

Article title: The deployment and use of social robots for home-based healthcare: A systematic review of enablers and barriers

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Author names: Eda Karaosmanoglu, Marco C. Rozendaal, Heike Vallery, Jane Murray Cramm

Affiliation and e-mail address of the corresponding author: Erasmus University Rotterdam, Rotterdam, The Netherlands; Delft University of Technology, Delft, The Netherlands. karaosmanoglu@eshpm.eur.nl

This Supplementary Material includes the details of each individual study reported in the main text, covering study characteristics (Table 1), participant characteristics (Table 2), and robot characteristics (Table 3).

Table 1 Characteristics of the individual studies

Author(s)	Country	Intervention	Methodology & Study Design
Abendschein et al. (2022) [1]	USA	Participants lived with the Joy for All (Ageless Innovation LLC, 2018) robot kitten for 6 weeks at home during COVID-19 isolation. Their experiences with the robot were explored.	Qualitative. Semi-structured interviews
Amabili et al. (2023) [2]	Italy	Prototype 2 and 3 of GUARDIAN system including the robot Misty II (Misty Robotics) were assessed with an alpha and a beta test conducted in participants' homes. The alpha test was run between March and May 2022, while the beta pilot test was run from September to December 2022. The acceptability, the usability, and the impact of the system were evaluated.	Mixed-method. Questionnaires, interviews
Bajones et al. (2019) [3]	Austria, Greece, Sweden	Hobbit PT2 was placed in the private home of older adults, where the participants could interact with the robot on a 24/7 basis for 3 weeks. The goal was to explore their interaction with the robot.	Mixed-method. Questionnaires, robot data log, semi-structured interviews
Cho et al. (2024) [4]	Korea	Two experiments were conducted. In the first, participants used eight out of ten services offered by the Pepper robot (Softbank Robotics) for 2 hours in an apartment-type testbed environment. In the second, the robot was deployed in participants' homes for 16-20 days, with participants using each service at least once per day. The service performance was evaluated.	Mixed-method, one-group pretest-posttest design (testbed environment), one-group time series design (home environment). Robot data log, surveys, interviews
Coşar et al. (2020) [5]	Poland, Greece, UK	Customized TiaGo iron (PAL Robotics) was deployed in serviced or private dwellings of the users for 8-10 weeks. User experiences with the robot were explored.	Mixed-method. Questionnaires, robot data log, unstructured interviews
de Graaf et al. (2015) [6]	UK	Nabaztag (Violet) was installed in homes of older adults as a health coach for a period of 10 days per usage phase (3 phases in total). User acceptance and engagement were investigated.	Qualitative. Semi-structured interviews and video recordings of the robot
Di Napoli et al. (2023) [7]	Italy	Sanbot Elf (Qihan Technology) was deployed in participants' homes for an average of 16 days per participant without the need of supervision of technical help to test the feasibility and reliability of the robot, and user experience.	Mixed-method, multiple single-subject study. Questionnaires, robot data log, pre-/post-test interviews

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Table 1 Characteristics of the individual studies (continued)

Author(s)	Country	Intervention	Methodology & Study Design
Doering et al. (2015) [8]	Germany	Each participant tested the SCITOS G3 robot (MetraLabs) at home for 35 to 40 mins. They were asked to use the robot’s applications at their own discretion. The goal was to explore the usage patterns and user acceptance.	Mixed-method, explorative multi-case study. Observations, semi-structured interviews, robot data log
Figuerroa et al. (2023) [9]	Japan	RoBoHoN (Sharp Corporation) was deployed first in the assisted living residence of an individual with Alzheimer’s disease for 6 months as the case study. In the main study, the robot was placed in each participant’s home for 7 to 20 weeks. The long-term usability and acceptability of the robot were assessed.	Mixed-method, one case and one main study. Robot data log, interviews
Gasteiger et al. (2022) [10]	New Zealand	The participants interacted with the robot Bomy (Robocare and Ewha Womans University in South Korea) in their private dwellings part of a retirement village up to one week, unsupervised and unrestricted. The goal was to explore the robot’s usefulness and users’ experiences.	Qualitative. Semi-structured interviews
González et al. (2023) [11]	Canada	The Nao 25 V6 robot (Aldebaran Robotics) was equipped with a simple, robust and privacy-proof behavior and placed in participants’ homes for 48 hours. Participants were asked to engage in conversation with it at their own discretion, both in terms of frequency and duration. The robot’s practical and technological feasibility was investigated.	Mixed-method, proof-of-concept study. Pre- and post-test questionnaires, semi-structured interviews
Harris-Gersten et al. (2023) [12]	USA	Animal companion robots were delivered to participants during scheduled home visits by nurses. Families received a 10-15 minute in-home demonstration. Caregivers were encouraged to remind, motivate, and cue Veterans to use the robot. After 3 months, caregivers were interviewed to assess usability and acceptability.	Mixed-method, within subjects, pre-post design. Questionnaires, phone interviews
Hudson et al. (2020) [13]	USA	Participants received the Joy for All (Ageless Innovation LLC, 2018) robot cat or dog in the mail and were instructed to treat it as a pet. Twice a week for 4 weeks, participants received an interactive voice reminder (IVR) phone call encouraging them to interact with the pet. The robot’s effect on loneliness was investigated.	Qualitative, multi-phase, cross-sectional study. Semi-structured interviews, post-intervention surveys

