs had benefits in these settings.

Methods: An online survey was used to obtain rankings of (among other topics) the extent to which SARs have benefits for health and social care. It also asked for free text responses regarding any concerns about SARs.

Results: Most respondents were overwhelmingly positive about SARs' benefits. A small minority strongly rejected this idea, and qualitative analysis of the objections raised by them revealed three major themes: things might go wrong, depersonalization, and patient-related concerns. However, many participants who were highly accepting of the benefits of SARs expressed similar objections. Cultural dimensions of long-term orientation and uncertainty avoidance

For affiliations refer to page 8

feature prominently in technology acceptance research. Therefore, the relationship between the proportion of respondents from each country who felt that SARs had no benefits and each country's ratings on long-term orientation and uncertainty avoidance were also examined. A significant positive correlation was found for long-term orientation, but not for uncertainty avoidance.

Conclusion: Most respondents were positive about the benefits of SARs, and similar concerns about their use were expressed both by those who strongly accepted the idea that they had benefits and those who did not. Some evidence was found to suggest that cultural factors were related to rejecting the idea that SARs had benefits.

KEYWORDS

artificial intelligence, cultural dimensions, socially assistive robots, technology acceptance

1 | INTRODUCTION

The use of technology-assisted interventions in health care is increasing. The field of robotics is gradually becoming more involved (Papadopoulos, Hill, et al., 2020; Scoglio et al., 2019). For example, socially assistive robots (SARs) have been deployed in residential care facilities for older people and may potentially be more widely used in the healthcare field (Loi et al., 2018). The purpose of SARs is to assist the human user (whether a patient or healthcare worker) to achieve progress in convalescence, rehabilitation, learning, and wellbeing, through features such as facial recognition, speech, and movement (Papadopoulos, Koulouglioti, et al., 2020).

The introduction of SARs in health care has been generally met with approval. Broadbent et al. (2012) conducted focus groups with retirement village residents, their relatives, and staff concerning their attitudes and preferences toward a SAR. Their attitudes were found to be generally favorable, with residents expressing more positive attitudes than either their relatives or the staff. Wing-Yue et al. (2014) also found that a group of elderly adults who had witnessed a robot demonstration session expressed positive attitudes toward the SAR and its intended applications. Kolstad et al. (2020) interviewed staff and managers from two nursing homes and a daycare facility and reported that their attitudes toward the benefits of SARs for both staff and service users were overwhelmingly positive. However, technological developments are often viewed with suspicion—a prime example being the Luddite movement in the UK during the early 19th century, which violently opposed the new technology which threatened the livelihoods of weavers and other textile workers. Indeed, Broadbent et al. (2012) reported concerns from staff about possible job losses if SARs were to be introduced. Research by Papadopoulos et al. (2021) reported that care home workers were found to be open to the use of SARs in their workplace, viewing them as potentially useful and complementary to human carers. However, they also expressed concerns regarding SARs' perceived lack of human qualities and traits that are deemed essential for the caring role, and were also concerned about possible job losses. Zuschnegg et al. (2021) found that nurses, informal carers, and trainers providing dementia care in home, daycare, and nursing home settings had quite positive views of the potential support that SARs might provide in terms of enabling telephone calls, providing entertainment, and reminders (concerning appointments, exercise, etc.), but expressed reservations concerning possible loss of human interaction and potential dangers. Similarly, Yu et al.'s (2022) systematic review and meta-analysis of 66 studies found that the use of SARs in providing dementia care was generally viewed as feasible and acceptable, but that high-quality studies were needed to establish clearer evidence of benefits for cognition, neuropsychiatric symptoms, and quality of life. Besides the issues of the acceptability of SARs in health and social care and of their potential benefits, the use of technical systems such as networked computers, robots, and artificial intelligence which interact with the physical world (in any setting, not just in health and social care) presents ethical and legal challenges, particularly in relation to liability, privacy, and autonomy. While detailed discussion of these issues is beyond the scope of this paper, the valuable work carried out by the European Parliament's Scientific Foresight Unit (Van Woensel et al., 2016) in exploring potential ethical concerns and unintended consequences of such technology, and the guidelines for addressing the legal and ethical concerns by Leenes et al. (2017) should be acknowledged.

According to the Technology Acceptance Model, people are more likely to use technology if they perceive it to be easy to use, and that it will improve and enhance their performance (Davis, 1989). However, technical problems with SARs and limitations to their capabilities, as well as some negative staff attitudes have been found to represent barriers to their successful implementation (Papadopoulos, Koulouglioti, et al., 2020). While technical problems can be resolved and SARs' capabilities can be improved, negative preconceptions by staff will inevitably affect their responsiveness to such innovations, and these represent an important contextual feature which is likely to affect their successful implementation (Hasson et al., 2012).

Rogers (1962) attempted to explain how the perceived attributes of an idea or product enables its diffusion through a given social system or population over time. These attributes include *Relative Advantage* (the degree to which it is seen as offering an advantage over what it is replacing), *Compatibility* (how it compares with the current product in terms of the user's experience, values, and needs), *Complexity* (the amount of effort it takes to learn to use and apply it), *Triability* (the ease with which it can be tested and deployed, which affects the decision as to whether or not to adopt it), and *Observability* (whether concrete and observable results can be seen) (Ali & Miraz, 2015). However, Deligiannaki and Ali (2011) argued that an innovation's characteristics are not the only factor affecting adoption; an innovation has to become socially embedded within the culture for it to become successfully adopted. This raises the question of the role played by cultural factors in accepting health and social care technologies by service users, family, and staff in a diverse, multicultural society and workforce.

