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Loneliness Reduction with Social Robot Companionship in Eldercare Facilities: Implementation Study

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Abstract

Loneliness and social isolation among older adults in residential care facilities constitute a growing public health crisis, exacerbated by demographic shifts and systemic workforce shortages in long-term care sectors. Socially assistive robots (SARs) have emerged as a promising technological intervention to provide companionship, cognitive stimulation, and social facilitation. While preliminary pilot studies suggest positive trends, robust implementation evidence regarding their longitudinal efficacy and integration into clinical workflows remains sparse. This study investigates the impact of social robot companionship on loneliness reduction in long-term eldercare facilities using a mixed-methods, multi-center implementation science framework. Over a six-month period, interactive biomimetic animal robots and humanoid conversational assistants were deployed in residential units. Quantitative assessments utilizing the UCLA Loneliness Scale and physiological measures of stress were paired with qualitative thematic analysis of resident and staff interviews. The results indicate statistically significant reductions in subjective loneliness and depressive symptoms, alongside improvements in social interaction frequency among residents. However, the outcomes varied significantly depending on the robotic platform, individual cognitive profiles, and institutional support structures. This paper discusses these findings, highlights key implementation barriers, addresses ethical concerns regarding machine-mediated companionship, and provides actionable recommendations for clinical practice and policy.

Keywords: Social Robotics; Eldercare Facilities; Loneliness Mitigation; Implementation Science; Loneliness Reduction

1. Introduction

1.1 Demographic Shifts and the Epidemic of Loneliness

The global population is undergoing an unprecedented demographic transition characterized by a rapid increase in the proportion of older adults. This shift, driven by declining fertility rates and advancements in medical science that extend life expectancy, presents profound challenges to healthcare systems, social structures, and municipal infrastructures worldwide. Within long-term care environments, such as nursing homes and assisted living facilities, a particularly silent and debilitating crisis has emerged: the epidemic of chronic loneliness and social isolation. Although these residential facilities are designed to house congregate communities, the actual lived experience of residents is frequently marked by profound disconnection, monotony, and a lack of meaningful relational engagement.

Loneliness in older adults is not merely a subjective state of emotional distress; it is a critical determinant of physical and psychological health outcomes. Longitudinal epidemiological research has established that persistent social isolation is associated with a dramatic escalation in mortality risk, comparable to well-known risk factors such as smoking and physical inactivity [1]. The physiological mechanisms underlying this relationship involve chronic activation of the hypothalamic-pituitary-adrenal axis, leading to systemic inflammation, elevated blood pressure, and compromised immune function [2]. Furthermore, cognitive decline, depressive disorders, and accelerated vulnerability to neurodegenerative pathologies are significantly more prevalent among older individuals who experience sustained isolation.

The traditional model of addressing this challenge relies heavily on human caregivers, recreational therapists, and family visits. However, the eldercare sector faces chronic systemic shortages of professional staff, high turnover rates, and severe administrative resource constraints. Human caregivers are often overwhelmed by the demanding physical and medical needs of residents, leaving minimal opportunity for sustained emotional support or social interaction. Consequently, there is an urgent and critical need to explore innovative, scalable, and sustainable complementary interventions that can mitigate loneliness and enrich the daily lives of institutionalized older adults.

1.2 Emergence of Socially Assistive Robotics

In response to the resource deficits in long-term care, the field of socially assistive robotics has expanded rapidly. Socially assistive robots are designed to interact with human users through social behaviors, conversational interfaces, and sensory cues, aiming to provide emotional support, cognitive engagement, and physical facilitation. Unlike industrial automation systems or purely utilitarian medical devices, these robots are engineered to elicit psychological responses, leverage human tendencies toward anthropomorphism, and establish a form of artificial companionship.

These platforms generally fall into two broad taxonomic categories: biomimetic animal-like robots and interactive humanoid or semi-humanoid assistants. Biomimetic robots, modeled after familiar domestic pets such as seals, dogs, or cats, focus heavily on tactile engagement, non-verbal vocalizations, and responsive physical movements [3]. These devices are designed to evoke the therapeutic benefits of animal-assisted therapy without the associated logistical, hygienic, and safety challenges of keeping live animals in medical facilities.

