

Model Innovation and Policy Research on Artificial Intelligence Empowering Community-based Elderly Care Services

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Abstract: As China's population aging continues to deepen, traditional family-based and institutional elderly care models face significant challenges. Community-based elderly care, serving as the core component of the "9073" elderly care structure, urgently needs to enhance its service efficiency. Artificial intelligence technology, as the core driving force of the new wave of technological revolution, provides unprecedented opportunities for the intellectualization, precision, and efficiency of community-based elderly care services. This paper aims to explore how AI can empower community-based elderly care services. By analyzing the integration path of "technology-service-model," it systematically proposes four major innovation models for AI-empowered community elderly care: the Intelligent Safety Monitoring Model, the Personalized Health Management Model, the Emotional Companionship and Social Support Model, and the Resource Integration and Intelligent Dispatch Model. Simultaneously, this paper delves into the key issues currently faced by the application of AI technology in the elderly care field, such as data security, technological age-friendliness, cost and the digital divide, and lack of standards. On this basis, the paper proposes a set of systematic policy recommendations from four dimensions: top-level design, data governance, industrial ecosystem, and talent development and humanistic care, hoping to provide theoretical reference and practical guidance for building an inclusive, precise, and warm AI-empowered community-based elderly care service system.

Keywords: Artificial Intelligence; Community-based Elderly Care; Model Innovation; Elderly Care Service Policy.

1. Introduction

China has entered a phase of deep aging society, with the population aged over 60 exceeding 300 million. It is projected that by 2035, the proportion of the population aged 65 and over will exceed 20%, characterized by the distinct features of "getting old before getting rich" and "getting old before being prepared." The current trend of smaller family sizes and the increase in empty-nest households have led to the weakening of family support functions. Institutional care resources are insufficient in total and unevenly distributed. Community-based elderly care, as an ideal model of "aging in place," has become a focal point of the national elderly care strategy. However, traditional community-based elderly care services suffer from pain points such as shortage of human resources, monotonous service content, untimely responses, and extensive management.

A new generation of information technologies, represented by artificial intelligence, big data, and the Internet of Things, is sweeping the globe, injecting new momentum into the transformation and upgrading of various social sectors. The perceptual, cognitive, decision-making, and interactive capabilities of AI technology provide new ideas and powerful tools for solving the aforementioned problems in community elderly care. AI can not only achieve imperceptible safety monitoring 24/7 through smart sensors but also enable early warning of health risks through data analysis. Furthermore, it can provide emotional companionship through intelligent voice and robots, thereby shifting elderly care services from a traditional, passive, labor-intensive model to a new model characterized by precision, proactivity, and intellectualization. Technological empowerment is no longer an optional add-on but an inevitable strategic choice to resolve the structural contradictions within the elderly care service system.

Research on the models and policies for AI-empowered community elderly care holds significant theoretical and practical importance for addressing the challenges of aging, improving the quality of life for the elderly, cultivating new drivers for the silver economy, and promoting the modernization of social governance.

2. Literature Review

The concept of "Smart Elderly Care" is fundamental to understanding AI empowerment. Its research trajectory shows an evolution from "informatization" to "intelligentization" and then to "smartification." Early research mostly focused on using information technology to improve the efficiency of elderly care management. Scholars explored how to use databases to manage information of the elderly and provide emergency assistance and daily life services through call center systems (Xu Xin, 2010[1]). The core concepts at this stage were "connection" and "response," which partially addressed the issue of service accessibility. However, service content was passive, data silos were severe, and the level of intelligence was low. With the development of technologies like the Internet of Things and cloud computing, the research focus shifted to "intelligentization." Scholars began constructing smart home environments based on sensor networks to achieve automatic safety monitoring and health data collection for the elderly (Du Peng et al., 2015) [2]. However, applications at this stage were mostly single-point technical solutions, lacking systemic integration and in-depth data mining and application. In recent years, with the maturation of AI technology, research has entered a new stage of "smartification." Its core characteristic is the use of AI to achieve "cognition," "decision-making," and "personalization" in elderly care services. Scholars generally agree that smart elderly care utilizes modern technological

means to provide real-time, fast, efficient, and low-cost, IoT-enabled, interconnected, and intelligent elderly care services centered around the various needs of the elderly in daily life, safety security, health care, rehabilitation, entertainment, and leisure (Zuo Meiyun, 2016)[3]. Research has begun to emphasize systemic solutions integrating multiple technologies and data-driven service model innovation.