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Table 1 Characteristics of the individual studies (continued)

Author(s)	Country	Intervention	Methodology & Study Design
Inoue et al. (2021) [14]	Japan	Family members of 7 households were asked to use PARO (PARO Robots) for at least three times per week, over 1 to 3 months, ranging from 15 to 180 min daily. Paro’s ability to mediate care and technical feasibility were investigated.	Mixed-method, exploratory study. Standardized assessments, semi-structured interviews, observations
Ishihara et al. (2023) [15]	Japan	A talking teddy bear (Mysterious teddy bear, T.Arts Inc.) was placed in the home of an older adult where she was asked to engage in conversations with the bear as long as possible for 3 days. The robot’s potential to spark conversations was investigated.	Mixed-method, pilot study. Robot data log, unstructured interview
Ito et al. (2023) [16]	Japan	The patient interacted (e.g., hugging, conversing) with Smibi (Togo Seisakusyo Corporation) for 30 minutes per day for a month. Robot use was limited to the patient’s home, and the time of use was left unrestricted. The patient was allowed to be accompanied by family members when interacting with the robot. The robot’s impact on the user’s mental state was investigated.	Quantitative, case study. Questionnaires, observations, functional measurements
Khosla et al. (2021) [17]	Australia	Participants interacted with the robot Betty (Matilda robot by RECCSI, 2014) at home for 3 months. The goal was to study user engagement and experience with the robot.	Mixed-method. Observations, robot data log, post-trial robot experience survey
Kim et al. (2023) [18]	South Korea	The intervention group were instructed to use Hyodol companion robot at home for 6 weeks, as they wished, whereas control group was provided with a health information leaflet and received usual care for 6 weeks. The goal was to investigate the robot’s effectiveness on perceived health, cognitive function, and depression.	RCT. Baseline and post-intervention surveys
Lee et al. (2022) [19]	South Korea	Participants interacted with Hyodol for 9 months to 4 years (Avg=18 mo) at home. The goal was to explore the roles of companion robots and identify these roles using the friendship framework.	Qualitative. In-depth interviews and observations
Lee et al. (2023) [20]	South Korea	Participants interacted with Hyodol at home for 6 months. The goal was to examine the robot’s impact on depressive symptoms and health-related quality of life.	Mixed-method, one-group pretest-posttest design. Focus group interviews and standardized assessments

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Table 1 Characteristics of the individual studies (continued)

Author(s)	Country	Intervention	Methodology & Study Design
Lei et al. (2024) [21]	China	The robot Little Baby was delivered to each older participant’s home. Participants were asked to interact with it freely on their own and use it for chatting with their peer volunteer for at least 15 minutes per day for 7 days. The goal was to investigate the level of user acceptance and the robot’s impact on loneliness.	Mixed-method, single group intervention design with pre- and post-tests. Semi-structured interviews, questionnaires
Leung et al. (2023) [22]	China (Hong Kong)	Older adults interacted with the social robot Ka Ka (Matilda robot by RECSI, 2014) at home every day for 2 weeks. The goal was to understand the experiences and perspectives of older adults and their family.	Mixed-method, case study. Post-trial semi-structured interviews, robot data log
Liang et al. (2017) [23]	New Zealand	Participants were randomized to the PARO (PARO Robots) intervention or standard care. Intervention group attended 30-minute unstructured group sessions with PARO at the daycare center 2–3 times a week and had PARO at home for 6 weeks. Control group had the same care without PARO. The study examined PARO’s affective, social, behavioral, and physiological effects.	Pilot block RCT. Observations and measurements
Luperto et al. (2022) [24]	Italy and Spain	Adapted Giraff-X robots were deployed in the apartments of the participants. Each participant used the robot for at least 10 weeks. The goal was to analyze how including the end users’ feedback impacts the SARs reliability and acceptance.	Quantitative, field tests. Questionnaires, robot data log
Luperto et al. (2023) [25]	Italy and Spain	Participants used ambient assisted living system installed in their apartments for 10 weeks. Some participants did not have the Giraff-X robot within the system. The study assessed long-term acceptability and feasibility of the system and compare its benefits with/without the integration of the robot.	Quantitative, field tests. Questionnaires
Pike et al. (2021) [26]	UK	Participants were given companion cats (Ageless Innovation LCC, 2018) to use at home for 3 months. The goal was to investigate the robot’s impact and acceptance.	Qualitative, case study. Interviews, autophotography
Pollak et al. (2022) [27]	USA	Participants randomized to the intervention group chose either a robotic dog or robotic cat (Ageless Innovation LCC, 2018) according to their preference. They used the robot for 1 month. The robot’s impact on social and physical frailty was investigated.	RCT. Questionnaires

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Table 1 Characteristics of the individual studies (continued)