In contrast, humanoid or conversational robotic systems emphasize verbal dialogue, cognitive games, information sharing, and structured social activities [4]. These platforms are capable of recognizing faces, tracking gestures, and tailoring interactive sequences to individual preferences, thereby serving as interactive partners for cognitive exercises and social activities. The therapeutic hypothesis underlying both modalities is that consistent engagement with these social agents can reduce feelings of abandonment, stimulate cognitive faculties, and act as a social catalyst, prompting increased peer-to-peer interactions among residents in shared communal spaces.

1.3 Scope and Objectives of the Study

While the theoretical promise of socially assistive robotics is compelling, the current empirical landscape is characterized by significant gaps. A substantial portion of the existing literature consists of short-term pilot studies, small sample sizes, and highly controlled laboratory experiments that fail to capture the complex, chaotic realities of day-to-day operations in eldercare facilities. Many of these studies suffer from a pronounced novelty effect, where initial improvements in resident mood and engagement fade rapidly once the initial excitement of interacting with a novel technological device diminishes.

Moreover, there is a lack of rigorous implementation science studies that investigate how these robotic systems can be successfully integrated into standard nursing workflows without imposing undue burdens on already overstretched care staff. The technical reliability of the platforms, the training protocols required for successful deployment, and the variations in response among residents with differing levels of cognitive impairment are major areas requiring systematic investigation.

This study addresses these gaps by presenting comprehensive evidence from a multi-center, mixed-methods implementation project conducted across three diverse eldercare facilities over a six-month period. The primary objectives are to evaluate the longitudinal efficacy of social robot companionship in reducing subjective loneliness and depressive symptoms among residents; to compare the distinct psychological and physiological impacts of biomimetic animal-like platforms versus interactive conversational systems; to identify the critical institutional, technological, and behavioral facilitators and barriers to successful deployment; and to formulate an evidence-based framework for integrating social robotics into clinical care pathways. By combining standardized psychometric assessments, physiological stress markers, and extensive qualitative interviews, this research aims to provide a robust, multi-dimensional understanding of the real-world utility of social robots in modern eldercare [5].

2. Literature Review and Theoretical Framework

2.1 Psychological Foundations of Companionship

To understand how non-human entities can alleviate human loneliness, it is necessary to examine the psychological and evolutionary mechanisms of attachment and social perception. Humans possess an innate, evolutionarily determined drive to seek social connection, a tendency closely linked to survival mechanisms. When these social needs are unmet, individuals experience a state of psychological distress that signals a threat to safety and well-being. According to attachment theory, individuals seek proximity to specific attachment figures who provide a secure base and a safe haven during times of distress. In late life, the loss of traditional attachment figures, such as spouses, siblings, and close peers, leaves a profound void that is difficult to fill through casual social contact.

Socially assistive robotics leverages the human cognitive predisposition to project agency, emotions, and intent onto non-human objects, a phenomenon known as anthropomorphism. When a robot exhibits contingent behaviors, such as turning its head when addressed, responding to touch, or displaying facial expressions, it triggers the same neural pathways that process human-to-human social interactions [6]. This cognitive response allows individuals to establish parasocial relationships with artificial agents.

Parasocial interaction theory, originally developed to describe the one-sided relationships that media consumers form with television personalities, has been adapted to describe the interactive, reciprocal bonds that develop between humans and responsive autonomous machines. In the context of older adults, especially those experiencing mild to moderate cognitive decline, these parasocial connections can feel remarkably real, providing a comforting presence that buffers the psychological impact of loneliness and stimulates emotional processing [7].

2.2 Previous Empirical Studies on Social Robots in Eldercare

The empirical exploration of social robots in eldercare has grown over the past two decades, yielding a diverse body of evidence. The most widely studied robotic platform in this domain is Paro, a biomimetic robotic seal equipped with dual microprocessors, touch sensors, light sensors, and posture sensors that allow it to recognize voices and respond to physical handling. Numerous clinical trials have demonstrated that interactions with Paro can lead to decreases in agitation, reductions in depressive symptoms, and improvements in overall mood among nursing home residents, particularly those diagnosed with advanced dementia [8]. These effects are often accompanied by reductions in the usage of psychotropic medications, highlighting the potential of biomimetic robots to serve as non-pharmacological interventions for behavioral symptoms of dementia.