Geert Hofstede has been enormously influential in the study of cultural differences (e.g., Hofstede, 1980), and defines culture as "the collective programming of the mind which distinguishes the members of one human group from another". Based on data originally collected in 50 different countries involving 1000s of IBM employees, Hofstede sought to understand how such programming differs between cultures. A four-dimensional model of cultural differences in work-related values and behaviors was originally developed, with two more dimensions added later (Hofstede, 2001; Hofstede et al., 2010) to form what is currently a six-dimension model: *Power Distance* (PD), *Individualism* versus *Collectivism* (IDV), *Masculinity* versus *Femininity* (MAS), *Uncertainty Avoidance* (UA), *Long-Term* versus *Short-Term Orientation* (LTO), and *Indulgence* versus *Restraint* (IVR).

There is a relatively long history of research into the role played by cultural factors in technology acceptance (Straub, 1994). While culture has been found to influence attitudes and preferences toward robots, firm conclusions cannot be made because of the quality of the evidence (Papadopoulos & Koulouglioti, 2018). Hofstede's work on cultural differences has been influential. LTO and UA have attracted particular interest among researchers concerned with cross-cultural differences in technology acceptance. LTO is the extent to which a country's people show a propensity to take a long-term perspective that primarily emphasizes doing things that improve the future as opposed to a short-term perspective which primarily emphasizes the present or the successes of the past (Sriwindono & Yahya, 2014), and has been used to explore cross-cultural differences in technology acceptance by several researchers (e.g., Straub et al. (1997), Veiga et al. (2001)), and Hwang (2005). Sriwindono and Yahya (2014) found that, compared to PD and IDV, LTO had greatest effect on perceived usefulness—a key aspect of technology acceptance (Davis, 1989).

The relationship between UA and technology acceptance is more ambiguous. Uncertainty results from situations where outcomes and conditions are unknown or unpredictable. A culture's UA score reflects the extent to which the culture's members are comfortable with uncertainty, thus behaving in ways which tolerate or avoid uncertainty. Hofstede (1991) hypothesized that because technological innovations may decrease uncertainty, they would be more likely to be embraced in countries that score highly on UA. However, Bagchi et al. (2004) noted that since the adoption of technological innovations is initially associated with a heightened sense of risk, it is reasonable to assume that these would be adopted more quickly in countries which score low on UA. Other researchers (e.g., Png et al., 2001; Sundqvist et al., 2005) are more inclined to suggest that a fear of uncertainty leads to resistance in adopting the technology, resulting in the technology only being adopted after considering the experiences of those who have adopted the technology earlier.

There appears to be a dearth of literature concerning cross-cultural aspects of the acceptability of SARs in health and social care settings. This paper attempts to begin addressing this need by presenting results from an exploratory, descriptive study of nurses and other care workers who responded to an international online survey concerning SARs in these settings. It examines the extent to which the respondents were accepting of the benefits that SARs might bring to the health and social care workplace, as well as the functions that they thought that SARs would provide. It also explores the misgivings behind participants' rejection of the idea that SARs have benefits for health and social care settings, as well as the relationships between the LTO and UA scores of participating countries and the proportion of participants who rejected the idea that SARs had benefits in these countries.

2 | MATERIALS AND METHODS

2.1 | Design

This was an exploratory, cross-sectional, descriptive study, which used an online survey. The main survey comprised both closed and open-ended questions, which allowed both quantitative and qualitative data analysis to be conducted, respectively. This was done to allow greater integration and triangulation of the data, to contextualize and give nuance to the data, and gain deeper insights into the respondents' views. The survey was developed with reference to the literature (e.g., Heerink et al., 2010; Papadopoulos & Koulouglioti, 2018), and was estimated as needing approximately 20 min to complete. The survey included questions concerning demographic and professional variables, as well as topics concerning SARs in health and social care settings, including the potential benefits of their use and the functions they might perform (which this paper is focused upon), and any reservations that respondents might have about their use. The survey was piloted among the members of an international team of co-researchers who were recruited by the lead researcher. The team provided feedback which improved question clarity, answer options, and the feasibility of translation. The whole questionnaire used in the survey can be accessed here: https://cultureandcompassion.com/victcory/international-on-line-compassion-survey.

2.2 | Ethical Approval

The study was approved by the Research Ethics Committee at the lead researcher's university. Members of the international team of co-researchers also followed the ethical approval procedures operating within their institutions.

2.3 | Data collection and sample

The international team of co-researchers translated and back-translated the questionnaire in their own language, and, where necessary, translated the responses to the survey's open-ended questions into English for qualitative analysis. The web-based survey software Qualtrics was used by the leading UK research team to collect the data. Links to the online survey for each country were created and distributed to all co-researchers of the international team, along with a proposed invitation letter (which was translated into all relevant languages). The invitation letter included the Participant Information Sheet, and explained that completion of the survey would be regarded as confirmation that the invitation letter and participant information contained within it had been read and understood, and that informed consent had been given.

