

Pathways for Generation Z to Address the Difficulties of Cognition, Usage, and Payment for Smart Healthcare and Elderly Care Robots

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Abstract: The accelerated population aging process in China has created a vast market for smart health and elderly care robots, but their large-scale promotion faces three major constraints: cognitive barriers, usage difficulties, and payment obstacles. Existing research predominantly focuses on the binary analytical framework of government and market forces, whilst relatively neglecting the potential role of intergenerational family relationships in consumer decision-making. Based on Intergenerational Solidarity Theory, this paper constructs an intergenerational transmission chain of "information acquisition—purchase intention—family payment" to explore how Generation Z, as "digital natives", can participate in addressing the structural challenges of elderly care robots— cognitive barriers, usage difficulties, and payment obstacles —from the life cycle of "active aging" to "disability care". This study provides theoretical perspectives and policy insights for building a techno-humanistic elderly care service system with Chinese characteristics.

Keywords: Intergenerational Solidarity Theory; Generation Z; Elderly care robots

1. Introduction

China is undergoing the world's largest and fastest demographic aging transition. According to data from the National Bureau of Statistics, by the end of 2023, the population aged 60 and above in China had exceeded 297 million, accounting for 21.1% of the total population, among which those aged 65 and above surpassed 217 million, representing 15.4% of the total population [1]. Meanwhile, the miniaturization of family structures and generalization of the inverted pyramid elderly care model "4-2-1" have continuously weakened traditional elderly care functions, necessitating the infusion of new vitality into elderly care services.

In 2024, the "Opinions of the Central Committee of the Communist Party of China and the State Council on Deepening the Reform and Development of Elderly Care Services" was issued, which proposes to consolidate the basic role of home-based elderly care [2]. The application of robotics technology to enhance elderly care services has been identified as a viable solution to address aging challenges and achieve home-based elderly care. Nowadays, elderly care robots are being developed around the world to help the elderly cope with declining physical health and cognitive abilities [3]. Notable examples include multi-heterogeneous robot systems and a smart home jointly developed in

China and Japan [4], as well as the Health Bot robot co-created by the University of Auckland [5].

Nevertheless, the promotion of smart health and elderly care robots faces three fundamental constraints: cognitive barriers—senior populations lack clear understanding of their functional value, thus leading to resistance; usage difficulties—robot products fail to adequately align with elderly users' digital literacy and physical capabilities, coupled with inadequate training and after-sales services, resulting in low perceived ease of use; payment obstacles—high R&D costs drive up pricing, making them unaffordable for average households [6, 7].

As the primary users of elderly care robots, the elderly population, influenced by inherent characteristics such as age and digital literacy, is unlikely to increase their acceptance of these robots in the short term. Marketing efforts directed primarily at the elderly population are often of limited efficacy. In contrast, Generation Z born between 1995 and 2009, as "digital natives," possess unique consumption patterns, technological optimism, and a distinct understanding of family responsibilities. Based on Intergenerational Solidarity Theory, the flow of resources, emotional support and shared responsibility among generations constitute key elements of family life cycles [8]. Generation Z's purchase or rental of elderly care robots is a form of appreciation and reciprocation to their family's upbringing and resource support. Meanwhile, they can strengthen emotional connections in using the robots and alleviate the caregiving burden for grandparents from parents. By leveraging elderly care robots as a bridge for intergenerational care, Generation Z can drive the evolution of elderly care models toward greater humanization and sustainability. This concerns not only the economic sharing of costs but also embodies the principles of techno-humanism.

2. Literature Review and Analytical Framework

2.1 Payment Challenges for Elderly Care Robots

The payment obstacles of smart health and elderly care robots are rooted in the structural contradictions of China's pension security system. First, the ratio of pensions to pre-retirement wages in China shows a declining trend, currently around 45% for public employees and enterprise employees, leaving the elderly unable to afford the services for smart elderly care robots [9]. Second, the coverage of long-term care insurance is limited, with reimbursement lists primarily focusing on basic care and low inclusion of smart devices. Third, the underdeveloped commercial pension insurance market in China results in widespread financial constraints among the elderly population. Studies indicate that approximately 82.5% of seniors are willing to pay up to 1,000 RMB [10]. For robots priced at the ten-thousand-RMB level, consumption willingness remains limited. It is imperative to explore new consumption incentive mechanisms.

