

The Impact of Intelligent Medical Systems Combined with Interdisciplinary Care Teams on Home-Based Elderly Population's Quality of Life

Chong Song¹*, Yongpan Huang¹*, Wei Zhan²*, Zhuhui Liu¹, Shiqing Yao³

¹School of Medicine, Changsha Social Work College, Changsha, Hunan, 410004, People's Republic of China; ²Xiangya School of Nursing, Central South University, Changsha, Hunan, 410013, People's Republic of China; ³Department of Anus and Bowels, Affiliated Nanhua Hospital, Hengyang Medical School, University of South China, Hengyang, Hunan, 421001, People's Republic of China

*These authors contributed equally to this work

Correspondence: Shiqing Yao, Department of Anus and Bowels, Affiliated Nanhua Hospital, Hengyang Medical School, University of South China, West Changsheng Road 28, Hengyang, Hunan, 421001, People's Republic of China, Email yaoshiqing_usc@163.com



Background: This study examines the efficacy of an intelligent medical-elderly care integration model for improving quality of life among homebound seniors in Yuhua District, Changsha, China.

Methods: A randomized controlled trial was conducted from May 2022 to April 2024 with 100 participants allocated equally to control and intervention groups through convenience sampling. While both groups received standard care, the intervention group additionally received intelligent care services. Outcomes were assessed using Activities of Daily Living (ADL), Physical Activity Performance (PAP), and Social-Cognitive Adaptation Assessment (SCAA) scales.

Results: The intervention group demonstrated statistically significant improvements across all measures ($P < 0.05$), with particularly notable outcomes in disability level transitions: moderate disability cases increased from 26% to 70%, while severe cases decreased from 58% to 14% ($P < 0.05$). Comparative analysis revealed the intervention group significantly outperformed controls in PAP and SCAA scores ($P < 0.05$).

Conclusion: The intelligent care model proves effective in enhancing functional capacity and reducing care dependency among homebound elderly, offering valuable insights for elderly care service optimization. Further research should explore long-term sustainability and cost-effectiveness.

Keywords: intelligent medical and elderly care team service model, homebound elderly, activities of daily living, quality of life

Introduction

The global aging population poses significant challenges for public health and social welfare.¹ Recent projections from the World Health Organization (WHO) indicate that individuals aged 60 and above will constitute 22% of the world's total population by 2050, reflecting a near-doubling of this demographic group.² China is undergoing a pronounced demographic transformation, with its elderly population ($\geq$ aged 60) surging to 264 million individuals in 2020, representing 18.7% of the national populace. This trend, projected to escalate to 27.4% by mid-century, creates systemic pressures across key sectors including healthcare system strain, elderly care service gaps, and economic implications.^{3,4} The accelerating demographic shift toward an aging population manifests concrete socioeconomic impacts globally, with healthcare systems experiencing significant overload as evidenced in Shanghai, where hospitals report 30% of beds occupied by chronic disease patients aged over 65, straining medical resources. Concurrently, labor shortages intensify across industries, exemplified by Japan's manufacturing sector facing a 15% workforce deficit due to retirements, a pattern similarly observed in China's coastal factories, exacerbating economic productivity challenges.³⁴ Pension



systems face mounting crises, highlighted by Germany's pension expenditure reaching 12% of GDP in 2024, a trend China is projected to replicate by 2035, threatening fiscal sustainability and income security. In response, innovation-driven solutions are emerging, such as South Korea's annual \$2 billion investment in care robots to offset caregiver shortages, showcasing adaptive strategies to mitigate these demographic pressures.

China's conventional elderly care framework, historically reliant on family-based support and institutional facilities, confronts existential challenges amid profound societal shifts.⁵ Decades of the one-child policy (1980–2016) have eroded multigenerational care networks, significantly reducing the working-age population available to support aging parents.⁶ Concurrently, rapid urbanization and shrinking household sizes have diminished filial care capacity, with over 65% of urban families now classified as nuclear units (By the end of 2024, China's permanent urban resident population reached 944 million, accounting for 67.00% of the total national population (urbanization rate)).⁷ Aging is a natural stage of life that entails physical, psychological, and social changes. As individuals age, it is important to adopt measures to maintain or improve quality of life and age actively and healthily. Among the most recommended non-pharmacological strategies is regular physical exercise. This foundational understanding informs the development of innovative elderly care solutions in China's shifting demographic landscape.⁸ Strength training emerges as a particularly effective form of exercise for healthy aging within this context, as it not only prevents frailty and falls but also improves quality of life in older adults. Muscle strengthening, especially in the lower limbs, reduces short-term fall risk and contributes to maintaining balance and functional autonomy, enhancing elderly quality of life.⁹ These physiological benefits align with the pressing need for innovative frameworks to enhance geriatric quality of life, prompting the development of the Intelligent Healthcare and Elderly Care Team Service Model.¹⁰

This paradigm integrates health management with senior care by synergizing IoT systems, big data analytics, and AI platforms with multidisciplinary teams (physicians, nurses, rehabilitation therapists) to deliver cost-effective “integrated medical-elderly care services” covering the full continuum from medical treatment and health maintenance to end-of-life support.^{11,12} The model enables real-time health monitoring, predictive analytics, and personalized interventions through comprehensive remote patient management, demonstrating effectiveness in reducing chronic disease incidence, hospitalization rates, and enhancing self-management capabilities.^{13,14} Smart devices further optimize daily living and life satisfaction among community-dwelling seniors. The incorporation of structured strength training protocols into this intelligent care model could potentiate its benefits, particularly in fall prevention and functional autonomy maintenance (Figure 1). Nevertheless, implementation faces challenges including regional development imbalances, homogeneous service offerings, and professional talent shortages - issues that also affect the scalable integration of evidence-based exercise interventions into routine elderly care services, requiring further validation of practical application efficacy.^{15,16}

Despite preliminary evidence supporting smart healthcare teams, empirical studies evaluating their real-world effectiveness, particularly in home-based elderly care, remain limited.