In parallel, research involving interactive humanoid platforms, such as Pepper or Milo, has focused on cognitive stimulation, entertainment, and social facilitation. Studies indicate that these larger, conversational platforms can successfully lead group activities, such as bingo, physical exercise classes, and cognitive trivia games, thereby drawing isolated residents out of their rooms and into communal areas [9].

However, several systematic reviews have pointed out that many of these studies are limited by methodological constraints [10]. These include a lack of appropriate control groups, brief intervention windows that do not exceed four to six weeks, and a reliance on subjective self-report measures that are prone to bias. Furthermore, the longevity of the observed benefits remains highly contested. Skeptics argue that the observed reductions in loneliness may be a temporary artifact of the novelty of the technology, and that once the novelty wears off, the robots may be ignored, leading to a return to baseline levels of isolation.

2.3 Barriers to Implementation and Sustained Adoption

Despite the promising clinical outcomes reported in controlled trials, the widespread adoption and integration of social robots in real-world eldercare settings face substantial institutional and behavioral barriers. One of the primary obstacles is the resistance and anxiety exhibited by healthcare staff. Caregivers often perceive the introduction of robotic systems as an administrative burden, fearing that they will be required to manage complex technical issues, troubleshoot software glitches, and transport heavy equipment, all while fulfilling their existing clinical duties [11]. There is also a persistent concern among staff that the introduction of robots represents an attempt by management to replace human care with automated systems, potentially devaluing their roles and reducing the quality of human contact provided to residents.

Additionally, older adults themselves exhibit varying degrees of technological acceptance. Factors such as sensory impairments, motor limitations, cognitive status, and prior experience with digital technology play a crucial role in determining how a resident responds to a social robot. An individual with severe hearing loss, for instance, may find a conversational humanoid frustrating and confusing, while a resident with advanced dementia might be frightened by the unexpected movements of a robotic animal.

Ethical concerns also represent a major barrier to sustained adoption. Ethicists raise questions about the moral implications of introducing artificial agents that mimic empathy and affection, arguing that this practice involves a form of emotional deception that undermines the dignity of vulnerable older adults [12]. There are concerns that relying on robotic companions could lead to a further reduction in human-to-human contact, as families and institutions might use the presence of a robot as a justification to reduce visits and care hours. Resolving these implementation barriers and ethical dilemmas requires rigorous, long-term research that evaluates the operational realities of deploying these technologies in actual care environments.

3. Methodology and Implementation Design

3.1 Study Setting and Participant Selection

This implementation study utilized a mixed-methods, quasi-experimental research design conducted across three distinct, accredited long-term eldercare facilities over a continuous six-month period. The participating facilities represented a range of operational sizes, staffing models, and resident demographics, thereby ensuring a highly representative sample of the broader institutional eldercare landscape.

Facility A was a large-scale public nursing home with a high-density, ward-style layout. Facility B was a mid-sized, private assisted living facility characterized by individual resident apartments and extensive communal spaces. Facility C was a specialized dementia care residence with secure memory units and a high staff-to-resident ratio. This multi-center approach allowed the research team to evaluate the adaptability and effectiveness of the robotic interventions across varying institutional contexts and care models [13].

A purposive sampling strategy was employed to recruit participants who met the following inclusion criteria: age 65 years or older; residing in the participating facility for at least three months prior to the commencement of the study; possessing a baseline score on the Mini-Mental State Examination (MMSE) indicating either intact cognitive function or mild-to-moderate cognitive impairment (scores between 10 and 26); and exhibiting self-reported or staff-reported signs of social isolation or chronic loneliness.

Exclusion criteria included severe cognitive impairment (MMSE score below 10) that would preclude meaningful interaction with the conversational platforms; acute psychiatric conditions; and severe, uncorrected visual or auditory impairments that would prevent sensory engagement with the robots. A total of 120 residents were enrolled across the three sites and randomly allocated into three equal, parallel arms: the biomimetic animal robot intervention group, the interactive humanoid conversational robot intervention group, and a passive control group that received standard recreational activities.