Data were collected between the end of October 2019 and end of September 2020. The inclusion criteria for participants were a nursing or midwifery qualification, and current employment in the health or social care sector as a nurse, midwife, or other role. The inclusion criterion for a country to be included in the sample was a minimum of 40 fully completed questionnaires.

The survey link was disseminated using a snowballing strategy whereby it was cascaded electronically by the international research team to colleagues in their personal networks, as well as via a professional mailing list (JISCMail). This strategy ultimately recruited a convenience sample of 1341 participants, with 19 countries represented within the sample (for the purpose of the study Turkish-speaking Cyprus and Greek-speaking Cyprus were treated as two different entities rather than a single country). Nine countries (47%) were from Europe (four of which were from eastern Europe), five countries were from the middle east and south-east Asia regions, while the far east and Pacific regions were each represented by two countries; the remaining country in the sample was from south Asia.

3 | RESULTS

The countries represented in the sample, the number of participants from each country, the percentage of each country's participants in the sample, the proportion of participants who identify with the culture of the country, and the LTO and UA scores for each country are summarized in Table 1. The LTO and UA ratings are taken from the Country Comparison Tool on the Hofstede Insights web page (https://hi.hofstede-insights.com/national-culture), which lists the scores on each of the six cultural dimensions in Hofstede's model for over 70 different countries. Hofstede treats Cyprus as a single country rather than two entities, and as no cultural dimensions data were available for Cyprus, the ratings for Greece were used instead (as done by, e.g., De Angeli & Kyriakoullis, 2006 and Mitchell & Vassiliades, 1997).

The demographic and professional characteristics of the sample are summarized in Table 2. Missing data are excluded, and valid percentages reported.

The final item presented in question 16 (which concerned the benefits of SARs) asked participants to rank the statement "robots have no benefits" from 1 (most important) to 10 (least important). Most participants (1069 participants, or 79% of the sample) ranked this as

TABLE 1 Participating countries, proportion of countries' participants in the sample, proportion identifying with the country's culture, and countries' long-term orientation (LTO) and uncertainty avoidance (UA) scores.

Country	% of sample (*n*)	% identify with country's culture	LTO score (maximum = 100)	UA score (maximum = 100)
Slovakia	10% (140)	96%	77	51
Spain	8% (102)	100%	48	86
Poland	7% (100)	99%	38	93
Hungary	7% (96)	98%	58	82
Germany	7% (89)	96%	83	65
Czech Republic	6% (81)	100%	70	74
Thailand	5% (73)	97%	32	64
Greece	5% (63)	81%	45	100
Japan	5% (62)	90%	88	92
UK	4% (60)	88%	51	35
Norway	4% (57)	100%	35	50
Philippines	4% (57)	98%	27	44
Cyprus (Turkish-speaking)	4% (57)	47%	45	100
Israel	4% (55)	89%	38	81
Nepal	4% (53)	100%	No score	40
Cyprus (Greek-speaking)	4% (52)	98%	45	100
Turkey	4% (52)	94%	46	85
Iran	4% (52)	88%	14	59
Australia	3% (40)	88%	21	51

TABLE 2 Sample demographic and professional characteristics.

Gender	
Female	1137 (85%)
Male	199 (15%)
Work setting	
Hospital	735 (55%)
Education	220 (16%)
Community	142 (11%)
Social care	97 (7%)
Other	151 (11%)
Years experience in health/social care	
1–5 years	359 (27%)
6–10 years	188 (14%)
>11 years	792 (59%)
Ever seen or used SARs in work setting?	
Yes	135 (10%)
No	1206 (90%)

Abbreviation: SARs, socially assistive robots.

least important, indicating a very high level of agreement that SARs had benefits in this setting. However, 71 participants (5% of the sample) ranked this item as most important, indicating a complete rejection of the idea that SARs could be beneficial in their work setting. The remaining rankings lay in between these two polar opposite opinions. Figure 1 illustrates the distribution of rankings within the sample, and illustrates the degree of polarization in responses to this item. Chi-squared tests were used to test for an association between participants giving a rank of 1 or 10 to this item and their having previously seen or used robots in a health or social care setting (yes or no), but no statistically significant association was found.

Because the idea that SARs could have benefits in health and social care was strongly rejected by 5% of the sample, the question of what this rejection might be based upon is raised. To address this, the responses made by these participants to question 25 were examined, which was an open-ended follow-up question asking participants to describe any objections they might have to the deployment of SARs. The responses made by these participants were examined using content analysis (Braun & Clarke, 2006) in order to identify themes within them, which was facilitated by use of NVivo software. Some responses contained more than one unit of meaning, so a total of 77 units of meaning were abstracted