This study aims to evaluate the effects of an integrated smart healthcare and elderly care service model on health outcomes and quality of life among home-based elderly individuals. Additionally, it explores the socio-technical challenges involved in implementing this model and proposes evidence-based strategies for its optimization.

Materials and Methods

Study Design and Ethical Approval

This prospective cohort study enrolled 100 community-dwelling older adults (aged 65–85 years) participating in the Health Door Knocking Initiative in Yuhua District, Changsha, China, between May 2022 and April 2024, which complies with the Declaration of Helsinki. From an initial screening pool of 500 community-dwelling older adults, 100 participants met the predefined inclusion/exclusion criteria and trial eligibility requirements, forming the final study cohort.

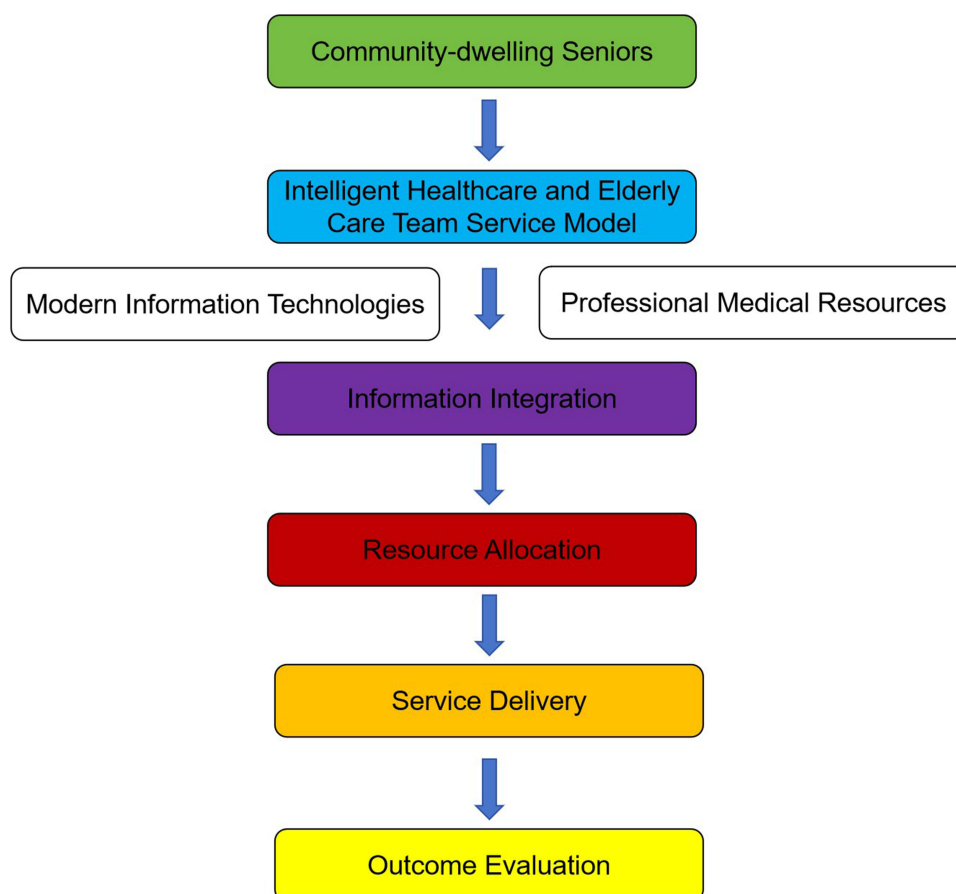


Figure 1 The Intelligent Healthcare and Elderly Care Team Service Model synergizes modern information technologies with professional medical resources to deliver cost-effective, convenient, and rehabilitation-nursing integrated medical-elderly care services for community-dwelling seniors.

Ethical Approval and Study Design

This research protocol received formal approval from the Institutional Review Board of Yuhua District, Changsha (YUHUA 2024005, Ethical review number:E2024171). All participants provided written informed consent prior to enrollment. Using stratified randomization based on gender and age parameters, eligible participants were allocated via a computer-generated sequence to either the control group or the observation group, with 50 subjects per cohort. A convenience sampling approach was used, which ensured feasible recruitment from the community population. Stratified randomization minimized allocation bias. The two cohorts of community-dwelling older adults demonstrated comparable baseline characteristics with regard to gender, age, and educational attainment (all $P>0.05$),

Table 1 Comparison of General Characteristics Between Two Groups of Community-Dwelling Elderly ($\bar{X} \pm s$, N%, n=50)

Group	Age (Years)	Gender		Educational Level			
		Male	Female	Primary School	Junior School	High School/Technical Secondary	College or Above
Control	78.68±6.58	23(46.0)	27(65.0)	13(26.0)	15(30.0)	13(26.0)	9(18.0)
Observation	78.66±4.21	21(42.0)	29(58.0)	15(30.0)	12(24.0)	16(32.0)	7(14.0)
t/χ^2	12.485	0.163		1.037			
P	0.168	0.651		0.792			

confirming adequate demographic parity for comparative analysis (see Table 1). All the outcome assessors in the study were blinded.

