

Integrated Home Service Robots for Ageing in Place: A Multi-Stakeholder Perspective on Acceptance and Care Needs in Taiwan

Yuhsin Chen and Wenhue Chou

Department of Digital Media Design, National Yunlin University of Science and Technology, Douliu, Yunlin 64002, Taiwan

ABSTRACT

As population ageing and ageing in place become increasingly important, home service robots (HSRs) have been discussed as potential support for domestic care. However, HSR acceptance in home settings involves not only older adults, but also family members and care workers. This study explores multi-stakeholder needs and concerns regarding HSRs in Taiwan through semi-structured interviews with six information-rich participants: two older adults, two family members, and two care workers. Findings show that stakeholders valued practical functions such as medication reminders, health monitoring, safety alerts, and support for daily routines. However, acceptance differed by role. Care workers emphasized workflow fit and early risk detection, family members valued reassurance and remote support, while older adults stressed autonomy, control, privacy, and low operational burden. The study suggests that HSRs should be designed as assistive tools that fit everyday care practices, domestic space, and existing family relationships rather than as replacements for human care.

Keywords: Home service robots, Ageing in place, Human-robot interaction, Multi-stakeholder perspectives, Older adults, Family caregivers

INTRODUCTION

Population ageing is reshaping the conditions under which care is provided at home, and this issue is particularly urgent in Taiwan, where demographic ageing is progressing rapidly (National Development Council, 2022; Ministry of the Interior, 2025). As home-based care becomes an important form of long-term care service, families and care workers face increasing pressure in supporting older adults' daily living and safety (Ministry of Health and Welfare, 2022; Chen, 2024).

Against this background, smart elderly care and home service robots (HSRs) have received growing attention as possible tools for supporting ageing in place (Executive Yuan, 2023; Sawik et al., 2023). However, the integration of HSRs into domestic environments does not depend only on technical functions. Prior research shows that perceived usefulness, ease of use, prior technology experience, and trust shape older adults' acceptance of

gerontechnology and home service robots (Chen and Chan, 2011; Chen and Chan, 2014; Kim, 2025).

In home care contexts, these issues become more complex because robots enter private spaces and interact with existing routines, relationships, and care responsibilities. This complexity is especially important in Taiwan's diverse household contexts. HSR acceptance should not be understood only from the perspective of a single user, because household composition and surrounding stakeholders may shape how such technologies are selected, used, maintained, or resisted (Kim, 2025; Tobis et al., 2023). A multi-stakeholder perspective is therefore needed to clarify how different actors understand the roles, functions, and risks of HSRs in everyday care.

This study examines the acceptance and needs of HSRs in Taiwan's ageing-in-place context through qualitative interviews with older adults, family members, and care workers. It is guided by two research questions: RQ1. What needs do older adults, family members, and care workers express regarding home service robots in domestic care contexts? RQ2. What concerns do older adults, family members, and care workers express regarding the use of home service robots in domestic care contexts?

Ageing in Place and Home Service Robots

Ageing in place generally refers to older adults' ability to live safely, independently, and comfortably in their own homes and communities (CDC, 2019; Pani-Harreman et al., 2021). Many older adults value familiar home environments because they are closely linked to autonomy, self-management, identity, and quality of life (Horner and Boldy, 2008; Means, 2007). However, ageing in place also increases care responsibilities for families and home-based care systems, especially when care needs grow while available care resources remain limited.

Home service robots have been discussed as one possible response to this care gap within broader smart elderly care development (Liu and Wang, 2025; Sawik et al., 2023). In domestic settings, HSRs may support reminders, monitoring, daily assistance, companionship, and emergency alerts (Broadbent et al., 2009; Sawik et al., 2023). However, acceptance depends on more than functional capability. Prior studies indicate that perceived usefulness, ease of use, trust, and prior technology experience influence older adults' willingness to adopt gerontechnology and home service robots (Chen and Chan, 2011; Chen and Chan, 2014; Kim, 2025). In this study, HSRs are defined as home service robots with care-oriented and integrated functions that may support domestic tasks, daily companionship, physiological monitoring, and safety reminders. They are not positioned as replacements for human caregivers, but as assistive technologies within the family and home care ecosystem.