2.2 Intergenerational Solidarity Theory and Its Application in Elderly Care Robot Consumption

The Intergenerational Solidarity Theory, systematically proposed by Bengtson etc., describes and analyzes mutual support among family members across generations in terms of emotions, behaviors, attitudes, and values, including associational, affectual, consensual, functional, normative and structural solidarity [8]. Research has found that in the context of elderly care, there is functional solidarity in material and service exchange between generations, manifested as children providing economic support, life care, and emotional comfort to their parents or grandparents. In digital elderly care scenarios, this extends to Generation Z purchasing, renting, or subscribing to smart elderly care products and services for seniors. This represents an extension of traditional economic support, serves as emotional compensation to make up for the lack of companionship caused by busy work and long

distance, and constitutes a novel digital expression of affectual solidarity.

2.3 Analytical Framework: "Information acquisition—Purchase intention—Family payment" Consumption Chain

Driven by high technological acceptance and intergenerational care awareness, Generation Z demonstrates keen insight into family-based elderly care needs. They proactively explore the functionalities and application scenarios of elderly care robots and make purchasing decisions tailored to their specific family circumstances. By leveraging family pension accounts and consumption subsidies, they facilitate family purchases while also assisting older adults in using the robots. This approach effectively addresses challenges related to cognitive barriers, usage difficulties, and payment obstacles, thereby establishing a complete consumption chain for Generation Z's engagement with senior care robots: information acquisition—purchase intention—family payment.

3. The Full-Process Demand Spectrum for Elderly Care Robots and Solutions to Promotion Dilemma

3.1 From Active Aging to Disability Care: The Full-Process Spectrum Supported by Generation Z

Throughout the life cycle of elderly individuals as they transition from "active aging" to "disability care", Generation Z's caregiving needs show distinct gradient variations. Elderly care robots with different functional configurations can provide differentiated, stage-specific supportive care tailored to these evolving needs.

During the active aging phase, elderly individuals need products that enhance daily convenience and health safety monitoring. Generation Z's primary spending focuses on lightweight elderly care robots integrating health monitoring, reminders, video calls, and entertainment functions—devices that can replace smart wristbands and blood pressure monitors, such as Xiaodu Home, which typically range from several hundred to two thousand RMB per unit. At this stage, robots combine multiple functions at a low cost, offering both emotional bonding and risk prevention. They help seniors establish smart device usage habits, lay the groundwork for future adoption of complex elderly care robots, and significantly improve their sense of life security.

When elderly individuals show signs of partial disability such as mobility impairment or cognitive decline, or face a high risk of functional deterioration, Generation Z's demand shifts toward functional products—including mobility aids, rehabilitation training, and assistance with heavy lifting or errand-running. Examples include wheeled robots and robotic dogs integrated with AGV technology, whose unit prices rise to tens of thousands or even over 100,000 RMB. At this stage, Generation Z faces greater caregiving pressure and higher time costs. Purchasing functional robots can ease their burden and ensure parents' quality of life, reinforcing both normative solidarity and functional solidarity.

When elderly individuals become completely incapacitated and require 24-hour professional care, Generation Z demonstrates strong demand for intelligent robots capable of complex tasks like turning, cleaning, and feeding, such as advanced nursing robots and exoskeleton rehabilitation robots. This phase represents the ultimate expression of intergenerational solidarity. Due to shortages of caregivers and exorbitant costs of institutional elderly care, technologically mature intelligent robots serve as essential supplements. Although financial burdens remain heavy for most families at this stage, the increasing incomes of Generation Z, declining technology costs, and various insurance subsidies will gradually improve affordability.

3.2 Solutions to Difficulties of Cognition, Usage, and Payment

Technology anxiety, learning barriers, conservatism, financial constraints, and insufficient family support all lead to lower acceptance of emerging technologies among seniors [11]. These factors lead Generation Z to establish a unique intergenerational bridge in the adoption of elderly care robots, aiming to solve the difficulties of cognitive, usage, and payment.

Information acquisition addresses cognitive barriers. Generation Z is either about to enter or has already begun participating in social production and development. They have access to diverse information channels for emerging technologies, including tech exhibitions and academic publications. Notably, younger generations demonstrate superior online information retrieval skills compared to older populations. As digital natives, Generation Z can learn about products through platforms such as Bilibili and Xiaohongshu and then share insights with family members. This effectively reduces information acquisition barriers and trust gaps that seniors often face when trying to understand new technologies.