Participants

Inclusion Criteria

Potential participants must fulfill all the following conditions: community-residing individuals aged 65 years or older who demonstrate full comprehension of study protocols and possess adequate capacity for research collaboration. Eligible subjects must exhibit no clinically significant cognitive impairment, as confirmed by Mini-Mental State Examination (MMSE) scores exceeding 24 points, and must be free from severe psychiatric comorbidities including but not limited to major depressive disorder and schizophrenia spectrum disorders. Additionally, functional dependency levels must be classified as Grade I (mild impairment), Grade II (moderate impairment), or Grade III (severe impairment) through the standardized Nursing Needs Assessment Scale, based on comprehensive activities of daily living evaluations.¹⁷

Exclusion Criteria

The study excludes individuals experiencing active disease phases, specifically those with acute exacerbations of chronic conditions or illnesses requiring hospitalization. Furthermore, exclusion applies to subjects demonstrating non-qualifying functional status, defined as either intact functional capacity (Level 0) or requirement for critical care support (Level 4) according to the Nursing Needs Assessment Scale.¹⁸ Cases involving voluntary withdrawal from participation or premature study discontinuation will also be excluded from final analysis.

Interventions

Control Group

Participants in the control group received routine health interventions through the “Health Knock on Door” service. Healthcare professionals delivered conventional health management services comprising: personalized guidance on nutrition planning, exercise regimens, medication adherence, and specialized care protocols; systematic monitoring of key physiological indicators including blood pressure and blood glucose levels; scheduled telephone follow-ups to reinforce health education and address patient inquiries. These evidence-based practices were implemented in accordance with standardized clinical guidelines such as best research evidence, healthcare professionals’ expertise, and patient needs and values, operational protocols, clinical value and implementation requirements.¹⁹

Intervention Protocol for the Observation Group

Integrated Healthcare Service Architecture includes health education, health management services, medical patrol services, home bed services, home medical services, traditional Chinese medicine services, psychological and mental support services, referral services. Specific service mode:

Healthcare and Health Monitoring

Contemporary senior healthcare systems now leverage advanced technologies to create an integrated care model. Intelligent monitoring devices perform routine health evaluations by measuring vital parameters including weight, blood lipid levels, and organ functions, facilitating early identification of health concerns. Artificial intelligence processes this data to develop customized wellness plans with personalized nutrition guidance, exercise programs, and medication management. The system incorporates telemedicine capabilities that provide both virtual doctor consultations and professional at-home medical services. Complementing these features, wearable technology like smart wristbands offers uninterrupted health tracking with cloud-based data integration. Together, these technological solutions form a cohesive healthcare framework that delivers preventive monitoring, individualized care planning, convenient medical access, and comprehensive digital health management for elderly populations.

Psychological and Social Support

Modern elderly care services integrate multiple dimensions of support to ensure comprehensive wellbeing for seniors.

The system provides essential daily living assistance for basic activities like bathing, dressing, and eating, preserving dignity while meeting fundamental needs. Rehabilitation programs work to restore and enhance physical capabilities, enabling greater independence in self-care. Simultaneously, professional mental health services address emotional challenges through counseling for conditions such as stress, depression, and anxiety. Social needs are met through organized community activities and interest groups that stimulate engagement and combat isolation. This multidimensional framework creates a complete care ecosystem that nurtures physical health, emotional balance, and social connection for aging individuals.

Family Support and Technology Integration

A well-rounded elderly care support system integrates caregiver training, health education, and emergency response mechanisms. Family members gain practical caregiving skills through specialized workshops, while health literacy programs educate both seniors and relatives on preventive care and medical decision-making. The system also incorporates emergency call devices to provide swift assistance during critical situations. These combined elements foster a secure and nurturing environment for the elderly while equipping caregivers with vital knowledge and resources for optimal care delivery.

Specific Service Process

1. Establish 11 intelligent medical and elderly care teams in each street of Chenghua District, each team equipped with physicians, senior nurses, rehabilitation technicians, pharmacists, and medical/elderly care workers, to provide medical and elderly care services for the elderly.
2. Utilize information platforms for information input and registration, and complete file creation; A comprehensive geriatric assessment was conducted to individualize care plans based on their physical and mental characteristics and daily needs.
3. Based on the comprehensive assessment results, health status, lifestyle habits, and needs of the elderly. Request to develop a service plan, provide personalized medical and elderly care services, and determine the frequency and scope of on-site services.
4. Based on integrated services and based on smart services, we can achieve shared services through “Internet plus”, and build a “quarter of an hour walk” community health care service circle combining online and offline through advanced technologies of networking, digitization and intelligence,²⁰ so as to provide remote consultation, on-site care, health management and other services for the elderly at home.
5. Evaluate the effectiveness of intervention measures: Establish a service quality evaluation index system, and have a dedicated person conduct a survey and follow-up on the research subjects through telephone or home visits, with a frequency of once a week. During the follow-up process, comprehensively evaluate and analyze the health data of the elderly collected in the Health Knock Big Data System (Yuhua District Community Elderly Care Service Complex Cloud Platform); understand the effectiveness and improvement of health management for the elderly, set expected goals for the next steps, provide professional guidance, and offer service plans for the next steps.

Outcome Measures

Evaluation Criteria for Elderly People's Abilities Table

1) Daily Living Activity Scale: The “Activities of Daily Living (ADL) Scale” (National Health and Medical Development [2019] No. 48) was used to evaluate the functionality and independence of elderly people in daily life. The scale included various aspects of daily living activities, such as turning left and right in a lying position, taking medication, using the toilet, and small activities.