Regarding research on the existing problems in community-based elderly care services and policy measures, Sejdiu et al. (2020)[4], from an ecosystem perspective, discussed in Gerontology that successful smart elderly care models require collaborative co-creation from multiple stakeholders including the government, enterprises, social organizations, and families. Chen Youhua and Shi Yini (2023)[5] systematically analyzed the "fragmentation" dilemma in community-based elderly care services, manifested as fragmented departmental responsibilities, fragmented service items, and fragmented information resources, leading to low service efficiency and difficulty in forming integrated solutions. Liu Tao and Zhang Xiaojuan (2022)[6] systematically reviewed the evolution of China's smart elderly care policies, pointing out that policy content is deepening from "encouraging technology application" to "standardizing service standards" and "ensuring data security." However, Peng Xizhe and Song Liangjun (2023)[7] incisively pointed out that the current development of smart elderly care in China faces a dilemma of "three emphases and three neglects": emphasizing technology over service (overemphasizing hardware while neglecting the essence of elderly care services), emphasizing products over models (having products but lacking sustainable operation models), and emphasizing construction over coordination (severe data barriers between departments and systems). This critical view profoundly reveals the gap between current practices and the ideal state. In summary, academia has reached a basic consensus on the systemic challenges faced by community elderly care and the empowering potential of AI technology. Based on this, this paper will not discuss technology, models, or policies in isolation but will construct an integrated analytical framework of "technology application - model innovation - policy support."

3. Challenges and Problems in AI-Empowered Community Elderly Care

(1) Data Security and Privacy Protection Challenges

Data is the lifeblood of AI, but physiological data, behavioral trajectories, home environment data of the elderly all belong to highly sensitive personal information, making data security issues particularly prominent. To provide precise services, the system needs to continuously and imperceptibly collect large amounts of data (e.g., activities in bedrooms and bathrooms). This constitutes a huge paradox: to provide meticulous "care," one must conduct pervasive "monitoring." This round-the-clock data collection can easily be perceived by the elderly and their families as an invasion of private space, triggering psychological resistance.

(2) Age-Friendliness and Usability Issues of Technology

Many AI products are not tailored for the elderly, suffering from severe "digital exclusion." Products commonly have problems such as fonts that are too small, complex interfaces, cumbersome operational logic, and poor speech recognition support for dialects and vague expressions. For the elderly

with declining vision, hearing impairment, or reduced cognitive ability, these products are not only difficult to use but also increase their frustration and anxiety. Some elderly people even have fear and distrust of new technology, believing that "machines are unreliable," and prefer direct human interaction.

(3) Cost and Digital Divide Issues

The initial investment and long-term operational costs of smart devices and services are relatively high, which may result in only the economically better-off elderly being able to enjoy them, exacerbating the "digital divide" in elderly care services and social inequity. Smart hardware devices, software platform development, network deployment, and later maintenance all require substantial funding. Regardless of whether this cost is borne by the government, institutions, or the elderly's families, it is a heavy burden. Currently, high-quality AI-powered elderly care services risk becoming a "privilege of the rich," which contradicts the inclusive purpose of elderly care services.

(4) Ethical Risks and Emotional Substitution

Over-reliance on machine companionship may lead to a reduction in real-world social interaction between people, raising ethical concerns about "coldness in human relationships" and "technological alienation." AI pursues efficiency, precision, and cost control, which may erode the emotional connection, ethical care, and humanistic spirit inherent in elderly care services. When care work is increasingly replaced by machines, elderly care services risk becoming a purely technical process, losing their core value of emotional interaction between people.

