

Research on Identifying and Optimizing Elderly Needs for Smart Elderly Care Service Platforms—An Empirical Analysis of Elderly Users Based on the Kano Model

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Article

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Abstract

To identify, classify, and prioritize elderly users' perceived needs for smart elderly care service platforms, this study applies the Kano model, mixed category analysis, and the Better-Worse coefficient method to systematically analyze 27 functional requirements. The findings reveal a clear hierarchy among elderly users' needs. Essential requirements mainly involve basic safety and operational functions and serve as fundamental conditions for user acceptance. Expectant requirements show a linear relationship with user satisfaction and play an important role in improving service experience. Attractive requirements provide additional value by generating positive surprises and enhancing user engagement, whereas indifferent requirements currently have limited effects on user satisfaction. Based on these findings, this study proposes a four-stage optimization framework: ensuring the stability of essential functions, improving the quality of expected services, exploring the potential of attractive features, and reducing redundant functions with limited user value. This study provides empirical evidence and practical guidance for the targeted optimization of smart elderly care service platforms and contributes to a deeper understanding of elderly users' differentiated needs in the context of digital transformation.

Key Points

1. This study classifies 27 platform functions into four need types using the Kano model, mixed category analysis, and Better-Worse coefficient method.
2. Must-be requirements centered on safety, anti-fraud, and ease of operation are the bottom line to prevent user dissatisfaction.
3. One-dimensional requirements such as clear language, real-time guidance, and family interaction linearly improve elderly users'satisfaction.
4. Attractive functions including screen reading, health visualization, and AI voice companionship significantly enhance user experience.
5. A four-stage optimization path is proposed to support precise age-friendly retrofits and bridge the digital divide for older adults.

Introduction

Driven by the global wave of population aging and China's national strategy of "actively responding to population aging," developing smart elderly care has become an inevitable choice to improve the efficiency of elderly care services and address the challenges of elderly care. Policy documents such as the "China's national Five-Year Plan for National Aging Undertakings Development and Elderly Care Service System" clearly propose promoting the deep application of new-generation information technology in elderly care services and building integrated and intelligent smart elderly care service platforms. These platforms aim to integrate technologies such as the Internet of Things, big data, and artificial intelligence to provide elderly people with one-stop services covering safety monitoring, health management, daily care, and emotional support, becoming an important bridge connecting the elderly with the digital society. Meanwhile, the number of elderly internet users in China continues to expand, and digital access capabilities are steadily improving. Data from the China Internet Network Information Center (CNNIC) shows that the elderly are rapidly integrating into digital life, with their acceptance and willingness to use intelligent products and services continuously increasing. This provides a broad user base and market prospects for the popularization and application of smart elderly care service platforms. In response to this trend, relevant national departments are actively promoting the elderly-friendly transformation of internet applications, aiming to lower the digital usage threshold for the elderly.

However, many smart elderly care service platforms exhibit a significant phenomenon of "technology-driven first, disconnected user needs" during their design and development processes. Platform features are often stacked based on technical feasibility and supply-side logic, failing to fully align with the unique cognitive abilities, operating habits, psychological needs, and real-life scenarios of elderly users. This has led to some services being superficial in "elderly suitability," failing to address the essence of enhancing elderly users' sense of gain, happiness, and security, and even by operating apps^[1], news apps^[2], and mobile banking apps^[3].but there has been limited research on the age-friendly transformation of smart elderly care service platforms. To more accurately identify and align with the real functional needs of elderly users for smart elderly care service platforms, effectively improving platform service efficiency and user satisfaction, this paper introduces the Kano model, a classic tool for classifying user needs and prioritizing analysis. The research will start from the core experiences and real-world scenarios of elderly users, systematically mining their key needs for age-friendly transformation of smart elderly care service platforms. Using scientific methods, they classify and prioritize these needs, thereby clarifying their core pain points, desired functions, and potential surprises during use. Ultimately, this study aims to provide planners,

developers, and operators of smart elderly care service platforms with an empirical, actionable functional optimization roadmap, offering reference for efficient age-friendly renovation work.