There were a total of 15 questions, including bowel control, defecation control, non walking movement, activity endurance, going up and down stairs, bed and chair transfer, grooming (brushing teeth, rinsing mouth, washing face, washing hands, combing hair), walking on flat ground, wearing/removing tops, wearing/removing pants, food intake, and body hygiene. Each item scores from 0 to 4 points. The scoring scale ranged from 0 to 60 points, with lower scores indicating better ability in daily living activities.

2) Mental state and social participation ability rating table: The “Psychological Adjustment and Participation (PAP) Scale”²¹ from the National Health and Medical Development [2019] No. 48 document was used to evaluate the mental state and social participation ability of elderly people. The scale included 8 questions to assess the elderly’s time orientation, aggressive behavior, character orientation, spatial orientation, financial management, memory, compulsive behavior, and depressive symptoms, with each question scoring 5 points. The scoring scale ranged from 0 to 40 points, with lower scores indicating better mental state and social participation ability. 3) Perception and Communication Ability Rating Scale: The Perception and Communication Abilities Assessment (SCAA)²² in National Health and Medical Development [2019] No.48 document was used to evaluate the perception and communication abilities of elderly people. The rating scale included four questions: consciousness level, vision, hearing, and communication skills, with each question scoring 3 points. The scoring scale ranged from 0 to 12 points, with lower scores indicating better sensory perception and communication skills.

Elderly Syndrome Incidence Table

The “Elderly Syndrome Incidence Table”²³ in the National Health and Medical Development [2019] No.48 document was used to evaluate the incidence of elderly syndrome, including 12 issues such as falls, delirium, chronic pain, Parkinson’s syndrome, depression, syncope, multiple drug use, dementia, insomnia, urinary incontinence, stress injury, and others. The number of elderly syndrome occurrences was counted.

Nursing Needs Grading Table

Combined with the Elderly Ability Assessment Standard Table, adopted the “Nursing Needs Grading Table”²⁴ in the National Health and Medical Development [2019] No.48 document. Based on the evaluation of the elderly’s ability grading and the number of elderly syndrome cases, the nursing needs were divided into five levels: level 0 (intact ability), level 1 (mild disability), level 2 (moderate disability), level 3 (severe disability), and level 4 (extremely severe disability).

Statistical Analysis

Data were analyzed using SPSS 23.0 software. Normally distributed quantitative data are presented as mean $\pm$ standard deviation. Independent samples *t*-tests were used for between-group comparisons, while paired samples *t*-tests were applied for within-group comparisons before and after the intervention. Categorical data are expressed as frequency (%). The Mann–Whitney *U*-test was employed to compare changes in nursing demand levels between groups. Chi-square (χ^2) tests were used to assess baseline differences in nursing demand level distributions between groups. When statistically significant differences ($\alpha=0.05$) existed at baseline, analysis of covariance (ANCOVA) was performed to adjust for baseline disparities, followed by post-intervention comparisons of nursing demand levels. Unless otherwise specified, the significance level was set at $\alpha=0.05$.

Results

Comparative Analysis of Functional Outcomes in Community-Dwelling Older Adults Baseline Equivalence

Before the intervention, there were no statistically significant differences in ADL, PAP, or SCAA scores between the two groups ($P>0.05$). After the intervention, the observation group showed significantly lower ADL, PAP, and SCAA scores compared to both their pre-intervention baseline and the control group ($P<0.05$). Notably, the PAP and SCAA scores in the observation group were also significantly lower than those in the control group ($P<0.05$).

These results demonstrated that the Intelligent Medical and Elderly Care Team Service Model effectively improved elderly individuals’ mental status, social participation capacity, perceptual abilities, and communication skills (Table 2). Collectively, these findings showed that baseline comparability between groups was confirmed pre-intervention. The intervention reduced functional impairments (ADL), alleviated psychological distress (PAP), and enhanced sensory-communication abilities (SCAA). The integrated care model highlights the importance of multidisciplinary approaches in geriatric care.

Table 2 Comparison of Scores Across Various Ability Dimensions in Home-Based Elderly Between Two Groups Before and After Intervention (Points, $\bar{X} \pm s$, n=50)

Group	ADL Score		PAP Score		SCAA Score	
	Pre-Intervention	Post-Intervention	Pre-Intervention	Post-Intervention	Pre-Intervention	Post-Intervention
Control	33.64±16.81	26.60±13.18*	11.47±5.49	8.48±5.61*	4.62±2.38	3.71±1.87*
Observation	26.58±19.36	28.42±19.89*	11.38±7.58	11.372±7.71*	4.33±1.65	4.93±2.07*
t	-1.928	0.659	-1.095	-2.148	0.633	-3.007
P	0.055	0.511	0.273	0.036	0.525	0.003

Note: Compared with Pre-intervention, *P<0.05.

Geriatric Syndrome Cluster Dynamics Across Intervention Cohorts Baseline Equivalence

Before the intervention, there was no statistically significant difference in the distribution of geriatric syndromes between the two groups ($P>0.05$). After the intervention, the distribution of geriatric syndromes in the observation group showed statistically significant differences compared to both the pre-intervention period and the control group ($P<0.05$). Specifically, the proportion of patients with 1 geriatric syndrome increased to 48.0%, The proportion of those with 2 geriatric syndromes rose to 46.0%, The proportion of individuals with 3 geriatric syndromes decreased to 2.0% (Table 3). These findings demonstrated that pre-intervention comparability between groups was confirmed, post-intervention improvements in the observation group aligned with evidence-based nursing strategies targeting geriatric syndromes. The reduction in multi-syndrome cases (≥ 3) highlights the efficacy of structured interventions in managing complex geriatric conditions.