3.2 Robotic Platforms and Intervention Protocol

The study utilized two distinct social robotic platforms to address different interactive modalities. The biomimetic animal-like platform was represented by Paro, the therapeutic robotic seal, which is designed to respond to touch, light, temperature, and voice commands. It displays lifelike behaviors such as blinking, moving its tail and flippers, and emitting soft, seal-like sounds, and it can learn to adapt its responses to user preferences over time.

The interactive conversational platform was represented by Pepper, a semi-humanoid robot designed to perceive human emotions through facial expression and vocal tone analysis. Pepper was programmed with customized software modules tailored for older adults, enabling it to engage in semi-structured conversations, lead memory exercises, play cognitive games, read news articles, and perform guided physical exercises.

The intervention protocol was structured to ensure consistency and comparability across the study arms. Over the course of 24 weeks, participants in both robotic intervention groups participated in thrice-weekly interaction sessions, with each session lasting exactly 30 minutes. The sessions were conducted in quiet, dedicated activity rooms within the facilities to minimize external distractions.

The biomimetic robot sessions were primarily individual and focused on tactile engagement, grooming, and non-verbal comforting. The humanoid robot sessions were conducted in small groups of four participants, where the robot facilitated collective games, storytelling, and structured discussions, encouraging participants to interact not only with the machine but also with one another.

A trained research assistant was present in the room during all sessions to ensure physical safety and to address any technical difficulties, but the assistant maintained a non-interactive, observational role to avoid confounding the social dynamics of the intervention [14]. The control group participated in parallel, structured social activities of equal frequency and duration, led by the facilities' activities staff, which included traditional board games, reading groups, and arts and crafts [15].

The systematic implementation flow of this longitudinal investigation is illustrated below. It highlights the progression from participant enrollment through the parallel intervention groups to the final diagnostic outcomes.

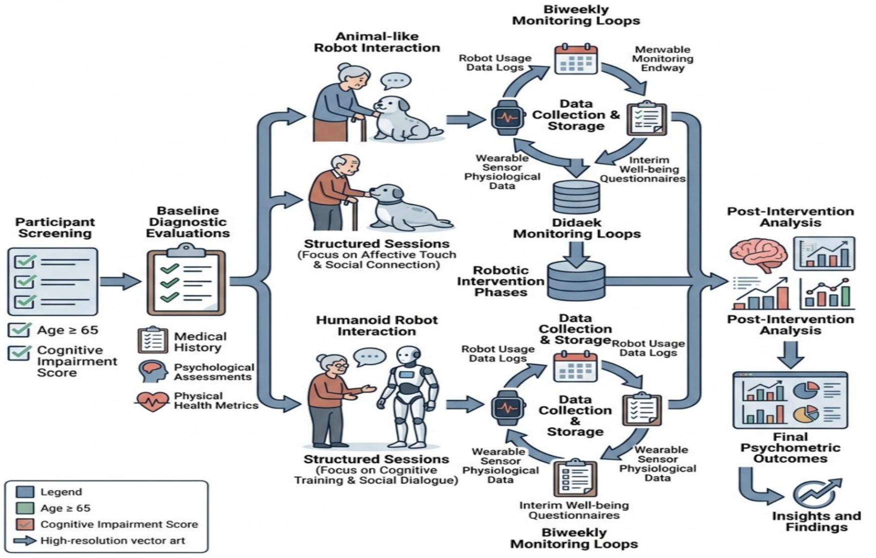

Figure 1: Comprehensive Methodological Framework of the Eldercare Social Robot Implementation Study

3.3 Data Collection and Outcome Measures

To capture the multidimensional impact of the robotic interventions, a comprehensive mixed-methods data collection strategy was deployed. Quantitative assessments were administered at four distinct time points: baseline (Week 0), midpoint (Week 12), post-intervention (Week 24), and follow-up (Week 28, to assess the presence of a sustained post-intervention effect). The primary psychometric outcome measure was subjective loneliness, evaluated using the UCLA Loneliness Scale Version 3, a highly validated 20-item instrument where higher scores reflect greater social isolation and feelings of loneliness [16].

