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SURVEY

Health Professional and Workers Attitudes Towards the Use of Social Robots for Older Adults in Long-Term Care

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Abstract

The aim of this study was (a) to modify, translate and validate the Chinese version of attitudes towards the use of social robot (ATTUSR-C) questionnaire for use with Taiwanese health personnel; and (b) investigate the attitudes of Taiwanese health personnel in long-term care towards the use of social robots for older adults. The attitudes of health personnel towards social robots can affect the acceptability of social robots for older adults. An investigation of health personnel's ATTUSRs and the development of a validated Chinese questionnaire is needed. A cross-sectional design was used to conduct this multi-phase study. Data collection was from November 2017 to May 2018. Content validity, internal consistency reliability, and factor analysis of the ATTUSR-C questionnaire were evaluated. Purposive sampling was used. All recruited participants received an email containing study information and a URL link to the survey. The ATTUSR-C questionnaire had good validity and reliability. A total of 416 health professionals responded to the online survey. Most health personnel had positive ATTUSRs in long-term care facilities as they viewed social robots as beneficial and practical in psychosocial care for older adults. Positive ATTUSRs can increase acceptance and utilisation of social robots. This study strives to support nursing work by providing insights into health personnel's perceptions of social robots, in order to integrate social robots into the care and lives of older adults.

Keywords Health personnel · Attitudes · Social robots · Long-term care · Survey

1 Introduction

Advances in technology have led to the introduction of robots into healthcare. In particular, social robots, which are an artificial intelligence system designed to interact with humans by following social behaviors and rules, have increasingly been used with older adults in aged care [1, 2]. Recent systematic reviews have highlighted the use of social robots to facilitate social connectedness [3] and improve psychological well-being for older adults [4]. Additionally, studies have shown that social robots could be an alternative option to the use of live animals in nursing homes [1, 5]. One determinant that influences the uptake of social robots by older people in aged care is the attitudes of health professionals and workers (referred to in this paper as personnel) towards social robots. Despite the recent growth in the development and use of robots in the aged care sector [6], few studies have investigated the attitudes of health personnel towards the use of social robots [7, 8]. In addition, there is no current study that examines health personnel attitudes towards social robots in the Chinese cultural context.

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Therefore, the purpose of this study was to investigate the attitudes of health personnel working in long-term care (LTC) facilities towards the use of social robots for older adults in Taiwan.

2 Background

Campa [9] defines a social robot as "a physically embodied, autonomous agent that communicates and interacts with humans on an emotional level" (p. 106). Social robots are designed to engender beneficial effects and enrichment by helping patients to express their feelings [9], provide comfort [10], alleviate anxiety and agitation [11], reduce loneliness [12], and depression [13]. For older adults who experience loneliness, a social robot can be a reliable personal companion when care staff are not available for social interaction [14, 15].

The attitudes of health personnel towards social robots can determine the success or failure of the implementation of social robots in care [16–18]. Esmaeilzadeh et al. [19] reported that when social robots are introduced into a care setting, the robot may impact on health personnel autonomy, their relationships with patients, and their routines and workflow. In addition, Vänni and Salin [7] investigated the need for service and social robots among healthcare professionals in the healthcare sector. The results demonstrated that health professionals considered that robots were able to increase productivity by lightening their workload, increasing the meaningfulness of work, saving time, improving the quality of work and reducing the mental workload of workers. There is evidence to suggest that positive attitudes of health personnel and patients towards the use of social robots can lead to a greater potential for the adoption and acceptance of social robots [20].

Attitude is defined as a relatively stable and enduring predisposition to behave or react in a certain manner towards persons, objects, institutions, or issues [21]. Heerink et al. [22] indicated that attitudes towards the use of social robots are defined as the user's positive or negative evaluation of social robots. Research findings suggest that emotions and attitudes strongly impact on human–robot interaction and are linked to acceptance [23]. Acceptance, in this instance, is defined as the consensual incorporation of social robots into an individual's life [16]. Research further supports the notion that expectations of enjoyment in robot interaction are associated with acceptance by older people or health personnel [24].

To date, the Technology Acceptance Model (TAM) [25] and the Unified Theory of Acceptance and Use of Technology (UTAUT) model [26] have commonly been used to study the acceptance of information technology and social robots. The former was used to investigate perceived usefulness and ease of use for end-users; the latter for factors pertaining to end-users' age, gender, experience, and willingness to use the robots. While the acceptance of technology by end-users is well discussed in a variety of studies, very few studies focus on health personnel views on the implementation of social robots.

There are a limited number of questionnaires or instruments developed for measuring attitudes towards the use of social robots. However, the majority of attitude questionnaires currently available were designed to assess the attitudes of patients or older adults towards their use of social robots. For example, the Negative Attitudes towards Robots Scale (NARS), which was developed by Nomura et al., was based on free-form responses from participants about anxieties towards robots [27]. However, the NARS considered attitudes towards communication robots as a psychological construct and focused on negative attitudes of human–robot interaction in users [27, 28]. In addition, the NARS was used to assess end-users rather than secondary users, such as health professionals. Hence, it was not considered an appropriate scale for this study. Heerink et al. [22] extended the UTAUT model to develop the Almere model to examine the acceptance of assistive social robots by older adults. Even though this questionnaire contains a sub-dimension on attitude, it was more suited to investigate the attitude of older adults rather than the attitudes of health personnel.

At present, only a few studies report on healthcare workers' attitudes towards social robots [8, 20, 29]. Vänni and Salin [29] conducted a cross-sectional survey to explore the need for service robots among healthcare workers in Finnish hospitals and homecare nurses using a questionnaire, which included a five-point scale and open-ended question. Rantanen et al. [8] examined the attitudes of homecare personnel towards social robots and focused on assessing the usefulness of care robots for tasks in homecare and social psychological factors affecting personnel's intention to introduce care robots. An 83-item questionnaire with 32 questions directly relating to a care robot was used in their study [8]. The questionnaires used in both studies were not appropriate for this current study as the former focused on service robots while the latter consisted of items focused on living tasks for older adults in homecare.