Author(s)	Country	Intervention	Methodology & Study Design
Randall et al. (2019) [28]	USA	After two initial focus groups with older adults, participants were given PARO (PARO Robots) to use in their homes for 4 consecutive weeks. The study evaluated the design and use of socially assistive robots and sensors as in-home therapeutic support.	Mixed-method. Pre-/post-robot home deployment focus groups, interviews, surveys, robot data log
Rossi et al. (2024) [29]	Italy	In a 2 hour lab experiment, participants performed daily activities while the Sanbot Elf (Qihan Technology) asked yes/no questions about entertainment activities. In home trials (2-4 weeks), participants interacted freely while the robot monitored meals, medication reminders, and suggested entertainment activities. User acceptance was assessed.	Mixed-method. Screening tests, questionnaires, interviews
Søraa et al. (2021) [30]	Norway	Tessa (Tinybots), SensaraCare sensor, and eWare system were implemented in the homes of older adults. Technology implementation was examined from a domestication theory perspective.	Qualitative. Interviews, focus groups
Tanaka et al. (2012) [31]	Japan	The participants were randomly assigned to 2 groups, matched for age and MMSE score, to live either with Kabochan (PIP Co., Ltd. + WiZ Co., Ltd.) or a control robot at home for 8 weeks. The effectiveness of Kabochan on cognitive function was investigated.	RCT. Measurements, questionnaires
Tokunaga et al. (2024) [32]	Japan	The robot Bono-06 (Yukai Engineering) and a tablet were mailed to each participant. The intervention group listened to a story and subsequently asked the robot questions, while the control group only listened. The goal was to assess the robot's effect on the users' cognitive functions.	RCT with a two-parallel-arm design and 1:1 allocation. System data log, pre/post screening tests, questionnaires
Tsujikawa et al. (2023) [33]	Japan	Older adults interacted with a conversational robot at home for 4-8 week, an average of 30 min two or three times per week. The robot aimed to offer offline psychological support in a user-friendly manner.	Quantitative. Pre-/post-test measurements of motor and cognitive function, assessment of psychological conditions
Turjamaa et al. (2023) [34]	Finland	A medicine management robot was implemented in the apartments of older adults. Use duration of the robot ranged from less than 3 months to more than 1 year. Users' experiences with its implementation and use were explored.	Qualitative, descriptive design. Semi-structured interviews

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Table 1 Characteristics of the individual studies (continued)

Author(s)	Country	Intervention	Methodology & Study Design
van Assche et al. (2023) [35]	Belgium	Participants were given James (Zora Robotics PLC) to live with in their apartments within independent living facilities for 2 weeks. User experience was investigated.	Mixed method. Semi-structured interviews, pre-test questionnaire, logbooks
van Dam et al. (2022) [36]	The Netherlands	Tessa (Tinybots) was used in the home environment for 3 months to study its impact on goal attainment in the execution of daily tasks and on perceived independence.	Mixed method, multiple-case study. Questionnaires, interviews
Wada et al. (2007) [37]	Japan	Each subject underwent a 3-week experiment with four art therapy sessions. In week 2, PARO (PARO Robots) was taken home, and interactions were recorded by a family member. Weeks 1 and 3 followed usual home routines without PARO. The influence of robot therapy at home was explored.	Mixed-method. Electroencephalogram (EEG), observation through family-kept diaries
Zafrani et al. (2024) [38]	Israel	After a pre-trial interview exploring the user expectations and attitudes, robot Gymmy was deployed at the homes of older adults living independently. Participants used the robot for 6 weeks at their own discretion. User experience and acceptance were investigated.	Mixed-method. Pre-/post-trial in-depth interviews, surveys, robot data log
Zsiga et al. (2018) [39]	Hungary	Kompai robot (Robosoft) was deployed to the users' homes. Each participant used the robot for 94.9 ± 19.6 days. The goal was to test the robot functions under real conditions.	Quantitative. Robot data log, case report forms, questionnaires

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Table 2 Participant characteristics across individual studies