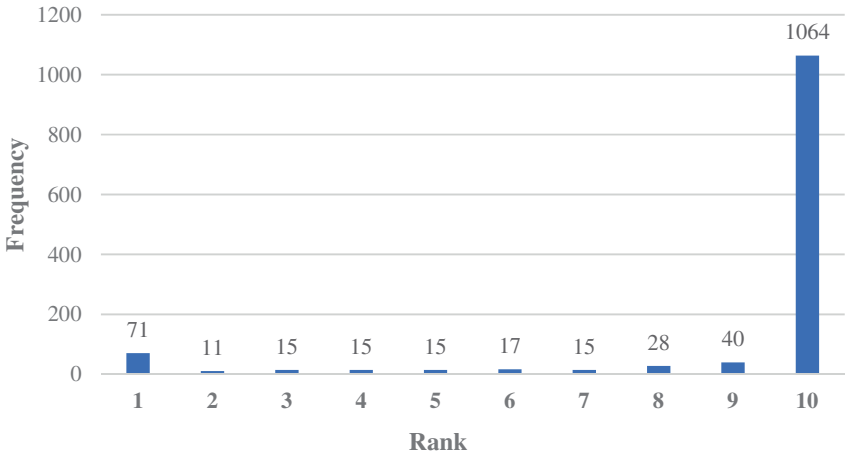

FIGURE 1 Distribution of rankings for the item "Robots have no benefits" (question 16).

TABLE 3 Themes, sub-themes, and representative quotes around concerns regarding the use of SARs in health and social care. (Question 25)

Themes	Sub-themes	Representative quotes
Things might go wrong (33 responses)	*Robots might malfunction and endanger patient safety* (25 responses).	"It can break and risk the patient safety" (Turkish-speaking Cyprus, participant 044)
	Robots might make mistakes (seven responses)	"Incorrect reading of data, e.g. measurement of parameters or will do it incorrectly" (Poland, participant 088)
	Confidentiality breaches (one response).	"Misuse of privacy" (Czech Republic, participant 070)
Depersonalization (27 responses)	*Depersonalization* (general) (nine responses)	"Everything, alienation, lack of human element, loss of personal approach" (Czech Republic, participant 002)
	Communication/rapport with robots (seven responses)	"It may interfere with the patient, the patient may not be able to explain the problem to the robot because the robot does not know how people grow in cultures in places" (Turkey, participant 019)
	Dehumanization/alienation of nursing/healthcare (eight responses)	"Individuality of a person is not taken into attention" (Germany, participant 077)
	Robots lack human perception/empathy/ethical judgment (three responses)	"Lack of empathy, and the ethical dilemmas that arise" (Spain, participant 070)
Patient-related concerns (five responses)	*Patients might feel neglected or ignored by staff if robots are used* (four responses).	"The patient will feel inferior – not even a nurse will see him, only a robot." (Slovakia, participant 036)
	Patients might object (one response)	"I do not think that patients will be happy about this." (Turkish-speaking Cyprus, participant 039)

Abbreviation: SARs, socially assistive robots.

from the responses of 62 participants. Two participants gave responses where the meaning was unclear (e.g., "Cool, programmed MACHINES!"), which were excluded. and seven participants gave no response to the question.

Three higher-order themes emerged:

- *Things might go wrong* (33 responses)
- *Depersonalization* (27 responses)
- *Patient-related concerns* (five responses).

The higher-order themes with their respective sub-themes (and a representative quote from each sub-theme) are presented in Table 3. Three further themes that emerged from comparatively few responses are also presented in the table.

The responses provided by the small group of participants who ranked SARs as having no benefits which expressed concerns about the deployment of SARs were also to be found among the responses of the vast majority of our participants who viewed SARs more positively. For example:

- *"The patient will feel inferior – not even a nurse will see him, only a robot."* (Slovakia, participant 036)
- *"The patient will feel inferior and useless because then the nurses would no longer be in contact with the*

patient, they would only send out the robots and the patient would feel that he is just a 'piece of goods'." (Slovakia participant 037)

- *"I will be worried about what to do if they do something wrong. It might be life threatening."* (Turkish-speaking Cyprus, participant 020)
- *"A robot is a machine, and a machine can fail. The machine may break or make mistakes."* (Poland, participant 001)

3.1 | SARs have "no benefits", LTO and UA

The percentage of participants in each country giving a rank of 1 to this item was correlated with each respective country's LTO and UA rating so that the strength of the relationship between these variables could be examined. Because culture was defined at the level of countries (national) in this study, participants who reported they did not identify with the country where they lived and worked were removed from these analyses, reducing the sample size by 6% to 1261. Respondents from Nepal were also removed from these analyses because there was no Hofstede rating for LTO available for Nepal.

While the distribution of LTO ratings for the participating countries was normally distributed, the distribution of the percentage of participants giving a rank of 1 to the item "Robots have no benefits" was heavily skewed, so Spearman's Rho was used to calculate the correlation coefficient. The r statistic for percentage of these participants in each country and each country's LTO score was found to be .58 with 15 degrees of freedom (DF), $P = .015$, indicating a statistically significant positive relationship between the two variables. Using Cohen (1988) guidelines, this indicates a large effect size, and the r^2 statistic (calculated from the r value) indicates that ~33% of the variance in percentage of participants in a country giving a rank of 1 to the item "[Robots] have no benefits" can be predicted from the country's LTO score, and vice-versa. A non-significant correlation of 0.41 ($P = .09$) was observed for percentage of participants in each country who ranked the item and each respective country's UA score.