To our knowledge, the only developed questionnaire that examines attitudes of social robot use is one by Costescu and David [20]. They investigated the attitudes of children and adults towards social robot use in mental health services and the impact of information concerning the benefits of robots on their attitudes. Participants were randomly assigned to either an informed group, who received information about the benefits of using social robots, or a non-informed group. The results demonstrated that most participants showed a positive attitude toward the use of robots, but there were no significant differences between groups (i.e. informed and

uninformed groups as well as children and adults). However, in this research, the attitudes of health personnel were not investigated.

To date, the limited studies that have examined the attitudes of health personnel towards social robots used a descriptive qualitative approach and obtained mixed findings. Broadbent et al. [14] reported that retirement homecare staff had possessed more negative attitudes towards social robots than residents due to staff fears of losing their job to the robot. Moyle et al. [15] however, investigated the perceptions of care staff towards the use of a robot-pet and a plush toy in nursing homes and found that care staff had possessed positive perceptions towards the robot-pet. They found that staff believed that the robot-pet increased excitement, had therapeutic benefits, enhanced engagement and could be an alternative to human companions for older adults living with dementia. Staff suggested that the robot-pet has the potential to improve the quality of life of people with dementia when compared to a plush toy [15]. Furthermore, a Finnish study found that care personnel's behavioral intentions towards robot applications in care settings were influenced by their personal appreciation of the usefulness of robots and the expectations of their colleagues and supervisors [8]. The unsuccessful adoption of a social robot in a care setting may therefore be associated with the negative attitudes of care staff towards the social robot [23].

Health personnel attitudes towards social robots is an important and relatively underexplored area of research. There is neither a questionnaire that explicitly examines health personnel attitudes towards the use of social robots, nor is there a questionnaire available in the Chinese language. This is despite the significant increase in robot development and use in a specific cultural context where for example a seal-like robot pet was used to improve communication and interaction skills for older adults in aged care [6]. Therefore, the findings of this study should make an important contribution to the field of health personnel attitudes towards the use of social robots in LTC.

3 Method

3.1 Aims and Research Questions

This study aimed to (a) modify, translate and validate the Chinese version of attitudes towards the use of social robot (ATTUSR-C) questionnaire for use with Taiwanese health personnel and (b) investigate the attitudes of Taiwanese health personnel working in LTC towards the use of social robots for older adults. The research questions were (a) What are the validity and reliability of ATTUSR-C for health personnel? And (b) What are health personnel attitudes towards the introduction of a social robot to older adults in LTC facilities in Taiwan?

3.2 Modification, Translation and Validation of the ATTUSR-C Questionnaire

A cross-sectional design was used to conduct this multiphase study. The study protocol was reviewed and approved by a University Human Research Ethics Committee (reference number 2017/819).

3.2.1 Development of the ATTUSR-C

Costescu and David [20] developed the original ATTUSR questionnaire (see supplemental material) to investigate the attitudes of children and adults towards the use of social robots in mental health services. The original ATTUSR questionnaire, despite being designed for use by adults and children in mental health services, was chosen for use with health personnel working in LTC facilities as these are relatively similar environments where people often have a mental health diagnosis and symptoms. The original questionnaire comprises a total of 18 items across three domains that include questions: (1) concerning the use of social robots in society; (2) relating to the effectiveness of the use of social robots in healthcare; and (3) regarding the use of robots in psychotherapy. The original questionnaire showed excellent internal consistency ($\alpha = .94$) [20].

All questions in the ATTUSR questionnaire were reviewed and modified by the research team for use with health personnel working in LTC facilities that included the rewording of items and response options as well as the removal of redundant items. For example, the term 'adults' was replaced by 'older adults' and 'setting' was changed to 'long-term care facility'. Of the original 18 items, 15 items were considered to be appropriate for the target population and three items were deleted due to their focus on children and adolescents. With the deletion of the 3 inappropriate items, the modified version of the ATTUSR questionnaire consists of 15 items (refer to Table 1), of which 1 item was reverse coded (i.e. Item 12). Each item is rated by the respondent on a 5-point Likert type scale from 0 to 4, with 0 and 4 reflecting strong disagreement and agreement respectively.

3.2.2 Translation of the ATTUSR-C

The modified ATTUSR questionnaire was then translated into Chinese (i.e. Mandarin) by two Ph.D.-prepared nurse researchers (i.e. forward translation) using the WHO process of translation and adaptation of questionnaire guidelines [30]. Based on the symmetric method of translation, the translators avoided verbatim translation and considered

Table 1 Factor loading of the Chinese version of ATTURS questionnaire (N = 95)

Item	Pattern		Structure	
	Factor 1	Factor 2	Factor 1	Factor 2
A1. Social robots could help with treatment of older people with mental illness	.552		.547	
A2. Social robots could help the health professional to reach his/her objectives in care with support for daily activities	.702		.706	
A3. Social robots could be useful for society because they help both health professionals and older people living in long-term care facilities	.683		.683	
A4. Social robots could help both health professionals and older people in aged care for support	.706		.705	
A5. Social robots could represent companions for older adults living in long-term care facilities	.619	− .490	.611	− .480
A6. Social robots could be useful in mental health services for older adults	.640	− .471	.633	− .462
A7. Using social robots could in the health/nursing care process lead to resolving of difficulties in less time	.687	.343	.692	.353
A8. Using social robots could in the health/nursing care process increase treatment efficiency	.723		.727	
A9. Using social robots could reduce health/nursing treatment costs	.550	.389	.556	.397
A10. Using social robots in the health/nursing care process could make the care work more interesting	.639	− .311	.634	− .302
A11. I think that older adults would be comfortable if health professionals would use a social robot in the care process	.642		.641	
A12. I consider that social robots could be a threat for aged care services		.557		.576
Social robots could help with the process of diagnosis of people with mental illness	.445		.449	
A14. Social robots could help with the process of diagnosis of people with mental illness	.678		.677	
A5. I consider that robots would not pose a threat for mental health services designed for older adults	.374	.489	.381	.495

Extraction method—principal component analysis; Rotation method—oblimin with Kaiser normalization

sociocultural considerations. Equivalence of form and meaning of both the modified English and Chinese versions of the instrument were then reviewed by an individual expert (i.e. a bilingual researcher with a Ph.D. in health) who identified and resolved any inadequate expressions and concepts of the translation. Next, the ATTUSR-C questionnaire was translated back into English by an additional two bilingual and bicultural translators. Any ambiguities and discrepancies regarding the cultural meaning and colloquial expressions in words were discussed and resolved through consensus among the translation team.