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Abendschein et al. (2022) ^[1]	Socially isolated college students (n=9)	19–30 (Mean=22.11)	3 female, 6 male	7 white, 1 multi-racial, 1 Asian Pacific Islander	University students (n=9)	-	No ownership of a robot prior to the study (n=9), interaction with a social robot before (n=1)	-
Amabili et al. (2023) ^[2]	Healthy older adults (n=15), their informal caregivers (n=15), and their formal caregivers (n=11)	Older adults: 74.4 (8.9) alpha, 75.4 (5.8) beta (Mean (SD)) Informal caregivers: 39.6 (13.7) alpha, 47.9 (10.5) beta (Mean (SD)) Formal caregivers: 30 alpha, 39.3 (13.0) beta (Mean (SD))	Older adults: 9 female, 6 male Informal caregivers: 8 female, 7 male Formal caregivers: 5 female, 6 male	-	Older adults: 3.6 (1.1) alpha, 3.2 (1.3) beta (out of 5, mean (SD)) Informal caregivers: 4.6 (0.5) alpha, 4.6 (0.7) beta (out of 5, mean (SD)) Formal caregivers: 5.0 alpha, 4.6 (0.5) beta (out of 5, mean (SD))	-	Older adults: 3.6 (1.3) alpha, 3.3 (1.7) beta (out of 5, mean (SD)) Informal caregivers: 4.6 (0.5) alpha, 4.6 (0.7) beta (out of 5, mean (SD)) Formal caregivers: 5.0 alpha, 4.6 (0.5) beta (out of 5, mean (SD))	-
Bajones et al. (2019) ^[3]	Independent single-living older adults with moderate to severe impairments in vision, hearing, mobility (n=16) and their informal caregivers (n=16)	Older adults: 75–89 (Mean=79.75)	Older adults: 14 female, 2 male	-	-	-	Older adults: People with technology affinity (computer, cellphone)	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Cho et al. (2024) [4]	Subjectively healthy older adults as testbed participants (n=40), older adults with normal cognitive functioning as home participants (n=2)	Testbed: 73.2 (avg) Home: 76 (avg)	Testbed: 25 female, 15 male Home: 2 female	-	Testbed: High school or higher (n=27)	-	Testbed: Smartphone usage ability=5.9, computer usage ability= 3.9 (out of 10, mean) Home: High levels of skill & familiarity with tech	-
Coşar et al. (2020) [5]	Individuals with mild cognitive impairment (n=12, 1 passed away before intervention) and their informal caregivers (n=12)	Older adults: 66-90 (mean(SD) =79.3 (8.1))	Older adults: 7 female, 4 male	-	-	-	Mixed, some with computers/cellphones. Mostly positive towards robots.	-
de Graaf et al. (2015) [6]	Older adults (n=6), 2 of whom lived alone and 1 who was visually impaired	50-76	4 female, 2 male	-	Formal education until 16 years old (n=1), BSc (n=1), MSc (n=3)	-	-	-
Di Napoli et al. (2023) [7]	Patients with cognitive impairments (n=7)	55-84 (Mean = 72)	3 female, 4 male	-	-	-	Familiarity, from 1 to 5, above 3 (n=2), 3 (n=1), below 3 (n=4)	-
Doering et al. (2015) [8]	Older adults (n=3), 1 with no major health problems, 1 with diabetes & cardiovascular diseases and 1 with cardiovascular & respiratory disease	67, 78 and 85	2 female, 1 male	-	-	-	Technological affinity (n=1), no experience (n=2, 1 interested in using tech)	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Figueroa et al. (2023) [9]	Older adult with Alzheimer’s disease (n=1) as case study participant, individuals with a cognitive decline living alone without pets (n=5) as main study participants	Case study: 88 Main study: 84-89	Case study: 1 female Main study: 5 female	-	Main study: 9-12 years	-	-	-
Gasteiger et al. (2022) [10]	Older adults with varying health needs living in retirement villages (n=6)	72-83 (Mean=78)	4 female, 2 male	2 NZ European, 1 European, 1 English, 1 Welsh and 1 not reported	-	-	-	-
González et al. (2023) [11]	Older adults living alone in detached homes or individual apartment units (n=14)	66-88 (mean (SD)=71.5(6.7))	-	-	-	-	No experience (n=14)	-
Harris-Gersten et al. (2023) [12]	Veterans with dementia (n=20), 16 with severe dementia, 4 with moderate dementia cared by informal caregivers	81 (avg) (SD=7.1)	2 female, 16 male	13 White/not Hispanic or Latino, 1 White/Hispanic or Latino, 6 African American/not Hispanic or Latino	High school or general education development (n=8), college (n=2), college and above (n=10)	-	-	-
Hudson et al. (2020) [13]	Self-reported lonely individuals (n=20), 12 of who is living alone, 5 with a spouse, 2 with a child or grandchild, and 1 with a caretaker	65-90+ (Mean =76.78)	10 female, 10 male	-	-	-	-	Previous own-ership (n=17)

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Inoue et al. (2021)[14]	PwD who did not show a repulsive reaction to PARO (n=7) & their informal caregivers (n=7)	79–97 (Mean (SD)= 87.29 (7.04))	6 female, 1 male	-	-	-	-	-
Ishihara et al. (2023)[15]	Older adult with no cognitive issues (n=1)	70	1 female	-	-	-	-	-
Ito et al. (2023)[16]	An older individual with increased anxiety and ADL, living with her husband and eldest son (n=1)	80	2 female	Japanese	-	-	-	-
Khosla et al. (2021)	PwD with multiple medical conditions and limited mobility, living with at least one family member (n=5)	75–85	-	-	-	-	-	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Kim et al. (2023) [18]	Older adults with cognitive decline (n=115) ^a , randomly assigned to robot intervention (n=56, n=30 completed) or control group (n=59, n=39 completed)	Intervention group: vMCI=79.00 (4.00), MCI=81.83 (6.56), MOCI=84.89 (4.59) (Mean (SD)) Control group: vMCI=79.24 (5.41), MCI=77.60 (5.65), MOCI=80.33 (3.21) (Mean (SD))	Intervention group: vMCI=8 female, 1 male, MCI=11 female, 1 male, MOCI=9 female Control group: vMCI=11 female, 10 male, MCI=11 female, 4 male, MOCI=2 female, 1 male	-	Intervention group: vMCI=2.67 (SD = 2.06), MCI=2.25 (SD = 1.54), MOCI=2.00 (SD = 1.00) (avg years (SD)) Control group: vMCI=3.86 (SD = 2.22), MCI=2.73 (SD = 2.21), MOCI= no formal schooling (avg years (SD))	-	-	-
Lee et al. (2022) [19]	Low-income, solo-living older adults with chronic health conditions (n=12)	72–93 (Mean (SD)=82(6.22))	6 female, 6 male	Korean	No formal education (n=7), 6 years of education (n=3), 9 years of education (n=1), 12 years of education (n=1)	-	-	-

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^aFurther classification based on GDS scores: very mild (vMCI), mild (MCI), and moderate (MOCI).

Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Lee et al. (2023) [20]	Low-income, socially isolated older adults (n=180), 10 of whom joined the post-intervention focus group	Baseline: 78.21(SD = 6.38) 6 months: 77.93 (SD=6.22) Focus group: 70–93 (Mean=82.8)	Baseline: 125 female, 55 male 6 months: 80 female, 36 male Focus group: 7 female, 3 male	Korean	-	Extreme poverty (n=125), second lowest poverty classification (n=55)	-	-
Lei et al. (2024) [21]	Older adults without severe mental illness or acute diseases, living alone in the community (n=50, completed n=44) and peer volunteers (n=19)	Older adults: 60-89 (Mean = 77.18) Peer volunteers: 50-88 (Mean = 63.40)	Older adults: 36 female, 8 male Peer volunteers: 19 female	-	Older adults: High school or below (n=45) Peer volunteers: high school or below (n=16)	Older adults: Lower than the local mean income (n = 50), no pension or benefits (n=30)	-	-
Leung et al. (2023) [22]	Older adults (n=4), of which living alone (n=3) and their family caregivers (n=3)	Older adults: 65-86	Older adults: 3 female, 1 male	Older adults: Ethnic Chinese	Older adults: Primary education (n=2), secondary education (n=2)	-	-	-
Liang et al. (2017) [23]	PwD (n=24), randomized to robot group (n=13) or control group (n=11) and their informal caregivers (n=24)	PwD: 67-98 Caregivers: 30-86	PwD: 15 female, 9 male Caregivers: 23 female, 1 male	-	-	-	-	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Luperto et al. (2022) [24]	Older adults without cognitive impairments, living independently (n=14, 4 of whom dropped out)	Mean=76.86 (75.3 after dropouts)	-	7 Italian, 7 Spanish	-	-	-	-
Luperto et al. (2023) [25]	Pre-frail older adults living alone (n=24), 11 of whom did not have the robot but the ambient system	65-92 (Mean(SD)=76.7(7.2))	-	11 Italian, 14 Spanish	-	-	-	-
Pike et al. (2021) [26]	PwD living independently with the support of both family and/or professional carers (n=12, n=8 completed)	-	11 female, 1 male	-	-	-	-	-
Pollak et al. (2022) [27]	Hospitalized individuals discharged home from medical/surgical telemetry units (n=220), assigned to intervention group (n=107) or control group (n=113)	65-93 Intervention group: 76.5 (Mean (SD)) Control group: 75.7 (Mean (SD))	Intervention group: 90 female, 17 male Control group: 80 female, 33 male	Intervention group: 86 White/Caucasian, 17 Black/African American, 4 Latin/Hispanic Control group: 18 White/Caucasian, 90 Black/African American, 4 Latin/Hispanic, 1 Asian	Intervention group: Higher education (n=62), high school or less (n=45) Control group: Higher education (n=71), high school or less (n=42)	-	-	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Randall et al. (2019) [28]	Low-income older adults diagnosed with major depressive disorder (n=10) and clinicians (n=8)	Older adults: 56-67 (Mean=62.8)	Older adults: 10 female Clinicians: 4 male, 4 female	-	-	-	-	-
Rossi et al. (2024) [29]	Older adults with Mild Cognitive impairment (MCI) (n=11), 4 of whom participated in lab experiments, 7 in home trials	Lab: 73.75 (1.89) (Mean (SD)) Home: 72.29 (11.19) (Mean (SD))	Lab: 2 female, 2 male Home: 3 female, 4 male	-	Lab: 9.75 (5.67) (Mean years (SD)) Home: 9.86 (5.39) (Mean years (SD))	-	Lab: 1(0) (out of 5, mean (SD)) Home: 2.27 (1.39) (out of 5, mean (SD))	-
Søraa et al. (2021) [30]	Older adults experiencing the beginning of reduced cognitive function and living alone (n=8, 2 dropped out), informal caregivers (n=10), and healthcare workers (n=3)	Older adults: 66-89	-	-	-	-	Older adults: Little experience using advanced technology (n=6)	-
Tanaka et al. (2012)	Healthy older adults living alone (n=40, n=34 completed), randomized to communication robot (n=18) or control robot (n=16)	66-84 Intervention group: 73.6±4.4 (mean (SD)) Control group: 73.1±5.3 (mean (SD))	34 female	-	-	-	-	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Tokunaga et al. (2024) [32]	Older adults with subjective memory concerns (n=81), randomized to intervention group (n=40) or control group (n=41)	Intervention group: 73.9 (3.8) (Mean (SD)) Control group: 74.0 (4.1) (Mean (SD))	Intervention group: 24 female, 16 male Control group: 25 female, 16 male	-	Intervention group: 19 (48) (≥ 13 yrs, n(%)) Control group: 30 (73) (≥ 13 yrs, n(%))	-	-	-
Tsujikawa et al. (2023) [33]	Healthy elderly living alone (n=15)	72-91 (Mean=79.3)	15 female	-	-	-	No computer literacy skills or daily internet usage (n=13)	-
Turjamaa et al. (2023) [34]	Older adults receiving home care for 1-5 years, living alone (n=38)	73-89 (Mean=78.6)	27 female, 9 male	Mostly Finnish	-	-	-	-
van Assche et al. (2023) [35]	Older adults with mild cognitive impairment, living alone (n=4)	70-90 (Median=86)	2 female, 2 male	-	Higher secondary education (n=2), lower secondary education (n=2)	-	Previous experience with laptop or a tablet (n=4)	-
van Dam et al. (2022) [36]	Individuals with self-reported executive dysfunction (n= 18) and their formal caregivers (n=17), (final analysis n=16 dyads)	Individuals with self-reported executive dysfunction: 18-63 (Mean=41)	Individuals with self-reported executive dysfunction: 8 female, 10 male Caregivers: 13 female, 4 male	-	-	-	-	-