Secondary outcomes included depressive symptoms, measured via the Geriatric Depression Scale (GDS-15), and social network density, assessed using the Lubben Social Network Scale (LSNS-6). To complement these self-report measures and provide objective physiological indicators of stress and emotional regulation, salivary cortisol samples were collected from participants immediately before and after selected interaction sessions at Weeks 1, 12, and 24. These samples were analyzed using enzyme-linked immunosorbent assays to measure acute changes in physiological stress response.

Qualitative data were gathered to capture the nuanced subjective experiences of the participants and the operational perspectives of the healthcare staff. At the conclusion of the 24-week intervention, semi-structured, one-on-one interviews were conducted with a subsample of 30 participating residents and 15 care staff members, including registered nurses, nursing aides, and activities coordinators. These interviews explored topics such as the perceived personality of the robots, emotional attachments formed, experiences of comfort or frustration, barriers to session attendance, and the impact of the robots on daily facility workflows.

The qualitative data were transcribed verbatim and analyzed using inductive thematic analysis, facilitating the identification of recurrent themes and operational insights that quantitative metrics alone could not capture [17].

Table 1 displays the baseline demographic and clinical characteristics of the participant cohort across the three randomized study arms. This ensures that key baseline variables, such as age, gender, and cognitive status, were balanced across the groups.

Table 1: Baseline Demographic and Clinical Characteristics of the Participant Cohort

Characteristic Parameter	Biomimetic Robot Group	Humanoid Robot Group	Passive Control Group
Sample Size	40	40	40
Mean Age in Years	78.40	79.10	77.90
Female Percentage	62.50	60.00	65.00
Mean Mini Mental State Exam Score	18.50	19.10	18.80
Mean Baseline UCLA Loneliness Score	54.20	53.80	54.50

4. Results and Comparative Analysis

4.1 Quantitative Loneliness and Wellbeing Trajectories

The quantitative data collected over the six-month study period were analyzed using mixed-effects linear regression models to evaluate changes in psychometric scores over time and to identify statistically significant differences between the intervention arms. The analysis of the primary outcome measure, the UCLA Loneliness Scale, revealed a substantial and statistically significant decrease in subjective loneliness for participants in both robotic intervention groups compared to the control group by the end of the 24-week intervention period [18].

However, the longitudinal trajectories of this reduction differed markedly between the biomimetic animal robot group and the interactive humanoid robot group. Participants interacting with the biomimetic robot showed a rapid, steady decrease in loneliness scores during the first 12 weeks of the study, which then stabilized and remained low through Week 24.

In contrast, those in the humanoid robot group experienced a more gradual reduction in loneliness, which reached its lowest point at Week 24. This suggests that while animal-like platforms provide immediate tactile comfort, conversational humanoid platforms require a longer period of habituation and social familiarization before their therapeutic benefits are fully realized [19].

The secondary psychometric outcomes, detailed in Table 2, mirror these positive trends. Depressive symptoms, as measured by the GDS-15, showed a significant downward trend in both intervention groups, with the biomimetic group exhibiting the most pronounced reduction, particularly among residents with higher baseline anxiety.

The Lubben Social Network Scale (LSNS-6) scores, which measure the perceived size and strength of an individual's social network, improved significantly for the humanoid robot group. This improvement is attributed to the group-based nature of the humanoid sessions, which fostered a shared social environment and encouraged participants to interact with their fellow residents.

Importantly, the follow-up assessments conducted at Week 28 (four weeks post-intervention) revealed that while the loneliness scores of the humanoid group began to rise back toward baseline, the biomimetic group maintained a statistically significant portion of their therapeutic gains, suggesting a more durable psychological impact of tactile companionship.