Multi-Stakeholder Acceptance of HSRs

Research on older adults' technology adoption has often focused on the individual user, emphasizing perceived usefulness, ease of use, trust, and behavioral intention (Davis, 1989; Chen and Chan, 2014; Heerink et al., 2010). In ageing-in-place contexts, however, technology is embedded in

household relationships and care arrangements rather than used by an isolated individual. Family members may influence purchase decisions, setup, monitoring, and continued use, while care workers may evaluate robots according to their fit with care routines and professional responsibilities (Kim, 2025; Tobis et al., 2023).

A multi-stakeholder perspective is therefore important for understanding HSR acceptance. Older adults may value robots when they support independence, dignity, and daily living, but may resist functions that reduce autonomy or increase privacy risks (Vandemeulebroucke et al., 2021; Sharkey and Sharkey, 2012). Family members may prioritize safety, reassurance, and remote monitoring, especially when they cannot be physically present. Care workers may focus on whether robots can support care practices, reduce workload, and detect risks without weakening the human dimension of care (Tobis et al., 2023).

These differences suggest that HSR acceptance cannot be explained only through individual attitudes toward technology. It must also be examined in relation to care roles, household routines, domestic space, and the boundaries between human care and robotic assistance.

Participants and Data Collection

Participants were recruited through purposive sampling to reflect a multi-stakeholder perspective. Three groups were included: older adults aged 65 and above, family members who lived with or were primarily responsible for caring for older adults, and professionals with home care experience. At the time of this study, 30 semi-structured interviews had been completed. For the present paper, six information-rich cases were selected through purposive contrast sampling, including two older adults, two family members, and two care workers. Within each group, one participant with a relatively supportive attitude toward HSRs and one participant with a relatively resistant attitude were included. These six cases were selected because they provided rich descriptions of both acceptance and resistance toward HSRs across different stakeholder roles.

Semi-structured interviews were used to explore participants' daily activities, care needs, prior technology experience, functional expectations, interaction preferences, privacy concerns, purchase intention, and perceived advantages and disadvantages of HSRs. The interview guide was informed by literature on technology acceptance, ADL/IADL, older adults' expectations of home robots, social responses to technology, and care ethics (Davis, 1989; Lawton and Brody, 1969; Broadbent et al., 2009; Sharkey and Sharkey, 2012). Each interview lasted approximately 40 to 60 minutes. Follow-up questions were asked based on participants' responses.

Data Analysis and Rigor

The interview data were analyzed using template analysis following Brooks et al. (2015). This method was appropriate because the study focused on a defined topic, HSR acceptance and needs in ageing-in-place contexts, while allowing the coding structure to be refined through the data. The researchers first conducted repeated reading and initial coding of three transcripts to

develop the initial template. The template was then applied to the remaining three transcripts and revised when new data could not be fully captured by the existing structure.

The final coding template consisted of five main themes: functional requirements, attitudes toward HSRs, concerns in practical use, appearance and operational preferences, and daily life habits and background experiences. To support trustworthiness, interviews were audio-recorded with consent and transcribed verbatim. Member checking and peer debriefing were used to improve coding consistency and the accuracy of interpretation. After revision, coding reliability increased from 0.788 to 0.905 for main-theme agreement and from 0.667 to 0.872 for main- and sub-theme agreement.

Table 1: Final coding template.

Main Themes	Sub-Themes
Functional Requirements	Assistive empowerment and quality of life improvement; health management and physiological monitoring; home safety and critical event reminders
Attitudes Toward HSRs	Priority of care targets and human touch; resistance and acceptance of technology intervention; budget and financial affordability
Concerns in Practical Use	Privacy and data security concerns; maintenance costs and reliability concerns; safety risks and loss of control
Appearance and Operational Preferences	Industrial design and aesthetics; mobility and control interface
Daily Life Habits and Background Experiences	Typical activity trajectories; experience with technology products; past life experiences; past caregiving experiences

FINDINGS

Based on the revised coding template, five themes were identified as shaping participants' acceptance of home service robots (HSRs): functional requirements, attitudes toward HSRs, concerns in practical use, appearance and operational preferences, and daily life habits and background experiences. Across these themes, participants did not evaluate HSRs mainly as new technologies. They considered whether HSRs could respond to practical needs, fit into existing routines, avoid new risks, and take an acceptable role in later-life care.