Operational assistance addresses usage difficulties. Younger family members providing "digital reverse mentoring" to seniors serves as a critical pathway for building and enhancing elderly digital competence [12]. Generation Z can assist seniors in installing and configuring robots, guiding them through basic operational procedures to ensure full use of the robots' functions. They can also manage software updates and troubleshooting to ensure continuous operation. Additionally, Generation Z can use multiple channels to promptly report usage issues, encouraging manufacturers of elderly care robots to implement age-friendly design improvements.

Innovative payment models address payment obstacles. As robot prices decline and the incomes of Generation Z rise, supplementary household pension funds will be better positioned to support payments for elderly care services. Rather than making one-time, high-asset investments, Generation Z prefers flexible payment methods such as leasing and subscription, which reduce immediate financial burdens while effectively encouraging experiential consumption and long-term payments, thereby creating a virtuous cycle in the market.

4. Survey Research on Generation Z's Purchase of Elderly Care Robots

4.1 Basic Survey Information

4.1.1 Survey Objectives

To explore the two stages of "information acquisition" and "purchase intention" among Generation Z, we surveyed 113 respondents via both offline and online channels regarding their views on elderly care robots. We presented four types of elderly care robots—desktop, quadrupedal, wheeled and humanoid—along with their intended uses under ideal conditions, and asked respondents relevant questions.

4.1.2 Survey Participants and Questionnaire

Among the respondents, males accounted for 42.5% and females for 57.5%. The proportions of individuals born in the years 1995-2000, 2001-2005, and 2006-2009 were 23.0%, 53.1%, and 23.9%, respectively. College students made up 73.5% of the sample. The survey questionnaire is provided in the appendix.

4.1.3 Descriptive Statistical Analysis

Firstly, we investigated Generation Z's understanding level on elderly care robot. While a large proportion of Generation Z know elderly care robots, the depth of understanding remains limited. Among the respondents, 80.5% knew elderly care robots, 43.5% were relatively familiar with them, and 6.3% possessed extensive understanding.

Secondly, we investigated information acquisition channels. 93.4% of respondents reported obtaining information about elderly care robots through news outlets, social media platforms, e-commerce platforms, and television advertisements, while only 17.6%, 14.3%, and 13.2% of respondents acquired information offline, through recommendations from friends and family, or via professional channels, respectively.

Thirdly, we investigated purchase intentions and demand for elderly care robots. 97% of respondents expressed willingness to purchase such devices. Acceptance rates for desktop, quadrupedal, wheeled and humanoid robots were 92.7%, 88%, 93.6% and 83.5% respectively. Specifically, 90% and 74% of consumers indicated purchasing needs when elderly individuals lived alone or were disabled. Generation Z primarily prioritized three core functions: daily assistance, safety protection, and health monitoring, each selected by over 85% of respondents. Concerns included practicality, flexibility, complex scenario handling capabilities, and safety issues.

4.2 Information Acquisition Influences Generation Z's Purchase Intention of Elderly Care Robots

We aimed to verify that understanding level significantly positively predicts willingness to purchase four types of elderly care robots. Using SPSS binary logistic regression analysis, knowledge level was categorized into three ordinal independent variables: no understanding, little understanding, and good understanding. The "no understanding" group served as the reference group, while the other two groups were converted into dummy variables. The dependent variable, purchase intention, was classified as binary (willing to purchase vs. unwilling to purchase). The results of the data analysis are presented in Table 1.

Table 1: Understanding Level has a Significant Positive Predictive Effect on the Willingness to Purchase Humanoid Robots.

| Variable | B | S.E. | Wald | df | p | Exp(B) | 95%EXP(B)CL | |
|----------------------|-------|-------|--------|----|-------|--------|-------------|----------------|
| | | | | | | | Lower limit | Superior limit |
| No understanding | | | 10.167 | 2 | 0.006 | | | |
| Little understanding | 1.637 | 0.614 | 7.106 | 1 | 0.008 | 5.139 | 1.542 | 17.121 |
| Good understanding | 1.764 | 0.611 | 8.320 | 1 | 0.004 | 5.833 | 1.760 | 19.335 |
| Constant | 0.182 | 0.428 | 0.181 | 1 | 0.670 | 1.200 | | |