Research Review

(1) Research on the Elderly-Friendly Renovation of Smart Elderly Care Service Platforms

The concept of age-friendly originated in Europe and was initially focused on research in design and architecture^[4]. In China, "age-friendly" first emerged against the backdrop of population aging. Currently, there is no consensus on the concept of "age-friendly" in academia. Research on existing literature shows that age-friendly is often associated with concepts like "renovation" and "design," referring to modifications or designs that consider the needs of the elderly, with its connotation largely consistent with "elder-friendly" ^[5]. With the deepening of population aging and the vigorous development of smart elderly care services, the elderly-friendly transformation of integrated service platforms as core carriers has increasingly become a focal point of attention for academia and industry. However, current renovation practices generally face deep challenges. Pu Xinwei and Zhang Xinkang (2024) precisely summarize these as "technology rejects aging" and "fragmented subjects," meaning that advanced technologies do not naturally adapt to the characteristics of the elderly population, and there is a lack of effective collaboration among service providers, resulting in platform functions disconnecting from the real life scenarios of elderly users ^[6]. Research by Chen Lifang et al. (2024) further revealed that many internet applications tend to be 'formalized' in their age-friendly modifications, with most modifications focusing on surface interface adjustments such as icon enlargement and font adjustments, failing to address functional process reconstruction and user experience optimization based on user needs ^[7]. This "formal, light-core" transformation model makes many smart elderly care platforms appear "elderly-friendly" but still poses high barriers for elderly users.

Faced with these difficulties, research consensus has gradually shifted to emphasizing the core role of "demand-driven." The effectiveness of smart elderly care platforms fundamentally depends on whether their functions and services precisely meet the real and urgent needs of elderly users. Therefore, systematically and scientifically identifying and understanding the complex and diverse demand spectrum of the elderly population has become a key prerequisite for optimizing platform design and improving service effectiveness. Existing research has made various attempts in needs exploration, such as using user profiling, in-depth interviews, and questionnaire surveys to characterize the elderly's expectations in areas such as safety monitoring, health management, convenience of life, and social participation from different perspectives. These studies provide rich qualitative insights and localized quantitative data for understanding the needs of elderly users.

Reviewing existing literature, there is still room for further research on the needs of smart elderly care service platforms as a specific group. Many studies either focus on macro policy and service model discussions or on analyses of requirements for single devices or functional modules such as smart wristbands and health monitoring, lacking sufficient systematic understanding of the synergy needs faced by comprehensive platforms that integrate multiple services and span multiple scenarios. More importantly, after a requirement is identified, methodological exploration and empirical research on how to transform it into a clear and actionable transformation plan remains insufficient. Therefore, exploring and introducing more structured and refined needs analysis tools to support precise decision-making for elderly transformation of smart elderly care service platforms has become a research direction worthy of in-depth exploration.

(2) Overview of the Kano Model

The Kano model was proposed in 1984 by Japanese scholar Noriaki Kano in combination with two-factor theory, and is a classic analytical method specifically used for needs evaluation. This model centers on user needs decomposition and builds a bidirectional cognitive analysis framework of "functional attributes—user perception," enabling scientific classification and prioritization of user needs ^[8]. The core viewpoint of the model points out that the relationship between various functional attributes of a product or service and user satisfaction is not simply linear; different functions have significant differences in their impact on user satisfaction, and not all features have a positive effect on improving satisfaction ^[9]. Based on this core theory, the model divides the various types of needs that affect user satisfaction into five major categories, specifically including: Must-be Requirement (M), Attractive Requirement (A: Attractive Requirement), Expectation Requirement (O: One-dimensional Requirement), and Indifference Requirement (I). Requirement and reverse requirement (R)^[10].