This analysis was then repeated for the proportion of each country's participants who gave a rank of 10 (least important) to the item "Robots have no benefits", indicating full acceptance of the benefits of SARs in health and social care. Once again, the LTO and UA scores for the participating countries were not normally distributed, so Spearman's Rho was used once again. Correlations of −.13 and −.23 were observed for LTO and UA respectively, but neither correlation achieved statistical significance at the .05 level ($P = .62$ and .34 respectively).

4 | DISCUSSION

This study found that the large majority of the participants ranked the item "[Robots] have no benefits" as 10 (least important), indicating an overwhelming degree of full acceptance of the benefits of SARs in health and social care, which is consistent with previous research (e.g., Papadopoulos et al., 2021; Yu et al., 2022 and Zuschnegg et al., 2021). This was found across all the countries in the sample, and is all the more striking considering that only 10% of the participants had actually worked with or seen SARs in use.

In terms of our qualitative analysis of the objections raised to the deployment of SARs among those who felt that SARs had no benefits in health and social care, comparatively few responses concerned possible job losses. This is an interesting contrast to the historical example and the findings of Broadbent et al. (2012) discussed earlier. Most objections related to fears for patient safety should the SAR malfunction, closely followed by misgivings concerning depersonalized and dehumanized care, which closely resemble the themes identified in the study by Papadopoulos et al. (2021) and Zuschnegg et al., 2021 discussed earlier. These latter objections relate to a key aspect of humanity and compassion. Compassion is regarded as a core foundation of nursing and healthcare practice in the Department of Health (2012) policy document Compassion in Practice (2012), and so such misgivings will therefore need to be better understood in order to be effectively addressed.

Despite the degree of bimodality in the rankings for the benefits of SARs, our qualitative analysis therefore suggests that the situation is more nuanced, and the finding that people can hold diametrically opposed views about the potential benefits of the deployment of SARs while sharing similar concerns about them cannot be explained by our data. Clearly, more rigorous exploration of this phenomenon is needed, which must also include patients, as they are likely to hold similar concerns.

The percentage of participants who rejected the idea that SARs could have benefits in health in each country was found to correlate significantly with the country LTO ratings, but not for UA ratings. When this was repeated in relation to the percentage of each country's participants who fully accepted the idea that SARs have benefits, non-significant correlations were observed for both LTO and UA. The lack of significant correlations with UA might be attributable to the ambiguous relationship between UA and technology acceptance discussed earlier

(e.g., Bagchi et al., 2004; Png et al., 2001; Sundqvist et al., 2005), while high LTO has been found to be an important obstacle to technology acceptance in several studies (e.g., Hwang, 2005; Sriwindono & Yahya, 2014; Straub et al., 1997; Veiga et al., 2001). While the negative correlation between percentage of countries' respondents who fully accepted the benefits of SARs and LTO rating was as expected, this was non-significant. This might have been because Hofstede's research on dimensions of cultural difference was conducted in the commercial, industrial, and financial sectors and not in health and social care. Therefore different, currently unknown cultural considerations might operate concerning health and social care in different countries, and this question needs further exploration. The limitations of the study may also have played a role.

While our findings are of interest, it must be remembered that the study is exploratory and largely descriptive, so unwarranted conclusions should not be drawn, particularly given the limitations to the study's sampling strategy and sample size. The sampling strategy resulted in nearly half of the participating countries being from Europe, with the Americas being unrepresented. While the sample of countries might have been more diverse if some countries had been able to collect enough responses for inclusion into the study, the predominance of European countries is striking. The snowball method used in recruiting the sample also introduces other sources of potential bias. For example, the international research team members might have varied in the extent to which they distributed the survey link, or may have preferentially sent the link to contacts who were interested in the topic, and people who received the link who were interested in and generally in favor of SARs may have been more likely to have completed the survey than those who were not. Regarding sample size, while seemingly large, it is actually a very small proportion of the total population that it was recruited from, and furthermore, no effort was made to standardize to number of responses from each participating country in relation to population size or number of nurses per head of population, meaning that responses from some countries may have had a disproportionate impact on the results of the whole sample. Taken together, these shortcomings mean that conclusions regarding the influence of culture on SAR acceptance are unreliable. However, the study was intended to produce an exploratory cross-sectional snapshot of the views of an international sample of health and social care workers at a time when no similar research had been conducted. The time and resources involved in obtaining truly representative national samples were prohibitive, given the exploratory nature of the research. As such, we cannot claim that our findings are in any way conclusive, but rather are suggestive of the influence of culture on the acceptance of SARs in health and social care settings.

Finally, while we asked respondents to describe the culture which they identified with in terms of food, customs and events, religious ceremonies, and leisure pursuits so as to arrive at a nuanced definition of respondents' cultures, the responses were so varied that they defied any attempt at systematic categorization, and a country-based definition of culture was therefore adopted instead. This method is not entirely satisfactory in some ways, but has been used in other cross-cultural studies (notably Hofstede, 1980), and is an issue that bears consideration in planning cross-cultural research.