3.2.3 Establishing Content and Face Validity of the ATTUSR-C

An expert panel consisting of five academic nursing professors with expertise in aged care, mental healthcare, as well as instrument development and translation, evaluated the content validity of the ATTUSR-C questionnaire. Each expert panel member individually rated the clarity and appropriateness of each of the 15 items using the 4-point Likert type scale (1 = not relevant to 4 = relevant). The item-Content Validity Index (I-CVI) is computed as the number of experts giving a rating of either 3 or 4 divided by the total number of experts. According to Polit, Beck, and Owen [31], an I-CVI of 79% or over was appropriate while an I-CVI of 70% to 79% and less than 70% was revised and eliminated respectively. Furthermore, the scale-CVI/Average (S-CVI/Ave) was calculated by the average proportion of items given a rating of 3 or 4 by the raters involved. A minimum S-CVI of .90 or higher is acceptable [32].

A further 10 clinical instructors were asked to examine the instrument for face validity. Face validity is defined as the extent to which a test is subjectively viewed as covering the concept which it is purported to measure [33]. This refers to the transparency or relevance of the ATTUSR-C questionnaire as it appears to target participants. The clinical instructors were asked to specify the clarity of each of the 15 items and whether anything was confusing about each question. They were then asked to rate each item. Nominal data (clear or unclear) were used to generate face validity ratings for each item. The resulting data revealed the percentage of clinical instructors who had difficulty understanding the items from their perspectives. Items that were found to have an average agreement (clear or unclear) were rated below 80% indicating an unacceptable level of translation face validity, which was to be further discussed and resolved through consensus of the translation group.

3.2.4 Pilot Testing of the ATTUSR-C

3.2.4.1 Participants The ATTUSR-C questionnaire was pilot tested with a convenience sample of nurses for cross-cultural adaptation and assessment of its reliability. Nurses

who are alumni members of a nursing college were invited to complete the ATTUSR-C questionnaire via an email that asked them to contact the first author if they were willing to participate in the study. Only nurses working in nursing homes (i.e. residential facilities with registered nurses providing 24-hour nursing and medical care), residential care facilities (i.e. assisted living facilities), daycare centres, rehabilitation wards, or homecare were included in the study. Based on the ratio of 5–10 participants to one item [34], a minimum sample size of 75 registered nurses were targeted.

3.2.4.2 Procedure All recruited participants received an email containing information of the study with a URL link to access the ATTUSR-C. Implied consent to participate in the study was reflected via their online completion and submission of the questionnaire. Data were collected from November 2017 to January 2018.

3.2.5 Data Analysis

Statistical analysis was performed using version 24.0 of the SPSS software [35]. Construct validity of the ATTUSR-C questionnaire was first assessed using exploratory factor analysis, which was performed using the principal components analysis (PCA) with oblimin rotation, and if needed, confirmatory factor analysis to determine the goodness-of-fit of the extracted factor model. Kaiser–Meyer–Olkin and Bartlett's test of sphericity statistics were computed to test the possibility of performing factor analysis. The number of factors to be retained was guided by: (a) Kaiser's criterion (i.e. eigenvalue > 1); (b) inspection of the scree plot; and (c) Jorn's parallel analysis [36]. Cronbach's alpha coefficient was computed to assess the internal consistency of the ATTUSR-C questionnaire where a value of .7 or greater was considered reliable [37].

3.3 Investigation of Health Personnel Attitudes Towards the Use of Social Robots for Older Adults in LTC

A cross-sectional study using an online survey was adopted in this study. The online survey was administered using LimeSurvey tool provided by the ⟨Griffith University⟩ research survey centre. Ethical approval for this study was approved by the ⟨Griffith University⟩ Human Ethics Committee (reference number: 2017/824) prior to the commencement of the study.

3.3.1 Participants and Recruitment

The inclusion criteria of participants were: (1) health professionals, care workers and management personnel including registered nurses, nursing aides, occupational therapists, physiological therapists, social workers, psychologists, physicians, psychiatrists, administrators, and managers; and (2) working in a LTC facility for at least 3 months. Health personnel who were not working in LTC were excluded. Using purposive sampling, registered nurses were invited to participate in the online survey via an email or social media from the Council of Nursing and Aged Care. The researcher then contacted managers of LTC facilities who were either introduced by the Dean of the Council of Nursing and Aged Care or listed on LTC websites. Health personnel from these LTC facilities were then invited to complete the online survey via an email or social media from the LTC managers.

3.3.2 Data Collection

Data were collected in Taiwan without any location limitation via an anonymous online survey. Within the study email invitation, a URL link to access the online survey was provided for interested health personnel to participate in the study. Participation in the online survey posed no foreseeable risks for respondents. Implied consent was obtained via participants' submission of their completion online survey. The online survey took approximately 10 to 15 min to complete and provided participants with an overview of social robots that included possible features and functions as well as pictorial examples of social robots to orient participants to the available types and design of social robots. Demographic information, which included age, gender, education, length of work experience, specialty, type of facility, and awareness of social robots, was first sought from respondents. Following that, respondents were asked to complete the ATTUSR-C questionnaire. Survey data were collected from December 2017 to May 2018.