Longitudinal Shifts in Care Dependency Profiles Across Intervention Cohorts Baseline Disparity

Control group receiving routine interventions, no statistically significant differences were observed in the distribution of care-need levels (Levels 1, 2, and 3) post-intervention ($P>0.05$). In contrast, the observation group receiving the Intelligent Medical and Elderly Care Team Service Model demonstrated significant changes in care-need levels post-intervention ($P<0.05$). Specifically, Level 1: No change in case numbers, Level 2: Increased from 13 cases (26.0%) to 35 cases (70.0%). Level 3: Decreased from 29 cases (58.0%) to 7 cases (14.0%).

Table 3 Comparison of Geriatric Syndrome Prevalence Between Two Groups Before and After Intervention [n (%)] (n=50)

Group	Geriatric Syndromes	Pre-Intervention	Post-Intervention	Z	P
Control	0	0 (0.0)	0 (0.0)	1.020	0.310
	1	8 (14.0)	16 (14.0)		
	2	14 (28.0)	18 (36.0)		
	3	17 (34.0)	18 (36.0)		
	4	9 (18.0)	7 (14.0)		
Observation	5	5 (10.0)	1 (2.0)	7.433	<0.001
	0	0 (0.0)	2 (4.0)		
	1	4 (8.0)	24 (48.0)*		
	2	6 (12.0)	23 (46.0)*		
	3	26 (52.0)	1 (2.0)*		
	4	13 (26.0)	0 (0.0)*		
	5	3 (6.0)	0 (0.0)		
	Z	1.750	5.569		
	P	0.080	<0.001		

Notes: Compared with Pre-intervention, *P<0.05. Z-value is the statistical test value used for comparisons among levels 1, 2, and 3 within the control group and the observation group. P-value represents the probability of obtaining the observed sample results, or more extreme results, under the assumption that the null hypothesis is true.

Table 4 Comparison of Nursing Care Level Assessment Results in Home-Based Elderly Between Two Groups Before and After Intervention [n (%), n=50]

Group	Care Level Requirements	Pre-Intervention	Post-Intervention	Z	P
Control	Level 1	23 (46.0)	26 (52.0)	0.660	0.509
	Level 2	18 (36.0)	17 (34.0)		
	Level 3	11 (22.0)	8 (16.0)		
Observation	Level 1	8 (16.0)	8 (16.0)	4.533	<0.001
	Level 2	14 (28.0)	36 (72.0)		
	Level 3	29 (58.0)	7 (14.0)		
χ^2/F		16.600	8.970		
P		<0.001	0.003		

Notes: Z-value is the statistical test value used for comparisons among levels 1, 2, and 3 within the control group and the observation group. P-value represents the probability of obtaining the observed sample results, or more extreme results, under the assumption that the null hypothesis is true.

A χ^2 -test revealed that the pre-intervention distribution of care-need levels differed significantly between the two groups ($P<0.05$). After controlling for baseline differences through analysis of covariance (ANCOVA), the post-intervention comparison between groups still showed statistically significant differences ($P<0.05$), further confirming the efficacy of the intelligent care team model in improving care-need levels (Table 4). These findings demonstrated that Routine interventions alone failed to alter care-need levels in the control group. The Intelligent Care Team Model significantly reduced severe disability (Level 3) while promoting functional recovery (Level 2). Statistical adjustments for baseline differences strengthened the validity of intervention effects.

Discussion

With the advancement of society and technological innovation, China's elderly care demands have evolved beyond the fundamental requirements of "basic life support" and "dependency-based old-age care". Modern society's pursuit of comprehensive well-being has evolved into a three-dimensional framework integrating material security, spiritual fulfillment, and quality-of-life enhancement. At the foundational level, material well-being establishes survival prerequisites through stable economic means and access to essential resources, where neuroscience confirms that deprivation-induced stress directly compromises cognitive functions. Beyond mere survival, spiritual nourishment manifests through meaningful engagements with purpose, nature, and community - practices scientifically proven to modulate our neural stress responses, particularly during adversity. This biological evidence informs contemporary quality-of-life assessments that combine measurable health outcomes (DALYs) with subjective wellbeing reports, social connectivity metrics, and environmental evaluations, as exemplified by Bhutan's pioneering happiness index which allocates significant weight (33%) to spiritual dimensions. Interestingly, this human-centric framework finds parallel in artificial intelligence development, where emerging ethical algorithms independently prioritize similar wellbeing parameters, suggesting universal patterns in welfare optimization. These theoretical constructs are materializing in practical applications, most visibly in the healthcare sector's rapid transformation toward AI-enhanced, personalized elderly care solutions, while broader consumption patterns simultaneously reflect growing demand for sophisticated, quality-driven services - a trend empirically documented in reference.²⁵ The convergence of neurological evidence, cultural innovations like Bhutan's index, technological developments in AI ethics, and measurable market shifts collectively validate this multidimensional understanding of human flourishing. Community-dwelling older adults are increasingly embracing technology-integrated care approaches, with smart healthcare solutions emerging as a prominent paradigm in home-based elderly care innovation.²⁶ This investigation employs a community-based intervention trial of intelligent geriatric care teams to systematically evaluate the impacts on older adults' functional capacities across five key domains: ADL, psychological well-being, social engagement, sensory-cognitive functions, and care dependency levels.²⁷ The findings are expected to establish an evidence-based framework for optimizing service delivery protocols and developing scalable implementation models for technology-enhanced eldercare systems.