(5) Dual Shortage of Professional Talent

The implementation of technology cannot be separated from human execution, and the shortage of interdisciplinary talent and frontline service personnel is a critical weakness. The current community elderly care sector presents a situation where "those who understand AI don't understand elderly care, and those who understand elderly care don't understand AI." The market severely lacks interdisciplinary talent who both deeply understand the physical and mental needs of the elderly and the processes of elderly care services, and are proficient in data analysis and AI product management. This leads to a disconnect between technological development and real needs, resulting in products that are "out of touch." At the same time, existing staff at community elderly care service centers (such as caregivers, social workers) mostly lack the ability to operate and maintain smart devices, and interpret data reports. When the system generates false alarms or malfunctions, they cannot intervene effectively, rendering the intelligent system useless.

4. Model Innovation for AI-Empowered Community Elderly Care Services

AI empowerment in community elderly care is not simply the superposition of technology, but the reconstruction and upgrading of traditional service models. Based on the perspective of integrating "demand-technology-business," this section systematically proposes and elaborates on four core innovation models, aiming to outline a clear vision for future smart community elderly care.

Model 1: Intelligent Safety Monitoring Model – From "Passive Response" to "Active Intervention"

The core of this model is to use AI to build a ubiquitous

"safety net," achieving 24/7 imperceptible, proactive safety protection. This model no longer relies on a single device but uses millimeter-wave radar (which can penetrate walls, detect falls, abnormal breathing, and protect privacy), infrared sensors, smart cameras (with blurred processing), door/window magnetic sensors, water leak/gas sensors, etc., to form a perception network. The daily activities of the elderly at home are silently recorded by the sensor network. Data is processed locally, without involving video/image uploads, maximizing privacy protection. If a sudden fall or prolonged absence of vital signs is detected, the system immediately automatically calls preset contacts and pushes alerts to the community service center platform. Upon receiving the alert, the duty officer at the community service center first confirms the situation through a two-way voice system. If there is no response or help is confirmed to be needed, the emergency procedure is immediately activated: one-click call to family members → coordinated property security personnel visit → if necessary, call 120 and push the elderly person's electronic health record to the emergency center. This model significantly reduces the risk of accidents for the elderly living alone or in empty nests and alleviates the care anxiety of family members.

Model 2: Personalized Health Management Model – From "Generic Service" to "One Policy Per Person"

This model aims to use AI as the "personal health manager" for the elderly, providing dynamic health management covering the entire life cycle. By integrating data from wearable devices (blood pressure, blood sugar, blood oxygen, sleep), daily behavior data (activity level, diet), as well as historical physical examination reports and electronic medical records, this model establishes disease risk prediction models for each elderly individual and provides early warnings. It can also set reminders for medication, dietary suggestions, etc. For example, if AI analysis finds that an elderly person's nighttime blood pressure has shown a sustained rising trend over the past week, the system will send a gentle reminder to the elderly person and push the warning information and data report to their contracted family doctor. The family doctor can then perform remote diagnosis or adjust the treatment plan more efficiently based on the structured report provided by AI. AI then adjusts its health monitoring and reminder focus according to the new plan. This model shifts the focus from "treating existing diseases" to "preventing diseases," improving the effectiveness of chronic disease management and reducing medical expenses.

Model 3: Emotional Companionship and Social Support Model – From "Physical Presence" to "Spiritual Companionship"

This model strives to use AI to alleviate the loneliness of the elderly and promote their social participation and mental health. Through cameras or voice analysis, it identifies the emotional state of the elderly. When the system detects low mood through voice patterns or facial expressions, it might proactively play the elderly person's favorite comedy skits or remind community volunteers. Simultaneously, the intelligent data platform can match the elderly with online interest groups within the community or across regions based on their interest tags, organizing video "tea parties" or online competitions. The platform can also generate a "daily life brief" for the elderly and share it with their children, serving as a digital link for family connection. This model can effectively fill the emotional void of the elderly, alleviate loneliness and depression, and improve their mental health

level.