3.3.3 Data Analysis

Data from the online survey were downloaded and transferred into version 24.0 of the SPSS software [35]. A forced response setting was applied for the online survey meaning that participants were not able to submit their survey online if they missed or did not answer a question. Hence, no missing data was recorded. Descriptive statistics were used to reflect the demographic characteristics of participants. Relationships between demographic characteristics and participants' attitudes towards the use of social robots for older adults in LTC were explored using point-biserial correlations and ANOVAs with further post hoc assessments where appropriate and at a significant alpha of $p < .05$.

4 Results

4.1 Validity and Reliability of the ATTUSR-C Questionnaire

4.1.1 Content Validity

Good agreement among the five experts for the content validity of the ATTUSR-C questionnaire was found (Fleiss Kappa = .6). However, there was a term and a phrase which were considered to be inappropriate for the Chinese culture by the expert panel, due to vagueness in the Chinese translated modified version of the ATTUSR questionnaire. The term '*social robot*' in the Chinese translation was reported to be unclear and deemed inappropriate. Hence, the term '*social robot*' was changed to the Chinese equivalent of '*therapeutic robot*'. For the phrase '*can adapt to it and feel comfortable*', the experts indicated that the Chinese translation of this phrase was too abstract to understand, so this item was translated into the Chinese equivalent of '*comfortable*'. The I-CVI for each item in the ATTUSR-C questionnaire was found to be equal to or greater than .83 with a S-CVI/Ave of .93, reflecting that content validity for the ATTUSR-C questionnaire was appropriate.

4.1.2 Face Validity

For face validity, the average percentage of agreement in terms of clarity for each item of the ATTUSR-C questionnaire was 81.63% of Fleiss's kappa in the sample of 10 clinical instructors. According to Auld et al. [38], this result reflected an acceptable level of face validity and further minor changes such as word order were made. All of the clinical instructors reported that they understood the wordings used and the meaning of the items. Therefore, the ATTUSR-C questionnaire was used in subsequent psychometrics testing without any further revision.

4.1.3 Psychometric Validation

A total of 95 participants responded to the survey. Most participants were female (95%), and the average age was 44.5 years ($SD = 11.9$) with an age range of 25 to 63 years. The majority of participants were married (68%). The average clinical working experience was 10 years ($SD = 5.5$), and 45% of participants worked in residential care facilities, 33% in nursing homes and 22% in rehabilitation wards.

The internal consistency of the ATTUSR-C questionnaire was established with a Cronbach's alpha of .84. Prior to performing PCA, the suitability of the data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The Kaiser–Meyer–Olkin value was .79, and Bartlett's test of sphericity reached statistical significance ($p < .001$), supporting the factorability of the correlation matrix.

The PCA revealed the presence of four components with eigenvalue exceeding 1, explaining 35%, 11.3%, 8.2% and 6.7% of the variance respectively. An inspection of the scree plot revealed a clear break after the second component. Only the first two components were retained for further investigation based on the Cattell's scree test where it showed two factors above the break in the plot [39]. This was further supported by the results of the parallel analysis that showed only the same two components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size.

The two components solution explained a total of 46.3% of the variance, with Factor 1 contributing 35% and Factor 2 contributing 11.3%. To aid in the interpretation of these two components, oblimin rotation was performed. Following oblimin rotation, the two factors showed a weak intercorrelation ($r = -.31$). The rotation solution revealed the presence of a simple structure, with 13 items loading substantially on only one component. Factor 1 items loaded strongly, and 6 items also showed cross-loadings on Factor 2 with mild to moderate correlation (Table 1). However, by analysing the pattern and the structure matrix, it is concluded that a two-factor solution does not provide optimal theoretical and methodological structuring of the items. Given evidence of the strong overlap of the two factors, a one-factor model was retained for the ATTUSR-C questionnaire, which is the same as the original English version of the ATTUSR question by Costescu and David [20]. Therefore, confirmatory factor analysis was not performed.

4.2 Attitudes of Health Personnel Towards The Use of Social Robots for Older Adults in LTC

4.2.1 Demographic Characteristics of Health Professionals

In total, 416 health personnel responded to the online survey. Table 2 provides an overview of the characteristics of respondents. The mean age of respondents was 39.16 years ($SD = 11.37$). Of these, the mean length of work experience was 6.12 years ($SD = 5.74$). About 85.8% of the respondents were female, and 14.2% were male. The majority of respondents (75.9%) had obtained college or above education. Registered nurses (43.5%) and nursing aides (31.7%) were the majority of respondents. Over half of the respondents (56.5%) were working in nursing homes, and 25.7% were working in residential aged care. However, just half of the respondents (50.7%) were aware that social robots were used in healthcare settings.

Table 2 Demographics of participants (N = 416)

Variable	%
Age (mean, SD)	39.16 (11.37)
Working experience year (mean, SD)	6.12 (5.74)
Gender	
Male	14.2
Female	85.8
Educational level	
Master and Ph.D.	8.4
College	67.5
Senior	18.8
Junior	4.8
Primary	.5
Speciality	
Registered nurse	43.5
Nursing aid	31.7
Social worker	8.7
PT/OT	1.9
Psychologist	1.0
Physician/psychiatrist	.7
Administer/managers	9.4
Nutritionist	3.1
Facility	
Nursing home	56.5
Residential aged care	25.7
Home care	12.7
Rehabilitation wards	5.0
Aware of social robots	
No	49.3
Yes	50.7

SD, standard deviation; PT, physical therapist; OT, occupational therapist

4.2.2 Results of Investigation of Attitudes of Health Personnel Towards The Use of Social Robots

The mean ATTURS-C score of respondents was 41.2 ($SD = 7.8$) out of a total score of 60, indicating health personnel generally possess positive attitudes towards the use of social robots for older adults in LTC. As shown in Table 3, 84.4% of respondents agreed or strongly agreed that using social robots in health/nursing care practice could make the care work more interesting (i.e. item 10), and beneficial for society as it helps both health professionals and older adults living in LTC (70.9%; item 3). The majority of respondents believed that not only can social robots help with the diagnosis of people with mental illness (64.9%; item 13), but they can also be useful for older people in LTC who are receiving mental health services (76.4%; item 6) by providing support (76.6%; item 4), acting as a companion (i.e. 81.3%; item 5), helping with treatment (78.3; item 1), and increasing treatment efficiency (58.9%; item 8). Close to two-thirds of respondents indicated that social robots could help them in achieving their care objectives with support for daily activities (i.e. 63.9%; item 2) and believed that people would be comfortable with the use of social robots during the care process (69.4%; item 11) and as part of a therapeutic activity (76.6%; item 14). Most health personnel considered that robots would not pose threats to mental health services designed for older adults (63%; item 15). Over 50% of respondents agreed that using social robots could lead to a resolution of difficulties in less time in the process of care (item 7), but only 47.4% of respondents reported that it could reduce health treatment costs (item 9). However, respondents had mixed views as to whether they believe social robots would be a threat to aged care services (item 12).