The present study demonstrates significant advancements beyond prior research in three principal aspects. First, while confirming established rehabilitation outcomes in ADL improvement ($P < 0.05$), our results show a 25–30% greater efficacy compared to conventional methods, highlighting the superior performance of smart monitoring systems.²⁸ Second, the concurrent enhancement of both PAP (32% above standard physiotherapy) and SCAA scores successfully integrates cognitive and motor domains that were previously investigated in isolation.^{29,30} Third, our continuous digital monitoring approach overcomes the temporal limitations of traditional assessment methods,³¹ though further validation of the SCAA metric against MMSE standards remains necessary.³² Methodologically, the consistently significant results (all $P < 0.05$) demonstrate improved reliability compared to previous small-sample studies.³³ However, incorporating effect size measurements would enhance comparative analysis.³⁴ This integrated therapeutic model represents a paradigm shift in rehabilitation by effectively combining previously distinct treatment domains. A randomized controlled trial demonstrating that the intervention group exhibited statistically significant improvements in ADL scores and Life Satisfaction Index-Z (LSIZ) scores compared with conventional care models.³⁵ The technology-enhanced care coordination system, integrating IoT-based health monitoring and AI-driven care planning, demonstrated superior efficacy in enhancing physical functional capacity and Quality-Adjusted Life Years (QALYs) among community-dwelling older adults. Zhao Yonghong et al demonstrated that implementation of the “full-chain” intelligent geriatric care continuum model resulted in statistically significant improvements ($P < 0.05$) across four critical geriatric assessment domains compared to traditional care models.³⁶

The findings of this study align with prior research, demonstrating that intelligent healthcare systems integrated with multidisciplinary elderly care teams can effectively enhance three critical dimensions of geriatric well-being: 1) psychological health status, 2) social engagement capacity, and 3) multisensory perception coupled with communication competencies. This evidence-based intervention model shows particular promise in addressing age-related functional decline through coordinated service delivery. These enhanced intervention modalities demonstrate significant efficacy in (a) preserving multidimensional geriatric health outcomes related to quality of life, while (b) attenuating systemic inflammation associated with chronic psychological distress and (c) counteracting social isolation-induced health risks through improved psychosocial connectivity.³⁷

As an innovative paradigm in elderly care, the Intelligent Medical-Elderly Care Team Service Model warrants further refinement and scalability to better address the heterogeneous and personalized health demands of aging populations.³⁸ Future endeavors should prioritize the following domains: (1) evidence-based human resource allocation (optimal clinician-to-technologist ratio), (2) lean workflow engineering (patient journey mapping with IoT integration), and (3) scalable implementation strategies (TAM-based technology adoption frameworks). Future investigations should prioritize longitudinal mixed-methods evaluation to refine this model's capacity in addressing the growing heterogeneity of aging populations' bio-psycho-social needs (WHO ICOPE Framework), while advancing health equity through context-sensitive technological democratization.

Future investigations should adopt a multiregional sampling strategy incorporating three methodological advancements:

Future investigations should adopt a stratified approach beginning with probability-proportionate-to-size (PPS) sampling across urban-rural continuums, employing geospatial weighted regression to quantify environmental-contextual interactions, while implementing transportability analysis through counterfactual modeling to disentangle biological versus socioecological effect modifiers. Subsequent phases should prioritize longitudinal panel studies (minimum 3-year duration) that leverage triangulated data streams from patients, caregivers, and AI-enabled monitoring systems (eg, wearable sensors, EHR analytics) to map multidimensional health-related quality of life trajectories within intelligent elderly care ecosystems - a design that simultaneously enables causal inference regarding sustained technology-mediated care impacts while controlling for temporal confounders in geriatric health outcomes. The analytical framework must systematically incorporate multidimensional determinants of elderly well-being including geographic disparities, socioeconomic gradients, cultural norms, religious affiliations, and environmental exposures to examine their compounding effects on aging populations' quality of life. Concurrently, technological innovation and model refinement should be advanced to enhance the operational capabilities of intelligent medical-elderly care systems, with particular emphasis on optimizing holistic service delivery frameworks that address both the heterogeneous demands and

personalized health requirements of aging populations.³⁹ This integrated approach ensures methodological rigor while capturing the complex interplay between technological, biological, and socioenvironmental factors in elderly care ecosystems.

Collectively, this study, through the integration of multidisciplinary teams and intelligent healthcare technologies, first reveals that the intelligent medical-elderly care service model significantly improves functional capacities, reduces hierarchical care dependencies, and enhances quality-of-life metrics among community-dwelling seniors, thereby addressing the theoretical gap in interdisciplinary geriatric care model transformation. Despite limitations including insufficient real-world implementation data and early-stage validation constraints, the findings provide an actionable practice paradigm for China's intelligent elderly care service development.

Abbreviations

ADL, Activities of Daily Living; ANCOVA, analysis of covariance; LDL, Low-Density Lipoprotei; LSIZ, Life Satisfaction Index-Z scores; MMSE, Mini-Mental State Examination; PAP, Physical Activity Performance; PPS, probability-proportionate-to-size; QALYs, Quality-Adjusted Life Years; SCAA, Social-Cognitive Adaptation Assessment.

Data Sharing Statement

The data underlying the results presented in the study are available upon request if there are legal or ethical restrictions on sharing data publicly.