5. Policy Recommendations for Promoting AI-Empowered Community Elderly Care

(1) Strengthen Top-Level Design and Strategic Planning

First, special plans should be issued at the national level to clarify the development goals, key tasks, technological pathways, and priority areas for AI-empowered elderly care during the 2025-2035 period. These plans need to align with the "AI Plus" initiative and the reform and development guidelines for elderly care services to ensure policy synergy. Meanwhile, local governments should, based on their local aging situation and needs, clarify the positioning of AI elderly care in their relevant plans for the 15th Five-Year Plan period, and incorporate goals such as the construction of smart elderly care service platforms and the application of smart devices into government performance assessments, ensuring that the top-level design can be implemented.

(2) Build a Sound Data Governance and Security Assurance System

Research and formulate "Regulations on the Management of Elderly Care Data Security" or guiding opinions to clarify the boundaries for collecting sensitive information such as biological information and behavioral data of the elderly, as well as ownership, usage rights, and benefit rights. Simultaneously, mandate that AI elderly care products use encryption, anonymization, and other technologies in data collection, transmission, and storage phases, and require products to pass strict data security certification before market launch. Furthermore, develop concise, visual privacy agreements tailored to the elderly, and encourage the use of voice explanations, video tutorials, and other age-friendly methods to ensure informed consent is effectively communicated. Explore the establishment of a "joint informed consent" model assisted by family members or community volunteers to safeguard the right to data self-determination.

(3) Cultivate the Industrial Ecosystem and Promote Inclusive Development

Fully implement the work led by the Ministry of Industry and Information Technology and the Ministry of Civil Affairs regarding pilot projects for the partnered research and application of smart elderly care service robots in specific scenarios. Mandate that products undergo application validation in three types of scenarios for no less than six months, and undergo continuous iteration and optimization based on feedback from elderly users to improve product usability and reliability. Promote models such as "service vouchers" or "equipment rental subsidies," prioritizing subsidies for special needy elderly groups such as those who are disabled, very old, or living alone. Encourage local governments to procure inclusive AI elderly care services and guide state-owned enterprises to cultivate business segments focused on inclusive elderly care as their main responsibility.

(4) Strengthen Talent Team Building and Guide Humanistic Care

Establish interdisciplinary programs in "AI + Elderly Care" in universities to cultivate professionals who understand both technology and elderly care. Support universities and vocational colleges in setting up interdisciplinary programs and curriculum systems for "AI + Elderly Care." Regularly

organize vocational skills competitions in elderly care services and AI applications to enhance the skill levels of practitioners. Provide training for frontline caregivers on the use of AI equipment, enabling them to become "technology stewards" connecting technology and the elderly.

In policy promotion and service design, consistently emphasize that AI is a supplement to, not a replacement for, human emotional care. Encourage the development of AI products that can promote intergenerational interaction and family connection, rather than completely independent companion robots. Simultaneously, encourage children, volunteers, and smart tools to collaborate in providing "warm" services for the elderly.

6. Conclusion and Outlook

Artificial intelligence provides powerful technological tools and novel solutions for resolving the dilemmas of community-based elderly care services. By constructing three innovative models—Intelligent Safety Monitoring, Personalized Health Management, and Emotional Companionship and Social Support—AI can significantly enhance the quality, efficiency, and accessibility of community-based elderly care services. However, this process will not be smooth sailing; it requires facing and resolving a series of challenges including data security, technological age-friendliness, cost equity, and ethical risks.

In the future, a successful AI-empowered community elderly care system must be a deep integration of technological rationality and humanistic care. It should not be a cold replacement by machines, but a warm collaboration of "technology + human effort." The government, enterprises, communities, and families need to form a synergy. Through scientific policy guidance and institutional guarantees, we can collectively build a new smart elderly care paradigm where every elderly person can enjoy a dignified, safe, and happy life in their later years.

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