In a sphere in which robot technology is likely to be increasingly deployed, and in which nurses have been positioned as "Guardians of humanity, defending the patient against the dehumanizing effects of technology" (Rubeis, 2021), it is likely that antipathy toward and resistance to the deployment of SARs in staff, patients, and the general public, will represent a barrier to their successful implementation. Such antipathy and resistance need to be well understood in order to address them on a reliably informed basis, and understanding cultural considerations concerning SARs in patients, carers, and staff is also highly important in such a culturally diverse field.

The findings presented in this exploratory paper, while interesting, cannot yield definite conclusions. But it is hoped they can be useful in informing more rigorously controlled studies that may better determine how health and social care professionals and patients alike perceive the value of SARs, and how cultural differences impact upon this.

AUTHOR CONTRIBUTIONS

Irena Papadopoulos conceived the study, initiated the development of the survey questionnaire, co-ordinated the data collection, advised on the data analysis processes and supervised the writing of this article. Steven Wright, Runa Lazzarino and Christina Koulouglioti contributed to the literature searches and reviews. Steven Wright drafted this article, and all authors critically revised and approved it.

AFFILIATIONS

[1]Head, Research Centre for Transcultural Studies in Health, Department of Mental Health and Social Work, School of Health and Education, Middlesex University, London, UK
[2]Department of Mental Health and Social Work, Middlesex University, London, UK
[3]Research Centre for Transcultural Studies in Health, Middlesex University, Western Sussex Hospitals NHS Foundation Trust Worthing, West Sussex, UK

[4]Research Centre for Transcultural Studies in Health, Middlesex University, London, UK
[5]San Blas Primary Healthcare Centre (Southern Area) of the Gerencia Asistencial de Atención Primaria, Servicio Madrileño de Salud, Madrid, Spain
[6]Nursing Department, Faculty of Medicine, Universidad Autónoma de Madrid, Madrid, Spain
[7]Department of Nursing, School of Health Sciences Cyprus University of Technology, Limassol, Cyprus
[8]University of Debrecen, Debrecen, Hungary
[9]SZŠ a VOŠZ Havlíčkův Brod (School of Nursing), Havlickuv Brod, Czech Republic
[10]Faculty of Health and Social Sciences, University of South Bohemia České Budějovice, České Budějovice, Czech Republic
[11]University of Thessaly, Larissa, Greece
[12]Faculty of Nursing, Campus Egaleo Park, University of West Attica, Egaleo, Greece
[13]State University of Applied Sciences in Pila, Pila, Poland
[14]Adjunct Faculty, Institute of Medical Sciences, Medical College of Rzeszow University, Rzeszów, Poland
[15]Faculty of Social Sciences and Health Care, Constantine the Philosopher University in Nitra, Slovak Republic
[16]Department of Nursing and Health Promotion, Faculty of Health Sciences, OsloMet - Oslo Metropolitan University, Oslo, Norway
[17]VID Specialized University, Oslo, Norway
[18]College of Nursing and Midwifery, Bataan Peninsula State University-Main Campus, Bataan, Philippines
[19]Bataan Peninsula State University, Bataan, Philippines
[20]Faculty of Nursing, Suratthani Rajabhat University, Surat Thani, Thailand
[21]Nursing Department, Hartwick College, Oneonta, New York, USA
[22]Faculty of Nursing & Midwifery, Iran University of Medical Sciences (IUMS), Nursing Research Center, Tehran, Iran
[23]Department of Psychology, Faculty of Arts and Science, Eastern Mediterranean University, Famagusta, Cyprus
[24]Manager Bachelor Programme Nursing, Vorarlberg University of Applied Sciences, Dornbirn, Austria
[25]MICD, Nayabato, Kathmandu, Nepal
[26]Department of Nursing, Faculty of Nursing and Rehabilitation, Konan Women's University, Kobe, Japan
[27]Faculty of Health Sciences, Nursing Department, Istanbul Aydin University, Istanbul, Turkey
[28]Faculty of Nursing, Near East University, Mersin, Turkey
[29]University of South Australia, Magill campus, Magill, South Australia, Australia
[30]Centre for Workplace Excellence (CWeX), University of South Australia
[31]Independent Researcher, Galil, Israel
[32]Tel Aviv University, Tel Aviv, Israel

ACKNOWLEDGMENTS

The research team would like to thank all participating healthcare professionals and our international research team for supporting this project.

CONFLICT OF INTEREST

The authors state they have no financial or other interests to declare.

ORCID

Irena Papadopoulos https://orcid.org/0000-0001-6291-4332
Steve Wright https://orcid.org/0000-0002-3184-4578
Christina Koulouglioti https://orcid.org/0000-0003-3227-6696
Runa Lazzarino https://orcid.org/0000-0002-4206-4913
Ángel Martín-García https://orcid.org/0000-0002-6648-5608
Cristina Oter-Quintana https://orcid.org/0000-0002-2192-5120
Christiana Kouta https://orcid.org/0000-0002-2079-638X
Elena Rousou https://orcid.org/0000-0001-6952-0483
Valerie Tothova https://orcid.org/0000-0002-7119-8419
Maria Malliarou https://orcid.org/0000-0002-6619-1028
Małgorzata Lesińska-Sawicka https://orcid.org/0000-0003-4222-7978
Małgorzata Nagorska https://orcid.org/0000-0002-3229-1186
Line Nortvedt https://orcid.org/0000-0003-2874-5138
Lise-Merete Alpers https://orcid.org/0000-0002-5523-3560
Sylvia Biglete-Pangilinan https://orcid.org/0000-0001-7986-8264
Wireeporn Chaisetsampun https://orcid.org/0000-0002-2189-0749
Nutchanath Wichit https://orcid.org/0000-0001-6103-8545
Akhtar-Ebrahimi Ghassemi https://orcid.org/0000-0002-7970-3096
Ezzat Jafarjalal https://orcid.org/0000-0002-6064-9974
Tomiko Toda https://orcid.org/0000-0003-3870-521X
Özlem Akman https://orcid.org/0000-0003-1460-3251
Candan Öztürk https://orcid.org/0000-0002-0909-5013
Teresa Puvimanasinghe https://orcid.org/0000-0003-2212-4381