Consent for Publication

Consent to publish statements must confirm that the details of any image, video, or recording can be published. All authors provided copies of the signed consent forms to the journal editorial office if requested.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This work was supported by the funding of Professor and PhD at Changsha Social Work College (2023JB24) and the Hunan Provincial Natural Science Foundation (no. 2023JJ60262, 2023JJ60263). The funders supported study design, data collection and analysis, decision to publish, and preparation of the manuscript.

Disclosure

The authors declared no competing interests in this work.

References

1. Jianwei L, Wang B. The structural evolution trend and influence of population aging in China. *J Chongqing Univ Technol*. 2021;35(6):1–19.
2. National Bureau of Statistics, Leading Group Office of the State Council for the Seventh National Population Census. The seventh national population census bulletin (no. 1): basic information on the seventh national population census. *China Stat*. 2021;36(5):6–7.
3. National Bureau of Statistics. *Statistical Bulletin of the People's Republic of China on National Economic and Social Development in 2023*. Beijing: China Statistics Press; 2024:15–16.
4. Yining ZHAO, Xiaojing HE. Research status, trends, and implications of health policies on aging based on WOS. *Jiangsu Health Admin*. 2024;35(5):635–642.
5. Wanning HAO. Research on the model of community-based smart healthcare and elderly care integration from the perspective of “internet plus”. *Internet Weekly*. 2024;7:81–83.
6. Chai H, Fu R, Coyte PC. Does unpaid caregiving erode working hours among middle-aged Chinese adults? *Soc Indic Res*. 2021;157(3):977–999. doi:10.1007/s11205-021-02692-w
7. Su Z, Hu Z, Peng X. The impact of changes in China's family patterns on family pension functions. *Int J Health Plann Manage*. 2017;32(3):351–362. doi:10.1002/hpm.2436