The Kano model is supported by user survey data, integrating multiple dimensions such as user motivation and service expectations, and has broad application value and practical foundation in academic research. The Kano model, originating from quality management

systems, has gradually been introduced into elderly care service research within this context, establishing a standardized analytical framework for the scientific analysis of elderly service needs. Zhang Wenhan et al. (2024) conducted a special study on the demand for smart health and elderly care services in Urumqi based on the Kano model. The results show that "emergency assistance" services are classified as essential needs that need to be prioritized, while services like "accompanying medical visits" and "remote consultations" are classified as attractive needs that can significantly enhance user satisfaction^[11]. Such research fully confirms the applicability and effectiveness of the Kano model in identifying and classifying elderly service needs. Cui Zixi et al. (2025) further explored the implementation path of Kano model analysis results in the design of elderly home medical service systems, fully presenting the practical process from requirement identification to functional iterative optimization^[12]. In addition, scholars in fields such as economics^[13] and medicine^[14] also commonly use this model to assess user needs and address practical development issues across various industries.

In summary, the Kano model has been widely adopted across multiple disciplines and has become a common analytical tool for user needs mining, satisfaction evaluation, and related research^[15]. Based on this, the Kano model is used to sort out user needs for age-friendly renovations of smart elderly care service platforms, completing need classification and prioritization, precisely extracting the pain points, interests, and core concerns of elderly users when using the platform. At the same time, the Better-Worse coefficient analysis method and hybrid analysis methods are supplemented and optimized to supplement and optimize the research results^[16], effectively promoting the improvement of the quality of age-friendly renovations on smart elderly care service platforms. Effectively meet the core usage needs of the elderly, providing strong support for the long-term and sustainable development of the platform's age-friendly construction.

Research Design

(1) Determination of user demand attributes for elderly adaptation of smart elderly care service platforms

Users are the core judging of the effectiveness and application value of smart elderly care service platform construction. Although various platforms in the market differ in design concepts, service forms, and functional positioning, the core of all platform construction must fundamentally meet users' actual needs. To ensure that this demand attribute survey is comprehensive, scientific, and precise, this study screens and identifies the key demand attributes for the elderly adaptation of smart elderly care service platforms through the following three core steps.

- 1) Clarify initial demand attributes based on literature review. It systematically reviews and integrates research findings on domestic and international smart elderly care service platform construction, age-friendly design guidelines, and digital usage behavior characteristics of elderly groups, focusing on three dimensions: usage barriers, functional expectations, and emotional demands, identifying a total of 35 demand attributes highly related to platform age-friendly renovations.
- 2) Use user interviews to verify and refine the required attributes. This study selected 12 elderly users as interview subjects, among whom 6 had at least 2 years of experience using the smart elderly care service platform, and the other 6 had at least 1 year of experience using the elderly-friendly version of the platform. Semi-structured in-depth interviews focused on two main questions: first, which functions are convenient to operate and which are inconvenient during platform use; Second, besides existing functions, what age-friendly designs are added or optimized on the platform. Based on interview feedback, four new renovation needs were added: fraud prevention and risk alerts, one-click help functionality, screen reading function, and appointment registration assistance. At the same time, three requirements were removed: special zone demonstration, smart wallet management, and health status monitoring, ultimately confirming 36 core items for elderly-friendly renovations.
- 3) After a series of studies, the above 36 specific renovation items were streamlined, categorized, and fully refined, ultimately determining 5 categories to include a total of 27 renovation items, as shown in Table 1.

Table 1
Summary of content attributes for elderly adaptation renovations on smart elderly care service platforms