Tahereh Ziaian https://orcid.org/0000-0001-7324-9171
Orit Eldar-Regev https://orcid.org/0000-0002-5397-5210
Sara Nissim https://orcid.org/0000-0001-8381-8104

REFERENCES

Ali, M., & Miraz, M. H. (2015). The cultural impact of diffusion of IT innovation in world society. In *International conference on recent advances in computer systems (RACS 2015)*. Atlantis Press. https://doi.org/10.2991/racs-15.2016.19

Bagchi, K., Hart, P., & Peterson, M. F. (2004). National culture and information technology product adoption. *Journal of Global Information Technology Management*, *7*, 29–46. https://doi.org/10.1080/1097198X.2004.10856383

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*, 77–101. https://doi.org/10.1191/1478088706qp063oa

Broadbent, E., Tamagawa, R., Patience, A., Knock, B., Kerse, N., Day, K., & MacDonald, B. A. (2012). Attitudes towards health-care robots in a retirement village. *Australasian Journal of Ageing*, *31*, 115–120. https://doi.org/10.1111/j.1741-6612.2011.00551.x

Cohen, J. (1988). *Statistical power and analysis for the behavioural sciences (2nd ed.)*. Lawrence Earlbaum Associates.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*, 319–340. https://doi.org/10.2307/249008

De Angeli, A. & Kyriakoullis, L. (2006). *Proceedings of the 8th international working conference on advanced visual interfaces*. Association for Computing Machinery.

Department of Health. (2012). *Compassion in Practice. Nursing, Midwifery & Care Staff: Our Vision & Strategy*. Department of Health Viewed at https://www.england.nhs.uk/wp-content/uploads/2012/12/compassion-in-practice.pdf 18/03/2022.

Deligiannaki, A., & Ali, M. (2011). Cross-cultural influence on diffusion and adoption of innovations: an exploratory case study to investigate the socio-cultural barriers. In *European, mediterranean and middle eastern conference on information systems 2011* (pp. 387–393). Brunel University.

Hasson, H., Blomberg, S., & Dunér, A. (2012). Fidelity and moderating factors in complex interventions: A case study of a continuum of care program for frail elderly people in health and social care. *Implementation Science*, *7*, 23. https://doi.org/10.1186/1748-5908-7-23

Heerink, M., Kröse, B., Evers, V., & Wielinga, B. (2010). Assessing acceptance of assistive social agent technology by older adults: The Almere model. *International Journal of Social Robotics*, *2*, 361–375. https://doi.org/10.1007/s12369-010-0068-5

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Sage Publications.

Hofstede, G. (1991). *Cultures & Organizations: Software of the Mind*. McGraw-Hill.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions & organizations across nations* (2nd ed.). Sage Publications.

Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind (revised and expanded, 3rd edition)*. McGraw-Hill.

Hwang, Y. (2005). Investigating enterprise system adoption: Uncertainty avoidance, intrinsic motivation, and the technology acceptance model. *European Journal of Information System*, *14*, 150–161. https://doi.org/10.1057/palgrave.ejis.3000532

Kolstad, M., Yamaguchi, N., Babic, A., & Nishihara, Y. (2020). Integrating socially assistive robots into Japanese nursing care. *Studies in Health Technology and Informatics (Ebook)*, *272*, 183–186. https://doi.org/10.3233/SHTI200524

Leenes, R., Palmerini, E., Koops, B.-J., Bertolini, A., Salvini, P., & Lucivero, F. (2017). Regulatory challenges of robotics: Some guidelines for addressing legal and ethical issues. *Law, Innovation & Technology*, *9*, 1–44. https://doi.org/10.1080/17579961.2017.1304921

Loi, S. M., Bennett, A., Pierce, M., Nguyen, K., Lautenschlager, N. T., Khosla, R., & Velakoulis, D. (2018). A pilot study exploring staff acceptability of a socially assistive robot in a residential care facility that accommodates people under 65 years old. *International Psychogeriatrics*, *30*, 1075–1080. https://doi.org/10.1017/s1041610217002617

Mitchell, V. W., & Vassiliades, V. (1997). Perceived risk and risk reduction in holiday purchases: A cross-cultural and gender analysis. *Journal of Euro-Marketing*, *6*, 47–79. https://doi.org/10.1300/J037v06n03_03