Functional Requirements: HSRS Were Valued When They Addressed Concrete Care Needs

The first theme, functional requirements, shows that participants valued HSRs when they addressed concrete problems in domestic care. Across stakeholder groups, the most frequently mentioned functions were medication reminders, schedule reminders, physiological monitoring, and safety alerts. These functions were seen as practical forms of support rather than highly social or highly intelligent capabilities.

Care workers emphasized reminders and monitoring as part of everyday care. One participant stated, "I would hope it has reminders for important

events. A medication calendar is also quite important” (C1-1-1). Family members connected these functions to reassurance when they could not be physically present. As one family member explained, such functions could “make us feel more at ease when we are not at home and reduce the psychological burden of caregivers” (F2-1-22).

These findings correspond to prior studies on ageing in place, which emphasize older adults’ desire to live safely and independently in familiar environments (Pani-Harreman et al., 2021). Participants valued HSRs not as replacements for human care, but as assistive resources for repetitive, easily overlooked, yet safety-critical tasks.

Attitudes Toward HSRS: Acceptance Depended on How Participants Defined Care

The second theme shows that acceptance depended on how participants defined care and usefulness. Although all stakeholder groups valued practical support, they understood usefulness differently. Care workers focused on whether HSRs could fit into care practices and support early risk detection. Family members valued reassurance and practical assistance when they were not physically present. Older adults were more concerned with whether robots supported rather than weakened their autonomy.

For care workers, HSRs were valuable when they could help identify abnormal situations and reduce delays in care. One care worker described a case in which an older adult who usually opened the door did not do so, and was later found to have fallen on the bed (C2-1-5). For older adults, the key issue was maintaining control over daily life. As one participant stated, “The point is to make your life more at your own will. That is the key point” (E2-1-36).

Participants were therefore not simply supportive of or opposed to robotic care. They were more willing to accept HSRs when robots were positioned as support for human care rather than replacements for family members or care workers. This indicates that acceptance should be understood in relation to stakeholder roles and care responsibilities, rather than as a single general attitude toward technology (Tobis et al., 2023; Vandemeulebroucke et al., 2021).

Concerns in Practical use: Adoption was Constrained by Space and Complexity

The third theme concerns the practical burdens that HSRs might create after entering the home. Participants’ concerns were not based on a general rejection of technology, but on whether robots could function safely and conveniently in actual domestic environments. Three issues appeared repeatedly: spatial fit, maintenance and hidden costs, and operational complexity.

Spatial fit was especially important. Older adults and family members worried that mobile robots might become obstacles rather than support. One older participant said, “I still think a fixed one is acceptable; that moving one is dangerous” (E1-8-2). A family member similarly worried that a robot could become a barrier in a multi-floor home with stairs and limited space (F2-1-23).

Operational complexity was another barrier. Older adults showed low tolerance for systems that required repeated setup or connection. One participant stated, “If you still need wireless transmission and all that connecting back and forth, then I would rather not use it. It is too troublesome” (E1-1-2). These concerns suggest that HSR acceptance depends not only on whether functions exist, but also on whether the robot can enter the home without increasing spatial, financial, or cognitive burden (Chen and Chan, 2014).

Appearance and Operational Preferences: Acceptable Robots Needed Clear Boundaries

The fourth theme concerns participants’ preferences for robot form, behavior, and interaction style. Overall, participants preferred robots with clear boundaries. Compared with highly anthropomorphic robots or systems that actively interpreted emotions, they preferred tool-like robots that could respond when needed, remain controllable, and avoid excessive intervention.

One family member rejected emotion recognition, explaining that if she was simply tired, she would not want the robot to repeatedly ask whether she was unhappy or unwell (F1-1-18). At the same time, participants still expected convenient support, especially through simple control methods such as voice commands or buttons. Another participant noted that a robot should be able to respond when called from different locations in the home (F1-1-17).

Participants were also cautious toward excessive human-likeness. One family member commented that a robot that looked too much like a human would feel “quite creepy” (F2-1-13). These findings suggest that acceptable HSRs should provide clear, immediate, and controllable assistance without blurring the role boundary between humans and robots (Broadbent et al., 2009; Sharkey and Sharkey, 2012).