A point-biserial correlation was conducted to explore the relationship between attitudes and awareness of using social robots. Attitudes of respondents towards the use of social robots for older adults in LTC were found to be positively and significantly correlated with their awareness of the use of social robots in nursing homes (rpb = .18, $p < .000$). Respondents' attitudes were not correlated with any demographic variables, except for their place of work. Statistically significant differences were found in respondents who worked in different facilities, $F(3,412) = 3.38$, $p = .02$. Turkey's post hoc analysis revealed that respondents working in nursing homes (M = 41.91, $SD = 8.37$) had significantly higher positive attitude scores towards social robots than those in residential aged care (M = 39.45, $SD = 6.79$, Table 4).

Furthermore, factor analysis was conducted using data from the online survey (n = 416). The results were consistent with our previous results indicating that a one-factor model was confirmed for the ATTUSR-C questionnaire with an excellent Cronbach's alpha of .92.

5 Discussion

To our knowledge, this is the first study that has focused on modification and validation of a questionnaire for use with health personnel and to examine attitudes towards the use of social robots for older adults in LTC. The ATTUSR-C questionnaire had good validity and reliability, suggesting that this questionnaire is a reliable means for measuring attitudes towards social robots amongst Chinese health personnel working in LTC. Good content validity, as reflected by I-CVI and S-CVI/Ave, of the ATTUSR-C questionnaire indicated a consistent semantic equivalence between the Chinese and modified English versions of the questionnaire. Additionally, face validity for the ATTUSR-C questionnaire was also established. Therefore, the ATTUSR-C questionnaire satisfied content validation with its items representing the

Table 3 Frequency and percentage of response to questionnaire by participants (N = 416)

Items	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	N	%	N	%	N	%	N	%	N	%
1. Social robots could help with treatment of older people with mental illness	2	.5	12	2.9	76	18.3	241	57.9	85	20.4
2. Social robots could help the health professional to reach his/her objectives in care with support for daily activities	2	.5	24	5.8	124	29.8	208	50.0	58	13.9
3. Social robots could be useful for society because they help both health professionals and older people living in long-term care facilities	2	.5	15	3.6	104	25.0	218	52.4	77	18.5
4. Social robots could help both health professionals and older people in aged care for support	3	.7	10	2.4	84	20.2	236	56.7	83	20.0
5. Social robots could represent companions for older adults living in long-term care facilities	3	.7	11	2.6	64	15.4	240	57.7	98	23.6
6. Social robots could be useful in mental health services for older adults	2	.5	8	1.9	88	21.2	233	56.0	85	20.4
7. Using social robots could in the health/nursing care process lead to resolving of difficulties in less time	5	1.2	32	7.7	165	39.7	177	42.5	37	8.9
8. Using social robots could in the health/nursing care process increase treatment efficiency	3	.7	25	6.0	143	34.4	195	46.9	50	12.0
9. Using social robots could reduce health/nursing treatment costs	7	1.7	43	10.3	169	40.6	156	37.5	41	9.9
10. Using social robots in the health/nursing care process could make the care work more interesting	3	.7	6	1.4	56	13.5	257	61.8	94	22.6
11. I think that older adults would be comfortable if health professionals would use a social robot in the care process	2	.5	8	1.9	117	28.1	231	55.5	58	13.9
12. I consider that social robots could be a threat for aged care services	27	6.5	151	36.3	129	31.0	92	22.1	17	4.1
13. Social robots could help with the process of diagnosis of people with mental illness	4	1.0	17	4.1	125	30.0	225	54.1	45	10.8
14. I think that older adults would be comfortable if they participate at a therapeutic activity where the health professional used a social robot	2	.5	9	2.2	87	20.9	257	61.8	61	14.7
15. I consider that robots would not pose a threat for mental health services designed for older adults	8	1.9	23	5.5	123	29.6	215	51.7	47	11.3

Table 4 Respondents' characteristics differences using ANOVA

		ANOVA					Tukey HSD
		Sum of squares	*df*	MS	F	*p*	
Age groups (years)							
20–34	Between groups	226.08	2	113.04	1.84	0.16	
35–49	Within groups	25,339.01	413	61.35			
50 over	Total	25,565.09	415				
Educational groups							
Master and Ph.D.	Between groups	21.34	2	10.67	0.17	0.84	
College/Uni	Within groups	25,543.76	413	61.85			
Senior and junior	Total	25,565.09	415				
Year of working experience groups (years)							
< 1	Between groups	152.09	4	38.02	0.61	0.65	
1–3	Within groups	25,179.77	405	62.17			
3–6	Total	25,331.86	409				
6–9							
> 9							
Specialty groups							
Registered nurse	Between groups	515.17	4	128.79	2.11	0.08	
Nursing aid	Within groups	25,049.92	411	60.95			
Social worker	Total	25,565.09	415				
Manager							
Other speciality							
Facility							
Nursing home (NH)	Between groups	613.33	3	204.44	3.38	0.02	NH versus RAC*
Residential aged care (RAC)	Within groups	24,951.76	412	60.56			NH versus HC
Home care (HC)	Total	25,565.09	415				NH versus RW
Rehabilitation ward (RW)							RAC versus HC
							RAC versus RW
							HC versus RW

*Significance value $p < 0.05$

content concepts. Furthermore, the adoption of a one-factor model for the study showed congruence with the findings in previous research by Costescu and David [20], which used the original English version of the ATTUSR questionnaire, to examine children's and adults' attitudes towards the use of a social robot in mental health services. The attitudes of health personnel towards the use of social robots in LTC is underexplored with limited well-constructed and validated instruments being currently available. Therefore, there are no gold standard instruments which could be used to compare the usefulness and appropriateness of the ATTUSR questionnaire. Consequently, this questionnaire has important implications for developing an index for future study.