Category	Attributes	Meaning	Attribute sources
Interface Display	1. Adjust font size	Font size can be freely adjusted according to the vision of elderly users	References [17]
	2. Adjust icon size	The function icon size is enlarged, making it easier for elderly users to quickly identify and click it, reducing the chance of accidental touches	References [17]
	3. Streamlined interface framework	The interface layout eliminates redundancy, highlights core functions, and reduces information interference	References [17]
	4. Adjust color recognizability	It uses high-saturation and strong contrast color combinations to enhance text recognition	References [18]
	5. Clear and easy-to-understand language expression	Replacing technical terms with colloquial language, such as changing "remote assistance" to "find someone to help"	References [18]
Easy Setup	6. Real-time guidance function	Real-time step-by-step instructions pop up during the operation process to assist elderly users in completing the process	References [19]
	7. On-screen reading function	Provides on-screen text and voice reading to solve visual reading difficulties	References [20]
	8. Reading and reading of words and sentences	Click on unfamiliar words and sentences to look up their meanings, helping elderly users understand complex information	References [21]
	9. Auxiliary input and output	Supports voice input and large icon tap input	References [15]
	10. Operational vibration feedback	Haptic feedback is provided through phone vibration during successful or failed operations, enhancing the sense of operation confirmation	References [20]
	11. Reduce ad pop-ups	Limit unnecessary ad pushes and eliminate pop-ups from obstructing core functions	References [22]
Safety Monitoring	12. Emergency contact linkage	Set emergency contacts to automatically notify in case of abnormalities	Interview findings
	13. Fraud prevention and risk warnings	Risk warnings and blocking recommendations for suspicious links, payment behaviors, and unfamiliar calls	References [23]
	14. Secure binding between device and account	Supports binding with smart wristbands, fall detectors, and other devices to achieve multi-terminal security linkage and protection	References [24]
	15. Basic offline functions are available	When the network is unstable, core functions such as emergency calls and local information viewing remain available	Interview findings
	16. One-click help function	A prominent help button function is set up on any interface	Interview findings
Health Services	17. Health data visualization reporting	Physical indicator data is presented in intuitive form such as charts, along with brief interpretations	References [25]
	18. Intelligent medication reminders	Supports scanning to add medications, with scheduled voice + pop-up reminders	Interview findings
	19. Emergency Green Channel	In emergencies, after one-click calls, the platform can simultaneously push a summary of the user's health record to the emergency center	Interview findings
	20. Appointment registration assistance	Integrate mainstream hospital sampling sources, offering "one-click registration" or "child-referral appointment" functions	References [15]
	21. Chronic disease management plan	Personalized monitoring and management recommendations for common chronic diseases are provided	References [15]

Category	Attributes	Meaning	Attribute sources
Emotional Care	22. Interest Groups and Activities	Based on location and interests, nearby senior classes and cultural and sports activities are recommended	Interview findings
	23. Intelligent voice companionship	Integrated AI voice assistant for daily chats, news broadcasts, and weather reminders	Interview findings
	24. Offline service docking	Integrate local life services such as housekeeping and meal delivery, enabling one-click reservations within the platform	Interview findings
	25. Digital Feedback Tutorial	Embedded "Mobile Phone Mini Classroom" videos teach commonly used functions in short video format	Interview findings
	26. Interaction space with friends and family	It offers family photo sharing and convenient video calls, among other family interaction features	References [26]
	27. Personalized content recommendations	Intelligently recommends related health consultations, entertainment content, and senior-friendly products based on user habits	Interview findings

(2) Questionnaire Design Based on the Kano Model

The core target audience for the elderly-friendly version of the smart elderly care service platform is the elderly group. Based on this characteristic, this study sets the elderly group as the main survey subjects to obtain their usage evaluations and feedback on the platform's age-friendly version.

After drafting a preliminary questionnaire based on the above established attributes, this study further invited five elderly users to conduct questionnaire testing and verify its rationality, then revised the items based on feedback and modified complex and difficult sentences, ultimately generating the official questionnaire. The formal questionnaire consists of two parts: the first part covers demographic variables, including age, gender, and whether they have used relevant smart elderly care service platforms; The second part is the matrix scale section, which is the main body of the questionnaire. It is divided into 5 categories with a total of 27 questions: interface settings (5 questions), convenience operations (6 questions), safety assurance (5 questions), health services (5 questions), and emotional care (6 questions). Each attribute is asked both positively and negatively, specifically the user's attitude when a function (service) exists (provided) versus does not (does not provide). All scale items are designed using the Likert five-scale scale, namely "Very like," "Right," "Doesn't matter," "Reluctantly accept," and "Dislike" to help users make intuitive judgments and choices based on their feelings. Some questionnaires are shown in Table 2.