Daily Life Habits and Background Experiences: Acceptance was Shaped by Existing Routines and Technology Experience

The fifth theme shows that HSR acceptance was shaped by existing routines, domestic space, prior technology experience, and past caregiving experience. Participants did not evaluate robots in abstract terms. Instead, they imagined whether HSRs could fit into specific daily situations and whether older adults would be able to use them without relying heavily on family members.

Prior technology experience strongly influenced acceptance. One family member explained that her mother used only simple phone functions, mainly making calls and watching LINE videos, and was resistant to learning new technology unless family members prepared and set it up for her (F2-1-1; F2-1-3). A care worker described similar situations in which older adults had difficulty recovering from small operation errors when using household technologies (C2-1-44).

Past caregiving experiences also shaped how participants imagined the role of HSRs. Those who had experienced long-term care burdens were more likely to view robots as potential support for repetitive or exhausting

care tasks. These findings indicate that HSR acceptance is closely related to existing technology products, family assistance, daily care arrangements, and prior experiences with care (Chen and Chan, 2014).

DISCUSSION

This study examined older adults' and stakeholders' needs and concerns regarding HSRs in ageing-in-place contexts. For RQ1, the findings show that participants' needs centered on practical support, including reminders, health monitoring, safety alerts, and assistance with daily routines. However, these needs were interpreted differently across stakeholder roles. Care workers emphasized workflow fit and early risk detection, family members valued reassurance and remote support, and older adults focused on autonomy, control, and maintaining their preferred way of life. This suggests that HSR usefulness is not a single concept, but depends on whose care responsibilities, risks, and daily routines are being considered (Kim, 2025; Tobis et al., 2023). For RQ2, participants' concerns were mainly related to spatial fit, operational complexity, maintenance and hidden costs, privacy, safety, and interaction boundaries. These concerns show that HSR adoption may fail if robots increase care burden rather than reduce it. Participants preferred robots that were easy to control, low in maintenance demands, suitable for domestic space, and limited in emotional or anthropomorphic intervention. HSRs were more acceptable when positioned as assistive tools within existing care relationships rather than as substitutes for human care (Sharkey and Sharkey, 2012; Vandemeulebroucke et al., 2021).

This study contributes to HRI research by showing how HSR acceptance differs among older adults, family members, and care workers in Taiwan's home care context. It extends prior discussions of technology acceptance by emphasizing the importance of care roles, domestic routines, and the boundary between robotic assistance and human care. For design, the findings suggest that future HSRs should prioritize practical reminders, safety monitoring, simple control, spatial adaptability, and continued support for setup and maintenance. This study is limited by its small number of selected cases and its focus on Taiwan's home care context; therefore, the findings should be interpreted as exploratory rather than generalizable. Future research could examine a larger range of household types, health conditions, and digital abilities, as well as how HSRs are negotiated among stakeholders after entering real homes.

REFERENCES

- Broadbent, E., Stafford, R. and MacDonald, B. (2009). Acceptance of healthcare robots for the older population: Review and future directions. *International Journal of Social Robotics*, Volume 1, No. 4, pp. 319–330. doi: 10.1007/s12369-009-0030-6.
- Brooks, J., McCluskey, S., Turley, E. and King, N. (2015). The Utility of Template Analysis in Qualitative Psychology Research. *Qualitative Research in Psychology*, Volume 12, No. 2, pp. 202–222. doi: 10.1080/14780887.2014.955224.
- CDC. (2019). Healthy Places Terminology. Centers for Disease Control and Prevention. Website: <https://www.cdc.gov/healthyplaces/terminology.htm>
- Chen, K. and Chan, A.H.S. (2011). A review of technology acceptance by older adults. *Gerontechnology*, Volume 10, No. 1, pp. 1–12. doi: 10.4017/gt.2011.10.01.006.00.