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Table 2 Participant characteristics across individual studies (continued)

Author(s)	Participants (n)	Age (yrs)	Gender	Ethnicity	Education	Socio-economic status	Prior tech experience	Pet ownership
Wada et al. (2007) [37]	PwD (n=5)	61-82	3 female, 2 male	-	-	-	-	Previous own-ership (n=5)
Zafrani et al. (2024) [38]	Healthy older adults without physical or cognitive impairments (n=19)	75-97 (Mean (SD) = 81.05 (6.19))	10 female, 9 male	17 not born in Israel	The majority had secondary education, post-secondary education (n=8)	-	-	-
Zsiga et al. (2018) [39]	Older adults with chronic diseases, living alone (n=8)	70-83 (Mean=77.125)	7 female, 1 male	-	College (n=4), polytechnic (n=2), secondary school (n=2)	-	Prior computer knowledge (n=4)	-

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Table 3 Robot characteristics across individual studies

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Abendschein et al. (2022) ^[1]	Bio-inspired (animal) companion robot	1 pound	Purring, meowing, moving front paws up and down, sensing when touched on the back	Cat-like sounds & movement	Touch sensor, vibration motor (VibraPurr technology), speaker, battery	N	\$139.99 ^[40]
Amabili et al. (2023) ^[2]	Bio-inspired (human) companion robot assisting with ADL & stimulation (+GUARDIAN system of apps)	-	User localization, making eye contact with the user, providing reminders & activity suggestions, asking for reports on sleep, meal, medication, speaking the message sent to the user aloud, waking up & going to sleep	Speech, facial expressions and gestures	Omnidirectional microphone, onboard sensors, animated eye images, motorized arms	N	\$3,995 ^[41]
Bajones et al. (2019) ^[3]	Bio-inspired (human) service/companion robot assisting with ADL	W0.48m x L0.55 x H1.25	Object recognition, manipulation, & transportation, autonomous navigation and charging, emergency detection & handling, entertainment & information provision, physical activity (PA) guidance, reminders	Written, speech, facial gestures	6 DoF arm with a 2 finger gripper, small turntable, temperature sensor, speaker, 2 cameras, microphone, touchscreen, 2 bumper sensors, emergency help button, water bottle holder, tray, head	Y	€16,000 ^[42]
Cho et al. (2024) ^[4]	Bio-inspired (human) companion robot assisting with ADL & stimulation	-	Object detection & recognition, human detection & tracking, human pose estimation, daily activity detection, co-speech & interaction gesture generation, navigation, proactive emergency call, providing lifestyle-related information & reminders, PA assistance, playing requested music	Speech, gestures	Power supply, Xtion camera, LiDAR sensor, navigation module	N	\$1,790 + \$360 monthly subscription costs ^[43]

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Coşar et al. (2020) [5]	Bio-inspired (human) service/companion robot assisting with ADL & stimulation	-	Object localization, autonomous navigation, human detection and tracking, physiological monitoring, entertainment and information provision, health guidance, reminders, learning user behavior	Written, speech	Differential drive base, lifting torso, pan/tilt head, RFID system, antenna, thermal camera, RGB-D camera, environment sensor, touchscreen, speaker, 2D laser scanner	Partially	€29,000 to 59,000[44]
de Graaf et al. (2015) [6]	Bio-inspired (animal) robot providing PA promotion	30 cm high	Information provision on weather and local events, advice on activity level, asking user to weigh themselves, going out and coming home dialog, evaluation of the day's activities	Speech	PIR sensor, webcam, array microphone, micro switch on a key hook that tracked whether the keys were taken away or were hung back, LEDs, movable ears, WiFi module, speaker, FID reader	N	\$149.99[45]
Di Napoli et al. (2023) [7]	Bio-inspired (human) service/companion robot assisting with ADL & stimulation (+system of smart devices)	-	Monitoring ADL, providing entertainment, cognitive stimulation, reminders, user location detection, emotion and activity recognition	Speech, written	Infrared sensors, omnidirectional locomotion, two cameras, touch sensors, microphone, speakers, subwoofer, full-HD touchscreen, moving head with a display showing different animations of the eyes	Partially	\$9,999 to \$14,300[46, 47]
Doering et al. (2015) [8]	Bio-inspired (animal) service/companion robot for health assistance supporting everyday life	-	Video telephony, monitoring vital signs, calendar functions for cognitive support including reminders for medication, navigation, verbal/non-verbal communication	Speech, written, paraverbal feedback (purring)	Camera, Kinect sensor, touch screen, microphone (3 directional, 1 omni-channel), capacitive fur, touch sensitive case, laser range finder, sonar array transducer, bumper ring	N	-