*Cox&Snell(R²)=0.086, Nagelkerke(R²)=0.137

The level of understanding significantly positively predicts consumers' willingness to purchase humanoid robots (Exp(B) = 5.833 for "good understanding" vs. 5.139 for "little understanding"). Humanoid robots are more likely to benefit from enhanced understanding due to their approachability and intuitive functionality, whereas other types may face challenges such as ambiguous features, insufficient trust, or unclear application scenarios. For humanoid robots, targeted educational campaigns should be intensified. For other types, clearer usage scenarios need to be defined, along with trust-building initiatives like free trials and real-world case studies to improve familiarity and credibility.

4.3 Generation Z Females Are More Inclined to Purchase Elderly Care Robots

We aimed to investigate whether there are significant differences in purchase intention among Generation Z consumers of different genders regarding four types of elderly care robots. The analysis employed Fisher's exact test, with gender as the independent variable and purchase intention as the dependent variable, both of which were binary variables. The results revealed that gender had a significant impact only on wheeled robots, with female consumers demonstrating significantly higher purchase intention than males (see Table 2).

Table 2: Female Purchase Intention was Significantly Higher than that of Males.

| Sex | Purchase intention rate (%) | p |
|-------|-----------------------------|-------|
| Man | 85.4 | |
| Woman | 98.5 | |
| Total | 92.9 | 0.010 |

This indicates that wheeled robots may better align with the needs and preferences of Generation Z female consumers due to their nursing-assisting functions. In the marketing promotion of wheeled robots, strategies such as in-depth development of nursing scenarios and feminine design can be employed to attract female consumers' attention and enhance their purchase intention.

4.4 Purchase Intentions for Different Types of Elderly Care Robots Are Correlated among Generation Z.

We investigated whether Generation Z consumers willing to purchase a specific type of elderly care robot are more inclined to purchase another type of robot. Correlations among the four robot types were examined, with the core variables being purchase intentions for four types of elderly care robots (see Table 3).

Table 3: Correlation in Purchase Intention of Different Elderly Care Robots Among Generation Z.

| Robot type | 1 | 2 | 3 | 4 |
|---------------------|------|-------|-------|---|
| 1 Desktop robot | — | | | |
| 2 Quadrupedal robot | .10 | — | | |
| 3 Wheeled robot | .24* | .46** | — | |
| 4 Humanoid robot | .12 | .42** | .47** | — |

** p <.01. * p <.05

The data analysis reveals strong correlations in consumer purchase intentions for quadrupedal, wheeled, and humanoid robots, while weak correlations exist between desktop and wheeled robot purchases. Among Generation Z consumers, quadrupedal, wheeled, and humanoid robots likely share a common cognitive framework: their ability to perform physical tasks and directly engage in caregiving activities. In contrast, desktop robots primarily focus on information delivery and companionship. The weak correlation in purchase intentions between desktop and wheeled robots indicates that some consumers prefer functional combinations emphasizing "companionship + nursing" capabilities.

This suggests that the market may consist of two distinct consumer segments. While some consumers remain open to diverse elderly care robots and anticipate product combinations, others maintain conservative attitudes toward all categories, necessitating efforts to stimulate latent demand. Quadrupedal, wheeled, and humanoid robots could be positioned as "labor-assisting" elderly care devices, while desktop and wheeled robots could be marketed as "companionship care" solutions through bundled promotions.

5. Conclusion and Implications

Based on the Intergenerational Solidarity Theory, this paper systematically analyzes the motivations, behavioral pathways, and profound impacts of Generation Z's participation in addressing the payment obstacles of smart health and elderly care in China. The study reveals that Generation Z is not a passive observer but rather an active constructor of a dynamically evolving consumption chain covering "information acquisition—purchase intention—family payment" through their technological literacy and consumption preferences. Their involvement provides vibrant, family-based solutions to resolve payment dilemmas under the backdrop of "aging before affluence," serving as a critical component in building a China-specific smart elderly care service system. This is not merely an economic issue but also a significant social proposition concerning intergenerational harmony, social equity, and the benevolent application of technology. Next, we will examine the relationship between purchase intention and family payment through further data analysis.

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