- Chen, K. and Chan, A.H.S. (2014). Gerontechnology acceptance by elderly Hong Kong Chinese: A senior technology acceptance model (STAM). *Ergonomics*, Volume 57, No. 5, pp. 635–652. doi: 10.1080/00140139.2014.895855.
- Chen, Y.L. (2024). Exploring Human Resources in Taiwan's Long-Term Care: A Study on Home Service Workers' Job Experiences and Stress Coping Mechanisms. *Journal of Management Practice and Theory*, Volume 18, No. 2, pp. 17–26. Website: <https://www.airitilibrary.com/Article/Detail/19957654-N202408220001-00002>
- Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, Volume 13, No. 3, pp. 319–340. doi: 10.2307/249008.
- Executive Yuan. (2023). Age-tech industry action plan. Executive Yuan, Taipei. Website: <https://english.ey.gov.tw/News3/9E5540D592A5FECD/0bff7ad5-1061-45b2-af14-01f6f6736271>
- Heerink, M., Kröse, B., Evers, V. and Wielinga, B. (2010). Assessing acceptance of assistive social agent technology by older adults: The Almere model. *International Journal of Social Robotics*, Volume 2, No. 4, pp. 361–375. doi: 10.1007/s12369-010-0068-5.
- Horner, B. and Boldy, D.P. (2008). The benefit and burden of 'ageing-in-place' in an aged care community. *Australian Health Review*, Volume 32, No. 2, pp. 356–365. doi: 10.1071/AH080356.
- Kim, M. (2025). Adoption of home service robots: Exploring household differences in perceived usefulness. *IEEE Access*, Volume 13, pp. 64737–64749. doi: 10.1109/ACCESS.2025.3559060.
- Lawton, M.P. and Brody, E.M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist*, Volume 9, No. 3, pp. 179–186. doi: 10.1093/geront/9.3_Part_1.179.
- Liu, J. and Wang, B. (2025). Systematic Review of Smart Elderly Care in Digital Environments: Toward Sustainable Wellbeing for Older Adults. *Sustainability*, Volume 17, No. 24, 11357. doi: 10.3390/su172411357.
- Means, R. (2007). Safe as houses? Ageing in place and vulnerable older people in the UK. *Social Policy & Administration*, Volume 41, No. 1, pp. 65–85. doi: 10.1111/j.1467-9515.2007.00539.x.
- Ministry of Health and Welfare. (2022). 2022 Taiwan Health and Welfare Report. Ministry of Health and Welfare, Taipei. Website: <https://www.mohw.gov.tw/cp-137-73456-2.html>
- Ministry of the Interior. (2025). Weekly Statistical Bulletin: Week 48, 2025 - Senior Housing and Living. Ministry of the Interior, Taipei. Website: <https://www.moi.gov.tw/>
- National Development Council. (2022). Population Projections for the R.O.C. (Taiwan): 2022-2070. National Development Council, Taipei. Website: https://pop-proj.ndc.gov.tw/main_en/News_Content.aspx?n=139&s=59
- Pani-Harreman, K.E., Bours, G.J., Zander, I., Kempen, G.I. and van Duren, J.M. (2021). Definitions, key themes and aspects of 'ageing in place': A scoping review. *Ageing and Society*, Volume 41, No. 9, pp. 2026–2059. doi: 10.1017/S0144686X20000094.
- Sawik, B., Tobis, S., Baum, E., Suwalska, A., Kropińska, S., Stachnik, K., Pérez-Bernabeu, E., Cildoz, M., Agustin, A. and Wiczorowska-Tobis, K. (2023). Robots for Elderly Care: Review, Multi-Criteria Optimization Model and Qualitative Case Study. *Healthcare*, Volume 11, No. 9, 1286. doi: 10.3390/healthcare11091286.

- Sharkey, A. and Sharkey, N. (2012). Granny and the robots: Ethical issues in robot care for the elderly. *Ethics and Information Technology*, Volume 14, No. 1, pp. 27–40. doi: 10.1007/s10676-010-9234-6.
- Tobis, S., Piasek-Skupna, J., Neumann-Podczaska, A., Suwalska, A., Baum, E., Tobis, L. and Wieczorowska-Tobis, K. (2023). The Effects of Stakeholder Perceptions on the Use of Humanoid Robots in Care for Older Adults: Postinteraction Cross-Sectional Study. *Journal of Medical Internet Research*, Volume 25, e46617. doi: 10.2196/46617.
- Vandemeulebroucke, T., Dzi, K. and Gastmans, C. (2021). Older adults' experiences with and perceptions of the use of socially assistive robots in aged care: A systematic review of quantitative evidence. *Archives of Gerontology and Geriatrics*, Volume 95, 104399. doi: 10.1016/j.archger.2021.104399.