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Figueroa et al. (2023) ^[9]	Bio-inspired (human) companion robot	19.5 cm tall, approx. 360 g	Speech recognition and dialogue generation, reacting to voice commands, information provision, dancing, singing, scheduled or random interaction attempts	Speech, gestures, facial expressions	Qualcomm Snapdragon 430 processor, microphone array, speaker, camera, accelerometer, magnetometer, gyroscope, Bluetooth, WiFi, GPS capabilities, LEDs on mouth and eyes, touch screen	N	Ca.\$715 ^[48]
Gasteiger et al. (2022) ^[10]	Bio-inspired (animal) robot for daily care	-	Providing reminders, cognitive games	Written, speech	2x1 DOF tilting wings, pan/tilt touch-screen as head	Partially	Ca.\$7,000 ^[49]
González et al. (2023) ^[11]	Bio-inspired (human) robot supporting individual self-reflection and wellbeing	58 cm tall	Asking well-timed general questions for reflection when its button is pressed, providing body-language feedback, does not parse or record the content of user utterances, offline, no dialogue generation	Speech, gestures	Touch button on the head, arm & leg motors, microphone, speaker	N	€11,088 ^[50]
Harris-Gersten et al. (2023) ^[12]	Bio-inspired (animal) companion robot as a therapeutic intervention	-	-	-	-	-	-
Hudson et al. (2020) ^[13]	Bio-inspired (animal) companion robot	-	Nuzzling when touched, barking/meowing and purring in response to light stimuli	Sound, vibration, movement	Touch-activated sensors in the upper abdomen and back, light sensor in the head, VibraPurr realistic cat purr (cat), microphone (dog)	N	\$139.99 ^[40]

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Inoue et al. (2021) [14]	Bio-inspired (animal) companion robot promoting psychological, physical, and social wellbeing	approx. 57 cm, 2.5 kg	Animal-like crying, moving head and legs, blinking, remembering name of a person and endearing itself to its owner with cute gestures and cries	Sound, move- ment	-	N	\$6,000 [51]
Ishihara et al. (2023) [15]	Bio-inspired (animal) companion robot	-	Passive dialogue generation in the local dialect based on prosody and pitch detection in human speech	Speech, head shake	Built-in speaker, HEARTalk™ board (Yamaha Corporation 2017), mobile battery	N	\$94 [52]
Ito et al. (2023) [16]	Bio-inspired (human) companion robot	W200 mm x D190 x H440, 1.2 kg	Requiring caregiving from the user, responding to user with 500 different emotional expressions	Speech, move- ment, gestures, sound	Li-ion battery, accelerometer, microphone, motors in the face, eyes and arms, LEDs on the cheeks, speaker	-	Ca.\$977.78 [53]
Khosla et al. (2021) [17]	Bio-inspired (human) companion robot (+separate touch interface)	39 cm tall, 6.5 kg	Face recognition, face registration and tracking, initiating communication, displaying human-like emotions, gestures and movements, providing personalized reminders, singing, reading stories/news	Speech, written, gestures, move- ment	Two cameras, two microphones, two axes of movement, nodding/panning ± 180 degrees and tilting ± 45 degrees, LEDs on the ears and chest, touch sensors, ultrasonic sensors, elevation sensors, bumper sensors, status display	N	-

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Kim et al. (2023) [18]	Bio-inspired (human) companion robot for cognitive therapy and stimulation (+Caregiver app)	-	Providing reminders and cognitive stimulation through quizzes, games and recreational activities, PA guidance, talking when pressed its buttons, activity monitoring, emergency detection	Speech	Touch sensor, pressure sensors, motion sensor, vibration sensor	N	Ca.\$892.04 [54]
Lee et al. (2022) [19]	Bio-inspired (human) companion robot assisting with ADL & stimulation	20" tall	Two way conversations imitating a 7-year old grandchild figure, providing reminders, user monitoring, PA guidance, delivery of popular songs, quiz games & stories	Speech, vibration	Motion sensor, touch sensor, pressure sensors, microphone, vibration sensor	N	Ca.\$892.04 [54]
Lee et al. (2023) [20]	Bio-inspired (human) companion robot assisting with ADL & stimulation	20" tall	Communicating with human voice imitating a 7-year old grandchild figure, assisting with ADL, providing reminders, user monitoring, PA guidance, providing recreational activities, delivering voice messages	Speech, vibration	Motion sensor, touch sensor, pressure sensors, microphone, vibration sensor	N	Ca.\$892.04 [54]
Lei et al. (2024) [21]	Bio-inspired (human) companion robot	90 cm high, 8 kg	Online chat function, voice-controlled entertainment function, such as dancing, playing music and movies, surfing on the internet or having simple conversations	Speech, written	Android operating system, screen featuring a smiling face and a human voice	N	-
Leung et al. (2023) [22]	Bio-inspired (human) companion robot assisting with ADL & stimulation (+App)	30 cm tall, 20 cm wide, 2 kg	Conversation, providing reminders, playing music, reading news/stories/weather reports, PA guidance, providing puzzle games and quizzes	Speech	-	N	-