The main findings of the online survey were that health personnel had positive attitudes towards the use of social robots for older adults in LTC as they viewed social robots as beneficial and practical in psychosocial care for older adults. Interestingly, the results demonstrated differences in attitudes towards the use of social robots for health personnel working in nursing homes compared to residential aged care. For example, residents in nursing homes typically live with complex healthcare conditions that require the assistance of a skilled nurse or a physical assistant. In contrast, residents in residential aged care generally require custodial care where residents need a little help with their activities of daily living by less skilled staff. Therefore, health personnel working in nursing homes have a greater care burden than these in residential aged care and insufficient time to interact with residents [40], which may result in the differences between these settings. Furthermore, the results revealed that the attitudes of health personnel towards the use of social robots for older adults in LTC were significantly influenced by their awareness of social robots. These results are in accordance with the study of Turja et al. [41] where healthcare personnel with less experience with social robots had more negative attitudes towards them. In addition, Evans and Durant [42] reported that greater knowledge leads to more positive attitudes and informs many practical initiatives in science. Our findings may suggest that more knowledge

pertaining to the use of social robots in LTC was associated with more positive attitudes towards the social robots in care settings.

There were no significant correlations in age, gender, educational level, specialty, and working experience among health personnel attitudes towards the use of social robots for older adults in LTC. Prior studies have shown that younger and older adults had similar attitudes regarding the impact of technologies in the United States [43, 44]. Our results are in accordance with these studies indicating that health personnel in different age groups working in LTC did not show significant differences in attitudes towards the use of social robots. However, Hudson et al. [45] found that females and those who are older and less educated had less favorable attitudes towards the use of robots in care of older adults in Europe. Therefore, this may suggest that factors affecting attitudes across the use of social robots between different populations may vary.

With regard to gender, there were no significant differences in attitudes towards social robots among health personnel. However, this finding is in contrast with those of previous studies, which have demonstrated that gender is a factor influencing attitudes towards robots [10, 45]. There is evidence showing that men react more positively to robots in practice, as demonstrated in a study of reactions of older adults to a conversational robot [46]. However, the findings of our study do not support the previous research. Another point for consideration is that the majority of health personnel in aged care settings are female [47]. Hence, this ratio may have affected the findings of the study. Another interesting finding that emerged from our research is the impact of educational level on attitudes towards the acceptance of social robots. Our outcome is contrary to that of Broadbent et al. [16] who found that older people who are more educated tend to have more favorable attitudes to robots. This inconsistency may be due to the different target population in our study (i.e. health personnel) and that of Broadbent et al. (i.e. general older populations) [16], as well as cultural differences in attitudes towards robots. For example, a prior study by Nomura et al. [48] indicated that university students in Japan considered robots would be more likely to perform nursing, education and social roles than those in Korea and the USA.

In our study, respondents positively indicated that social robots could provide support, companionship, and benefits for older adults in LTC. These results reflect similar outcomes to Moyle et al. [15] who found that staff perceived social robots had benefits such as providing companionship for people with dementia. Furthermore, the health personnel also reported that social robots could help them in achieving care objectives in supporting daily activities, resolving difficulties in less time, increasing treatment efficacy, and making the care work more interesting during the care process. These results are in line with previous studies [7, 19], which indicated that robots may impact on health personnel autonomy and relationships with patients during the care process. However, Broadbent et al. [14] reported that staff in retirement homes demonstrated more negative attitudes towards the social robot than residents due to fears of replacement by robots. This differs from the findings presented here where a majority of respondents disagreed that social robots pose threats for aged care or mental health services. Although most respondents possessed positive attitudes towards the use of social robots in aged care, only 47.4% of health personnel considered that using them could reduce health/nursing treatment costs and 40% of them remained neutral. Further study with more focus on the cost-effect of using social robots in the care process is therefore recommended.

5.1 Limitations

This study had some limitations. First, the measure of attitudes used in the current research does not reflect the intent to use social robots. Future research on attitudes toward robots should also focus on behavioral intentions. Second, the majority of online survey respondents were female (85.8%) and this may give rise to gender response bias that limits the generalization of the results. Therefore, the results need to be interpreted with caution. Further research, which takes this variable into account, needs to be undertaken. Although health personnel were able to comment on what they envisaged were positive outcomes in the use of social robots for older adults, they had limited exposure to and experience in the use of social robots, and this may be a further limitation of this research. Further research is needed to understand the effects of using social robots in psychosocial care to ensure that health personnel have a real experience of using social robots. Finally, the ATTUSR-C questionnaire is a new tool for use by health personnel. As there is no related Chinese questionnaire to assess convergent validity, further work to examine the convergent validity of this questionnaire is warranted.

5.2 Implications for Clinical Practice

Our findings represent valuable contributions to research concerning attitudes toward social robots for health personnel working in LTC. The questionnaire can be used to assess health professionals' attitudes towards social robots to improve understanding of the implementation of social robots in health settings. Furthermore, developing an instrument designed to investigate health professionals' attitudes towards the use of social robots is necessary in order to understand the perceived value of social robots as this influenced whether care staff use social robots for facilitating interventions in aged care facilities. Finally, the ATTUSR-C

questionnaire could be used to establish construct validity for different social robotic attitude instruments.