Table 2: Comparison of Standardized Psychometric and Physiological Outcomes at Completion

Outcome Measure	Biomimetic Robot Group	Humanoid Robot Group	Passive Control Group
Mean UCLA Loneliness Score Week 24	42.10	44.50	53.90
Mean Geriatric Depression Score Week 24	5.30	6.20	8.20
Mean Lubben Social Network Score Week 24	14.20	17.50	12.10
Salivary Cortisol Reduction Rate	0.15	0.08	0.01

The physiological analysis of salivary cortisol samples corroborated the subjective psychometric findings. Pre-to-post session comparisons revealed a significant acute reduction in salivary cortisol levels following interactions with the biomimetic robot, particularly during the early phases of the study. This biological marker of stress reduction supports the hypothesis that physical contact with responsive, lifelike robotic entities can induce physiological relaxation, akin to the calming effects observed in traditional animal-assisted therapy. The humanoid conversational robot also produced a downward trend in cortisol levels, though the change was less pronounced and highly dependent on the participant's self-reported enjoyment of the conversational activities.

4.2 Qualitative Themes and Social Facilitation

The thematic analysis of the qualitative interviews with residents and staff provided deep insights into the subjective experiences of robotic companionship, revealing the psychological mechanisms underlying the quantitative improvements. Three primary themes emerged from the transcripts: the robot as an emotional anchor, the robot as a conversational catalyst, and the negotiation of artificial authenticity.

The theme of the robot as an emotional anchor was especially prevalent among participants in the biomimetic animal group. Many residents described the robot as a source of unconditional acceptance and comfort, reporting that the simple act of holding, stroking, and talking to the robotic seal brought a sense of peace and relief from daily anxieties. They projected real feelings onto the device, often referring to it with affectionate pronouns and viewing it as a living pet that recognized and responded to their individual presence.

The second major theme, the robot as a conversational catalyst, highlighted the social facilitation effect of the technologies. Both care staff and residents observed that the presence of the robots in common areas stimulated spontaneous social interactions among the residents. The humanoid robot, through its group trivia games and storytelling sessions, provided a common focus that broke down social barriers. Residents who had previously sat in silence next to one another began discussing the robot's jokes, debating answers to the trivia questions, and sharing personal memories triggered by the conversation.

Staff members noted that these interactions often persisted long after the robot had been turned off, with residents continuing to converse about their experiences in the dining hall and during subsequent recreational activities [20]. This social facilitation effect is crucial, as it indicates that social robots do not merely replace human interaction, but can actually serve to enhance and stimulate human-to-human connection [21].

The final theme, the negotiation of artificial authenticity, captured the psychological tension some residents experienced regarding the non-human nature of the companion. While many embraced the illusion of life, a subset of participants remained highly conscious of the machine behind the fur or plastic. Some residents expressed a sense of intellectual conflict, enjoying the interactions while simultaneously reminding themselves that the robot was an engineered device.

For these individuals, the companionship was experienced as a pleasant game or a form of entertainment rather than a genuine relationship. This perspective highlights the importance of individual differences in cognitive style, personal history, and psychological openness in determining how older adults integrate social robots into their personal narrative of aging and institutional life.

4.3 Implementation Feasibility and Staff Perceptions

The success of any technological intervention in eldercare depends heavily on its feasibility and integration into daily clinical workflows. The qualitative interviews with healthcare staff revealed a major evolution in perceptions over the six-month study period. Initially, many staff members expressed significant skepticism and apprehension regarding the deployment of the social robots. They voiced concerns that the devices would be difficult to operate, would require constant technical troubleshooting, and would ultimately add to their already heavy workloads [22]. There was also an underlying anxiety that the robots were being introduced as a cost-cutting measure to replace human caregivers, leading to defensive attitudes and passive resistance during the early weeks of the project.

However, as the study progressed, these apprehensions subsided. The staff witnessed firsthand the positive behavioral changes in the residents, particularly the reductions in agitation among individuals with dementia and the increased social engagement of previously isolated residents.

Furthermore, the implementation protocol, which integrated the robotic sessions into structured, scheduled activities led by the research team, minimized the operational burden on the facility staff. Nursing aides reported that the calming effect of the biomimetic sessions often made subsequent care activities, such as bathing and dressing, easier and less stressful for both the residents and the caregivers.