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Liang et al. (2017) [23]	Bio-inspired (animal) companion robot promoting psychological, physical, and social wellbeing	-	Responding to various stimuli, operating based on its internal states, sensory information, and diurnal rhythm	Sound, movement	-	N	\$6,000 [51]
Luperto et al. (2022) [24]	Functional/ caricatured robot assisting with ADL, stimulation, and monitoring (+system of smart devices)	-	Autonomous navigation, relocation & person identification, speech recognition, help in finding lost objects, providing reminders, delivering cognitive assessment and socialization, PA guidance, emergency assistance	Speech, written	Fish-eye webcam, touchscreen, microphone, speaker, RGB-D cameras, action buttons, RFID module & antennas, emergency button, on-board computer, 2D Lidar, two-wheel differential drive with two caster wheels, GPU board	Partially	\$11,900 [55]
Luperto et al. (2023) [25]	Functional/ caricatured robot assisting with ADL, stimulation, and monitoring (+system of smart devices)	1.70 m tall	Autonomous navigation, relocation & person identification, speech recognition, help in finding lost objects, providing reminders, cognitive games and socialization, PA guidance, emergency assistance	Speech, written	Fish-eye webcam, touchscreen, microphone, speaker, RGB-D cameras, action buttons, RFID module & antennas, emergency button, on-board computer, 2D Lidar, two-wheel differential drive with two caster wheels, GPU board	Partially	\$11,900 [55]
Pike et al. (2021) [26]	Bio-inspired (animal) companion robot	-	-	Sound, movement	-	N	\$139.99 [40]
Pollak et al. (2022) [27]	Bio-inspired (animal) companion robot	-	Responding to petting, hugging and motion, providing companionship and comfort	Sound, movement	-	N	\$139.99 [40]

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Randall et al. (2019) [28]	Bio-inspired (animal) companion robot for alleviating loneliness and improving mood (+sensors)	-	-	-	-	N	\$6,000 [51]
Rossi et al. (2024) [29]	Bio-inspired (human) companion robot providing stimulation	-	Providing entertainment and cognitive stimulation (two modes: personalized/non-personalized), monitoring health status	Written	Infrared sensors, omnidirectional locomotion, two cameras (an RGB-D and a full-HD), touch sensors, microphone, speakers, subwoofer, Full-HD touchscreen	N	\$9,999 to \$14,300 [46, 47]
Søraa et al. (2021) [30]	Bio-inspired (human)/artifact-shaped robot assisting with ADL & stimulation (+system of ambient sensors)	-	Giving suggestions for daily activities through spoken messages and reminders, providing feedback on goal achievement	Speech	LED-lit blinking eyes	-	€1.499 [56]
Tanaka et al. (2012) [31]	Bio-inspired (human) companion robot providing cognitive therapy	28 cm high, 680 g	Nodding, talking, sensing the situation and environmental surroundings	Speech, movement	Light sensor, motion sensor, sound sensor	N	Ca.\$171.48 [57]
Tokunaga et al. (2024) [32]	Bio-inspired (human) robot providing cognitive therapy (+Tablet)	-	Providing responses to questions from a list of approximately 550 responses or thanking participants	Speech, nodding	1 DoF head, red, green, and blue full-color LEDs on cheeks, push switch on the chest for recording utterances	N	-

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Tsujikawa et al. (2023) [33]	Bio-inspired (human) robot functioning as a psychological intervention	W35 x D30 x H40 cm	Speech recognition, conversation (Text-to-speech)	Speech	One microphone, two speakers, two square buttons, four round buttons, Raspberry Pi 3 Model B	Partially	-
Turjamaa et al. (2023) [34]	Functional robot for medicine management	-	Scheduling medicine dispensing, providing verbal, auditory and visual guidance on medication intake, providing reminders, auto-lock when medication is not taken after multiple reminders, maintaining an electronic treatment record of each dose taken by the person	Speech, sound, light, written	-	N	-
van Assche et al. (2023) [35]	Functional companion robot	28 cm high, 680 g	Providing cognitive training, physical exercises and entertainment, such as playing games, listening to music and watching digital newspapers	-	-	N	€7,499 [58]
van Dam et al. (2022) [36]	Bio-inspired (human)/artifact -shaped robot assisting with ADL (+App)	30 cm tall	Providing vocal reminders of activities, tasks, or tips at a preset time, Wi-Fi connectivity	Speech	LED-lit blinking eyes	-	€1,499 [56]
Wada et al. (2007) [37]	Bio-inspired (animal) companion robot providing cognitive therapy	570 x 350 x 160 mm, 2.7 kg	Reacting to sudden stimulation, has a diurnal rhythm and spontaneous needs, producing proactive behavior according to its internal states of stimulation, desires, and rhythm, reinforcement learning	Sound, move- ment	Posture sensor, 2 32-bit RISC chips, artificial fur, 3 microphones, 2 light sensors, speaker, stereo whisker, ubiquitous surface tactile sensor, 7 actuators on each eyelid, 2 in the neck, each front flipper and rear flipper	N	\$6,000 [51]

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Table 3 Robot characteristics across individual studies (continued)

Author(s)	Type	Weight/ dimen- sions	Functions	Interaction modality	Components	Co- designed? (Y/N)	Price
Zafrani et al. (2024) [38]	Bio-inspired (human) robot for physical training	-	Demonstration of exercises, following the execution of exercises through a camera and giving feedback, presentation of cognitive exercises during physical training sessions on a screen, offering relaxation exercises	Speech, movement, written	Computer system (NUC mini-PC), RGB-D camera, speakers, touch screen	N	-
Zsiga et al. (2018) [39]	Bio-inspired (human) robot assisting with ADL and stimulation	-	Providing cognitive and memory assistance, safety- and health-related functions, information inquiry & communication services, speech recognition & synthesis, entertainment opportunities, autonomous navigation, carrying small objects on a tray	Speech, written	Notebook with touch interface, microphone to recognize human speech, speaker	Partially	Min. €20,000 [59]

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