Papadopoulos, C., Hill, T., Battistuzzi, L., Castro, N., Nigath, A., Randhawa, G., Merton, L., Kanoria, S., Kamide, H., Chong, N. Y., Hewson, D., Davidson, R., & Sgorbissa, A. (2020). The CARESSES study protocol: Testing and evaluating culturally competent socially assistive robots among older adults residing in long term care homes through a controlled experimental trial. *Archives of Public Health*, *20*, 26. https://doi.org/10.1186/s13690-020-00409-y

Papadopoulos, I., Ali, S., Papadopoulos, C., Castro, N., Faulkes, N., & Koulouglioti, C. (2021). A qualitative exploration of care homes workers' views and training needs in relation to the use of socially assistive humanoid robots in their workplace. *International Journal of Older People Nursing*, *17*, e12432. https://doi.org/10.1111/opn.12432

Papadopoulos, I., & Koulouglioti, C. (2018). The influence of culture on attitudes towards humanoid and animal-like robots: An integrative review. *Journal of Nursing Scholarship*, *50*, 653–665. https://doi.org/10.1111/jnu.12422

Papadopoulos, I., Koulouglioti, C., Lazzarino, R., & Ali, S. (2020). Enablers and barriers to the implementation of socially assistive humanoid robots in health and social care: A systematic review. *BMJ Open*, *10*, e033096. https://doi.org/10.1136/bmjopen-2019-033096

Png, I. P. L., Tan, B. C. Y., & Wee, K.-L. (2001). Dimensions of national culture and corporate adoption of IT infrastructure. *IEEE Transactions on Engineering Management*, *48*, 36–45. https://doi.org/10.1023/A:1027452919403

Rogers, E. M. (1962). *Diffusion of innovations*. the Free Press.

Rubeis, G. (2021). Guardians of humanity? The challenges of nursing practice in the digital age. *Nursing Philosophy*, *22*, e12331. https://doi.org/10.1111/nup.12331

Scoglio, A., Reilly, E. D., & Gorman, J. A. (2019). Use of social robots in mental health and wellbeing research: Systematic review. *Journal of Medical Internet Research*, *21*, e13322. https://doi.org/10.2196/13322

Sriwindono, H., & Yahya, S. (2014). The influence of cultural dimension on ICT acceptance in Indonesia higher learning

institution. *Australian Journal of Basic & Applied Sciences*, *8*, 215–225.

Straub, D. W. (1994). The effect of culture on IT diffusion: E-mail and FAX in Japan and the U.S. *Information Systems Research*, *5*, 23–47. https://doi.org/10.1287/isre.5.1.23

Straub, D. W., Keil, M., & Brenner, W. (1997). Testing the technology acceptance model across cultures: A three country study. *Information & Management*, *33*, 1–11. https://doi.org/10.1016/S0378-7206(97)00026-8

Sundqvist, S., Frank, L., & Puumaliainen, K. (2005). The effects of country characteristics, cultural similarity and adoption timing on the diffusion of wireless communications. *Journal of Business Research*, *58*, 107–110. https://doi.org/10.1016/S0148-2963(02)00480-0

Van Woensel, L., Kurrer, C., & Kritikos, M. (2016). *Scientific Foresight study: Ethical Aspects of Cyber-Physical Systems*. European Parliament. https://doi.org/10.2861/68949.EPRS_STU(2016)563501_EN.pdf

Veiga, J. F., Floyd, S., & Dechant, K. (2001). Towards modeling the effects of national culture on IT implementation and acceptance. *Journal of Information Technology*, *16*, 145–158. https://doi.org/10.1080/02683960110063654

Wing-Yue, G. L., McColl, D., & Nejat, G. (2014). Acceptance and attitudes toward a human-like socially assistive robot by older adults. *Assistive Technology*, *26*, 140–150. https://doi.org/10.1080/10400435.2013.869703

Yu, C., Sammerlad, A., Sukure, L., & Livingstone, G. (2022). Socially assistive roots for people with dementia: Systematic review and meta-analysis of feasibility, acceptability and the effect on cognition, neuropsychiatric symptoms and quality of life. *Ageing Research & Reviews*, *78*, 101633. https://doi.org/10.1016/j.arr.2022.101633

Zuschnegg, J., Paletta, L., Fellner, M., Steiner, J., Pansy-Resch, S., Jos, A., Koini, M., Prodromou, D., Halfens, R. J. G., Lohrmann, C., & Schuessler, S. (2021). Humanoid socially assistive robots in dementia care: A qualitative study about expectations of caregivers and dementia trainers. *Aging & Mental Health*, *26*, 1270–1280. https://doi.org/10.1080/13607863.2021.1913476

How to cite this article: Papadopoulos, I., Wright, S., Koulouglioti, C., Ali, S., Lazzarino, R., Martín-García, Á., Oter-Quintana, C., Kouta, C., Rousou, E., Papp, K., Krepinska, R., Tothova, V., Malliarou, M., Apostolara, P., Lesińska-Sawicka, M., Nagorska, M., Liskova, M., Nortvedt, L., Alpers, L.-M., ... Nissim, S. (2023). Socially assistive robots in health and social care: Acceptance and cultural factors. Results from an exploratory international online survey. *Japan Journal of Nursing Science*, e12523. https://doi.org/10.1111/jjns.12523