By the end of the study, the staff overwhelmingly viewed the social robots not as competitors or administrative burdens, but as valuable clinical tools that enhanced their ability to deliver high-quality, person-centered care. Despite this positive shift, staff emphasized that ongoing technical support, simple user interfaces, and structured training programs are essential requirements for the long-term sustainability of robotic interventions in real-world settings.

5. Discussion, Recommendations, and Conclusion

5.1 Therapeutic Potential and the Novelty Effect

The findings of this six-month implementation study provide strong evidence of the therapeutic potential of socially assistive robotics in mitigating chronic loneliness and depression within institutional eldercare. By combining longitudinal psychometric tracking with objective physiological markers and qualitative thematic insights, this research demonstrates that both biomimetic animal-like platforms and interactive humanoid conversational systems can produce meaningful improvements in the psychosocial well-being of older adults.

Crucially, the six-month duration of this study addresses the persistent criticism in the literature regarding the novelty effect. Because the positive outcomes—particularly the reductions in UCLA Loneliness Scale scores—persisted and in some cases deepened over 24 weeks, we can conclude that these benefits are not merely transient reactions to a novel stimulus, but represent a genuine, sustained psychological adjustment facilitated by robotic companionship [23].

However, the comparative analysis highlights that a one-size-fits-all approach to social robotics is clinically inappropriate. The distinct trajectories of change observed between the two robotic modalities suggest that different platforms serve different therapeutic needs and cognitive profiles. The biomimetic animal-like robot, with its emphasis on tactile engagement and simple, non-verbal feedback, appears highly effective for immediate stress reduction, anxiety management, and emotional comforting. This makes it an ideal intervention for residents with moderate cognitive impairment or those who experience language barriers and severe sensory processing issues.

Conversely, the conversational humanoid robot, by driving cognitive exercises and group activities, is better suited for cognitively intact or mildly impaired residents, where it acts as a tool for cognitive stimulation and social facilitation. Recognizing these distinct therapeutic pathways is essential for designing targeted, clinically effective robotic intervention programs that maximize resident benefit while optimizing institutional resources [24].

5.2 Ethical Considerations and Policy Implications

As socially assistive robotics transitions from experimental research into widespread clinical practice, it is imperative to address the moral and ethical challenges associated with their use. The projection of human emotions and intent onto autonomous machines, while therapeutically beneficial, raises fundamental concerns about dignity, deception, and the commodification of care.

Ethicists rightly warn against the danger of substituting genuine human companionship with artificial simulations. It is vital to establish a clear policy framework stating that social robots must always be positioned as complementary tools to enhance and facilitate human care, never as replacements for human-to-human contact. The goal of robotic intervention should be to enrich the social landscape of the care facility, freeing up valuable staff time for deeper clinical and emotional engagement, and serving as a catalyst to connect residents with their peers, families, and caregivers.

To facilitate the ethical, sustainable, and widespread implementation of social robotics in eldercare, we propose the following policy and operational recommendations:

First, funding and reimbursement models must be adapted to support the integration of validated assistive technologies. Governments and insurance providers should consider recognizing social robots as reimbursable therapeutic devices, similar to physical therapy equipment, provided they meet rigorous safety, hygiene, and clinical efficacy standards. This would lower the financial barriers that currently prevent resource-constrained public facilities from adopting these beneficial technologies.

Second, eldercare facilities must invest in comprehensive, mandatory training programs for their staff. This training should focus not only on the technical operation and maintenance of the robotic platforms but also on the psychological and clinical principles of machine-mediated care. Staff must be trained to identify which residents are most likely to benefit from specific robotic modalities, how to manage resident expectations, and how to use the robots as tools to stimulate, rather than replace, human-to-human interaction.

Third, future research and development must prioritize co-design methodologies that actively involve older adults, healthcare professional staff, and family members in the design and development of next-generation social robots. This collaborative approach will ensure that the platforms are designed with intuitive interfaces, robust physical designs, and culturally sensitive interaction modules that align with the diverse needs and values of the global aging population [25]. By addressing these ethical, clinical, and operational dimensions, the eldercare sector can successfully harness the power of social robotics to create more compassionate, connected, and resilient care environments.

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