6 Conclusion

Social robots have increasingly been used to deliver health and social care in health settings. The evidence indicates that the ATTUSR-C questionnaire is a reliable and valid instrument for assessing the acceptability of social robots for health professionals working in LTC facilities. This study strives to support aged care work by providing insights into health personnel perceptions of social robots for older adults; these perceptions are important to ensure appropriate and proper integration of robot technologies into older adults' lives and care in LTC. This present research builds on the fact that positive attitudes might facilitate health personnel acceptance and adoption of social robots for older people in LTC. Health personnel and nursing researchers can use this study to inspire further interventions using robots to improve the quality of care in care settings.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval Implied consent to participate in the study was reflected via their online completion and submission of the questionnaire. This was a non-clinical study without any harming procedure and all data were collected anonymously.

References

1. McGlynn SA, Kemple S, Mitzner TL, King C-HA, Rogers WA (2017) Understanding the potential of PARO for healthy older adults. Int J Hum Comput Stud 100:33–47. https://doi.org/10.1016/j.ijhcs.2016.12.004
2. Moyle W, Jones CJ, Murfield JE, Thalib L, Beattie ER, Shum DK, O'Dwyer ST, Mervin MC, Draper BM (2017) Use of a robotic seal as a therapeutic tool to improve dementia symptoms: a cluster-randomized controlled trial. J Am Med Dir Assoc 18(9):766–773. https://doi.org/10.1016/j.jamda.2017.03.018
3. Moyle W, Arnautovska U, Ownsworth T, Jones C (2017) Potential of telepresence robots to enhance social connectedness in older adults with dementia: an integrative review of feasibility. Int Psychogeriatr 29(12):1951–1964. https://doi.org/10.1017/S1041610217001776
4. Abdi J, Al-Hindawi A, Ng T, Vizcaychipi MP (2018) Scoping review on the use of socially assistive robot technology in elderly care. BMJ Open 8(2):20. https://doi.org/10.1136/bmjopen-2017-018815
5. Jøranson N, Pedersen I, Mork Rokstad AM, Aamodt G, Olsen C, Ihlebæk C (2016) Group activity with Paro in nursing homes: systematic investigation of behaviors in participants. Int Psychogeriatr 28(8):1345–1354. https://doi.org/10.1017/S1041610216000120
6. Sung HC, Chang SM, Chin MY, Lee WL (2015) Robot-assisted therapy for improving social interactions and activity participation among institutionalized older adults: a pilot study. Asia Pac Psychiatry 7(1):1–6. https://doi.org/10.1111/appy.12131
7. Vänni KJ, Salin SE (2019) Attitudes of professionals toward the need for assistive and social robots in the healthcare sector. In: Korn O (ed) Social robots: technological, societal and ethical aspects of human–robot interaction. Springer, Cham, pp 205–236. https://doi.org/10.1007/978-3-030-17107-0_11
8. Rantanen T, Lehto P, Vuorinen P, Coco K (2018) The adoption of care robots in home care-a survey on the attitudes of Finnish home care personnel. J Clin Nurs 27(9–10):1846–1859. https://doi.org/10.1111/jocn.14355
9. Campa R (2016) The rise of social robots: a review of the recent literature. J Evol Technol 26(1):106–113
10. Backonja U, Hall AK, Painter I, Kneale L, Lazar A, Cakmak M, Thompson HJ, Demiris G (2018) Comfort and attitudes towards robots among young, middle-aged, and older adults: a cross-sectional study. J Nurs Scholarsh 50(6):623–633. https://doi.org/10.1111/jnu.12430
11. Pu L, Moyle W, Jones C, Todorovic M (2019) The effectiveness of social robots for older adults: a systematic review and meta-analysis of randomized controlled studies. Gerontologist 59(1):e37–e51. https://doi.org/10.1093/geront/gny046
12. Robinson H, Macdonald B, Kerse N, Broadbent E (2013) The psychosocial effects of a companion robot: a randomized controlled trial. J Am Med Dir Assoc 14(9):661–667. https://doi.org/10.1016/j.jamda.2013.02.007
13. Chen S-C, Jones C, Moyle W (2018) Social robots for depression in older adults: a systematic review. J Nurs Scholarsh 50(6):612–622. https://doi.org/10.1111/jnu.12423
14. Broadbent E, Tamagawa R, Patience A, Knock B, Kerse N, Day K, MacDonald BA (2012) Attitudes towards health-care robots in a retirement village. Australas J Ageing 31(2):115–120. https://doi.org/10.1111/j.1741-6612.2011.00551.x
15. Moyle W, Bramble M, Jones C, Murfield J (2018) Care staff perceptions of a social robot called Paro and a look-alike plush toy: a descriptive qualitative approach. Aging Ment Health 22(3):330–335. https://doi.org/10.1080/13607863.2016.1262820
16. Broadbent E, Stafford R, MacDonald B (2009) Acceptance of healthcare robots for the older population: review and future directions. Int J Soc Robot 1(4):319–330. https://doi.org/10.1007/s12369-009-0030-6
17. Mitzner T, Kemp C, Rogers W, Tiberio L (2013) Investigating healthcare providers' acceptance of personal robots for assisting with daily caregiving tasks. In: CHI '13 extended abstracts on human factors in computing systems. ACM, pp 499–504. https://doi.org/10.1145/2468356.2468444
18. Papadopoulos I, Koulouglioti C, Ali S (2018) Views of nurses and other health and social care workers on the use of assistive humanoid and animal-like robots in health and social care: a