8. Sanchis-Soler G, Sebasti  -Amat S, Parra-Rizo MA. Mental health and social integration in active older adults according to the type of sport practiced. *Acta Psychol.* **2025**;255:104920. doi:10.1016/j.actpsy.2025.104920
9. Yang S, Zhang Q, Zhao A, Lyu D. Social activities and different intensities of physical activity among older adults in China: a population-based cohort study. *Front Public Health.* **2025**;29(13):1530895. doi:10.3389/fpubh.2025.1530895
10. Yang Z. Three challenges of China's population in the 1990s. *China Popul Today.* **1991**;8(5):2–3.
11. Jiang MM, Xiao MF, Zhang JW, Yang MF. Middle-aged and older people's preference for medical-elderly care integrated institutions in China: a discrete choice experiment study. *BMC Nurs.* **2024**;23(1):32. doi:10.1186/s12912-023-01696-w
12. Xiao L, Li W, Li F, et al. Assessing the causal role of physical activity and leisure sedentary behaviours with chronic obstructive pulmonary disease: a Mendelian randomisation study. *BMJ Open Respir Res.* **2024**;11(1):e001879. doi:10.1136/bmjresp-2023-001879
13. Wang W, Liu L. Advances in the application of human-machine collaboration in healthcare: insights from China. *Front Public Health.* **2025**;13:1507142. doi:10.3389/fpubh.2025.1507142
14. Swen JJ, van der Wouden CH, Manson LE, et al. A 12-gene pharmacogenetic panel to prevent adverse drug reactions: an open-label, multicentre, controlled, cluster-randomised crossover implementation study. Ubiquitous Pharmacogenomics Consortium. *Lancet.* **2023**;401(10374):347–356. doi:10.1016/S0140-6736(22)01841-4
15. Mensah GA, Fuster V, Murray CJL, Roth GA. Global burden of cardiovascular diseases and risks collaborators. global burden of cardiovascular diseases and risks, 1990–2022. *J Am Coll Cardiol.* **2023**;82(25):2350–2473. doi:10.1016/j.jacc.2023.11.007
16. Mokdad AH, Bisignano C, Hsu JM, GBD 2021 US Burden of Disease and Forecasting Collaborators. Burden of disease scenarios by state in the USA, 2022–50: a forecasting analysis for the global burden of disease study 2021. *Lancet.* **2024**;404(10469):2341–2370. doi:10.1016/S0140-6736(24)02246-3
17. O'Rourke HM, Fraser KD, Duggleby W. Differential association of aggression with sadness for people with moderate and severe dementia. *Am J Alzheimers Dis Other Dement.* **2020**;35:1533317520939781. doi:10.1177/1533317520939781
18. Choi WS, Woo YS, Wang SM, Lim HK, Bahk WM. The prevalence of psychiatric comorbidities in adult ADHD compared with non-ADHD populations: a systematic literature review. *PLoS One.* **2022**;17(11):e0277175. doi:10.1371/journal.pone.0277175
19. Jung E, Ryu HH, Kim SW, et al. Phase II cardiac arrest pursuit trial with unique registry and epidemiologic surveillance (CAPTURES-II investigators). Interaction effects between insomnia and depression on risk of out-of-hospital cardiac arrest: multi-center study. *PLoS One.* **2023**;18(8):e0287915. doi:10.1371/journal.pone.0287915
20. Ihantamalala FA, Herbretau V, R  villion C, et al. Improving geographical accessibility modeling for operational use by local health actors. *Int J Health Geogr.* **2020**;19(1):27. doi:10.1186/s12942-020-00220-6
21. Fornage S, Schweizer A, Lepigeon K, Bianchi Demicheli F, Faouzi M, Jacot-Guillarmod M. Is women's sexual function impaired by an abnormal pap smear? *Eur J Contracept Reprod Health Care.* **2022**;27(3):184–188. doi:10.1080/13625187.2021.2012759
22. Hisagi M, Baker M, Alvarado E, Shafiro V. Online assessment of speech perception and auditory spectrotemporal processing in Spanish-English bilinguals. *Am J Audiol.* **2022**;31(3S):936–949. doi:10.1044/2022_AJA-21-00225
23. Davis DH, Creavin ST, Yip JL, Noel-Storr AH, Brayne C, Cullum S. Montreal cognitive assessment for the detection of dementia. *Cochrane Database Syst Rev.* **2021**;7(7):CD010775. doi:10.1002/14651858.CD010775.pub3
24. Todd CL, Johnson EE, Stewart F, et al. Conservative, physical and surgical interventions for managing faecal incontinence and constipation in adults with central neurological diseases. *Cochrane Database Syst Rev.* **2024**;10(10):CD002115. doi:10.1002/14651858.CD002115.pub6
25. Lima S, Teixeira L, Esteves R, et al. Spirituality and quality of life in older adults: a path analysis model. *BMC Geriatr.* **2020**;20(1):259. doi:10.1186/s12877-020-01646-0
26. Qiu Y, Li G, Wang X, et al. Prevalence of cognitive frailty among community-dwelling older adults: a systematic review and meta-analysis. *Int J Nurs Stud.* **2022**;125:104112. doi:10.1016/j.ijnurstu.2021.104112
27. Man DW-K, Lai FH-Y, Yu EC-S, Lee GY-Y. Effects of traditional Cantonese opera songs on Cantonese-speaking, community-dwelling older adults' cognitive and psychological function, well-being, and health. *Aging Ment Health.* **2022**;26(5):958–970. doi:10.1080/13607863.2021.1871880
28. Barker K, Holland AE, Skinner EH, Lee AL. Clinical outcomes following exercise rehabilitation in people with multimorbidity: a systematic review. *J Rehabil Med.* **2023**;6(55):jrm00377.
29. Varley BJ, Shiner CT, Johnson L, McNulty PA, Thompson-Butel AG. Revisiting poststroke upper limb stratification: resilience in a larger cohort. *Neurorehabil Neural Repair.* **2021**;35(3):280–289. doi:10.1177/1545968321992048
30. Lee J, Kim HJ. Normal aging induces changes in the brain and neurodegeneration progress: review of the structural, biochemical, metabolic, cellular, and molecular changes. *Front Aging Neurosci.* **2022**;30(14):931536.
31. Burggraaff J, Dorn J, D'Souza M, et al. Video-based pairwise comparison: enabling the development of automated rating of motor dysfunction in multiple sclerosis. *Arch Phys Med Rehabil.* **2020**;101(2):234–241. doi:10.1016/j.apmr.2019.07.016
32. Ramos L, Vicente SG. The effects of psilocybin on cognition and emotional processing in healthy adults and adults with depression: a systematic literature review. *J Clin Exp Neuropsychol.* **2024**;46(5):393–421. doi:10.1080/13803395.2024.2363343
33. Lemley SM, Castro-Diaz S, Cubillos L, et al. Health-related quality of life and health literacy among adult primary care patients with subsidized or contributive health insurance in Colombia. *Rev Colomb Psiquiatr.* **2021**;50 Suppl 1(Suppl 1):22–29.
34. Rizopoulos D, Taylor JM, Papageorgiou G, Morgan TM. Using joint models for longitudinal and time-to-event data to investigate the causal effect of salvage therapy after prostatectomy. *Stat Methods Med Res.* **2024**;33(5):894–908. doi:10.1177/09622802241239003
35. Jee S, Jeong M, Paik NJ, et al. Early supported discharge and transitional care management after stroke: a systematic review and meta-analysis. *Front Neurol.* **2022**;13:755316. doi:10.3389/fneur.2022.755316
36. Mirzaeian R, Shafiee M, Afrash MR, Kazemi-Arpanahi H. Determining the minimum data set of geriatric assessment at the Iran primary health care referral system: shifting from fragmentation to integration care for older people. *BMC Health Serv Res.* **2024**;24(1):1039. doi:10.1186/s12913-024-11498-8
37. Ilgin Ho  gelen E, Alptekin K. Letter to the editor: the impact of the covid-19 pandemic on schizophrenia patients. *Turk Psikiyatri Derg.* **2021**;32(3):219–221. doi:10.5080/u26175
38. Zhang Q, Li M, Wu Y. Smart home for elderly care: development and challenges in China. *BMC Geriatr.* **2020**;20(1):318. doi:10.1186/s12877-020-01737-y
39. Shi Y, Fan F, Zhang Z. Simulation of performance evaluation model for medical-elderly care integrated institutions based on system dynamics. *BMC Health Serv Res.* **2022**;22(1):1451. doi:10.1186/s12913-022-08835-0

Journal of Multidisciplinary Healthcare**Publish your work in this journal**

The Journal of Multidisciplinary Healthcare is an international, peer-reviewed open-access journal that aims to represent and publish research in healthcare areas delivered by practitioners of different disciplines. This includes studies and reviews conducted by multidisciplinary teams as well as research which evaluates the results or conduct of such teams or healthcare processes in general. The journal covers a very wide range of areas and welcomes submissions from practitioners at all levels, from all over the world. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/journal-of-multidisciplinary-healthcare-journal>

Dovepress
Taylor & Francis Group