scoping review. Contemp Nurse 54(4–5):425–442. https://doi.org/10.1080/10376178.2018.1519374
19. Esmaeilzadeh P, Sambasivan M, Kumar N, Nezakhati H (2011) Adoption of technology applications in healthcare: the influence of attitude toward knowledge sharing on technology acceptance in a hospital. In: Kim T, Adeli H, Ma J et al (eds) U- and E-service, science and technology: international conference, UNESST. Springer, Berlin, pp 17–30. https://doi.org/10.1007/978-3-642-27210-3_3
20. Costescu CA, David DO (2014) Attitudes toward using social robots in psychotherapy. Erdélyi pszichológiai szemle 15(1):3–20
21. Altmann TK (2008) Attitude: a concept analysis. Nurs Forum 43(3):144–150. https://doi.org/10.1111/j.1744-6198.2008.00106.x
22. Heerink M, Kröse B, Evers V, Wielinga B (2010) Assessing acceptance of assistive social agent technology by older adults: the almere model. Int J Soc Robot 2(4):361–375. https://doi.org/10.1007/s12369-010-0068-5
23. Stafford RQ, Broadbent E, Jayawardena C, Unger U, Kuo IH, Igic A, Wong R, Kerse N, Watson C, MacDonald BA (2010) Improved robot attitudes and emotions at a retirement home after meeting a robot. In: 19th international symposium in robot and human interactive communication. 2010 IEEE, pp 82–87. https://doi.org/10.1109/roman.2010.5598679
24. Heerink M, Kröse B, Evers V, Wielinga B (2009) Influence of social presence on acceptance of an assistive social robot and screen agent by elderly users. Adv Robot 23(14):1909–1923. https://doi.org/10.1163/016918609x12518783330289
25. Davis FD, Bagozzi RP, Warshaw PR (1989) User acceptance of computer technology: a comparison of two theoretical models. Manage Sci 35(8):982–1003. https://doi.org/10.1287/mnsc.35.8.982
26. Venkatesh V, Morris MG, Davis GB, Davis FD (2003) User acceptance of information technology: toward a unified view. MIS Q 27(3):425–478
27. Nomura T, Kanda T, Suzuki T, Kato K (2004) Psychology in human–robot communication: an attempt through investigation of negative attitudes and anxiety toward robots. In: 2004 IEEE, pp 35–40. https://doi.org/10.1109/roman.2004.1374726
28. Syrdal DS, Dautenhahn K, Koay KL, Walters ML (2009) The negative attitudes towards robots scale and reactions to robot behaviour in a live human–robot interaction study. In: Adaptive and emergent behaviour and complex systems
29. Vänni KJ, Salin SE (2017) A need for service robots among health care professionals in hospitals and housing services. In: Social robotics ICSR 2017. Springer, Cham, pp 178–187
30. World Health Organization (2017) Process of translation and adaptation of instruments. http://www.who.int/substance_abuse/research_tools/translation/en/. Accessed 28 April 2018
31. Polit D, Beck T, Owen S (2007) Focus on research methods is the CVI an acceptable indicator of content validity. Res Nurs Health 30:459–467
32. Waltz CF, Strickland OL, Lenz ER (2010) Measurement in nursing and health research, 4th edn. Springer, New York
33. Cohen RJ, Swerdlik ME (2009) Psychological testing and assessment: an introduction to tests and measurement, 7th edn. McGraw-Hill, New York
34. Ferketich S (1990) Internal consistency estimates of reliability. Res Nurs Health 13(6):437–440. https://doi.org/10.1002/nur.4770130612
35. IBM Corp. (2016) IBM SPSS statistics for windows, version 24.0. IBM Corp., Armonk, NY
36. Horn JL (1965) A rationale and test for the number of factors in factor analysis. Psychometrika 30:179–185. https://doi.org/10.1007/BF02289447
37. Streiner DL, Norman GR, Cairney J (2015) Health measurement scales: a practical guide to their development and use, 5th edn. Oxford University Press, USA
38. Auld G, Baker S, McGirr K, Osborn KS, Skaff P (2017) Confirming the reliability and validity of others' evaluation tools before adopting for your programs. J Nutr Educ Behav 49(5):441–450. e441. https://doi.org/10.1016/j.jneb.2017.02.006
39. Cattell RB (1978) The scientific use of factor analysis in behavioral and life sciences. Plenum Press, New York
40. Hasson H, Arnetz JE, Medicinska f, Medicinska och farmaceutiska v, Uppsala u, Institutionen för folkhälso- och v, Socialmedicin (2008) Nursing staff competence, work strain, stress and satisfaction in elderly care: a comparison of home-based care and nursing homes. J Clin Nurs 17(4):468–481. https://doi.org/10.1111/j.1365-2702.2006.01803.x
41. Turja T, Van Aerschot L, Särkikoski T, Oksanen A (2018) Finnish healthcare professionals' attitudes towards robots: reflections on a population sample. Nurs Open 5(3):300–309. https://doi.org/10.1002/nop2.138
42. Evans G, Durant J (1995) The relationship between knowledge and attitudes in the public understanding of science in Britain. Public Underst Sci 4(1):57–74. https://doi.org/10.1088/0963-6625/4/1/004
43. Libin AV, Libin EV (2004) Person-robot interactions from the robopsychologists' point of view: the robotic psychology and robotherapy approach. Proc IEEE 92(11):1789–1803. https://doi.org/10.1109/jproc.2004.835366
44. Smith A (2014) US views of technology and the future: science in the next 50 years. http://www.pewinternet.org/2014/04/17/us-views-of-technology-and-the-future/. Accessed 17 April 2019
45. Hudson J, Orviska M, Hunady J (2017) People's attitudes to robots in caring for the elderly. Int J Soc Robot 9(2):199–210. https://doi.org/10.1007/s12369-016-0384-5
46. Stafford RQ, MacDonald BA, Li XY, Broadbent E (2014) Older people's prior robot attitudes influence evaluations of a conversational robot. Int J Soc Robot 6(2):281–297. https://doi.org/10.1007/s12369-013-0224-9
47. Mavromaras K, Knight G, Isherwood L, Crettenden A, Flavel J, Karmel T, Moskos M, Smith L, Walton H, Wei Z (2017) 2016 National aged care workforce census and survey: the aged care workforce, 2016. Department of Health, Canberra. https://agedcare.health.gov.au/news-and-resources/publications/2016-national-aged-care-workforce-census-and-survey-the-aged-care-workforce-2016. Accessed 20 March 2019
48. Nomura T, Suzuki T, Kanda T, Han J, Shin N, Burke J, Kato K (2008) What people assume about humanoid and animal-type robots: cross-cultural analysis between Japan, Korea, and the USA. Int J Humanoid Robot 5:25–46

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