Table 2
.Sample Kano Questionnaire for Elderly Adaptation of Smart Elderly Care Service Platform

Title	I really like it	As is expected	It doesn't matter	Reluctantly accepted	I really don't like it
If this feature exists, you think:					
If this feature is not available, you feel:					

(3) Kano questionnaire collection

The questionnaire was preliminarily designed based on the Wenjuanxing platform. The survey participants were elderly users within and around the community who have used smart elderly care service platforms. The survey combined online distribution with offline submission, supplemented by paper questionnaires for data collection. The questionnaire distribution period is from January 16 to February 16, 2026, with a total of 337 questionnaires collected, including 217 collected online and 120 offline. Subsequently, all collected questionnaires were preliminarily sorted and screened, removing 43 invalid questionnaires with highly consistent options and obvious logical contradictions in answers, resulting in 294 valid questionnaires with a valid response rate of 87.24%. The basic details of effective research samples are shown in Table 3.

Table 3
Basic Information Statistics of the Survey Sample

Statistical items	Options	Sample	Proportion (%)
Gender	Male	137	46.60
	Female	157	53.40
Age	60 ~ 65 years old	108	36.73
	66 ~ 70 years old	97	32.99
	Ages 71 ~ 79	76	25.86
	80 years old and above	13	4.42
Elderly care with wisdom	1 year or less	104	35.37
How long have the service platforms been around?	2 ~ 3 years	117	39.80
	4 ~ 5 years	52	17.69
	5 years or more	21	7.14
They've come into contact with it before	Ankang Tong	94	31.97
Smart elderly care services	Jiuru City	87	29.59
Platform	Xiamen Zhiyu	67	22.79
	Chunxi Hall, Hangzhou	72	24.49
	Yinling World	68	23.13
	Others	43	14.62

From Table 3, it can be seen that in terms of gender, the gender ratio is relatively balanced, but the proportion of females is slightly higher than that of males; In terms of age, users aged 60–70 account for a high proportion, reaching 70%; In terms of user experience and usage of smart elderly care service platforms, 75% of users have used the platform for less than three years, and 25% have used it for more than three years. Among various smart elderly care service platforms, Ankangtong and Jiuru City are the platforms most frequently accessed by elderly users. In summary, the distribution of respondents in terms of gender, age, and usage experience is relatively even, and all survey subjects are elderly users, which fully matches the main research content of this study. Therefore, this statistical data is somewhat representative.

(4) Kano Questionnaire Reliability and Validity Test

This study utilized SPSS 27 data analysis software to conduct reliability and validity tests on survey questionnaire data. Specific test results are shown in Table 4. From the data in the table, it can be seen that the Clonbach Alpha coefficients corresponding to the Kano questionnaire, positive and negative items, all met the established standards, fully demonstrating that this survey questionnaire has qualified internal consistency reliability. At the same time, KMO test values for all dimensions were above 0.8, and the significance probability of Bartlett's sphericity test was 0.000, indicating excellent structural validity of the questionnaire. Based on the above test results, it can be concluded that the reliability and validity of the Kano questionnaire used in this study comply with academic research standards. The collected data have high reliability and authenticity, meeting the analytical needs of subsequent studies and being suitable for further empirical research.

Table 4
Kano questionnaire reliability and validity test

Indicators/Questions	Klonbach Alpha	KMO value	Bartlett Sphericity inspection	Number of survey items
Kano questionnaire	0.763	0.812	0.000	54
Positive questions	0.725	0.807	0.000	27
Reverse question	0.736	0.811	0.000	27

Data Analysis

(1) Kano Hierarchical Analysis of User Needs for the Elderly Version of Smart Elderly Care Service Platforms

Kurt M et al. [8] proposed that to carry out the need hierarchy identification work for the Kano model, three types of statistical tools should be integrated: the Kano questionnaire, the model positioning comparison table, and the result analysis table. Based on collected and organized Kano questionnaire survey data, this study takes the lead in systematically categorizing elderly users' needs using the Kano model. At the same time, it combines the Kano model's positioning comparison table to compare and evaluate the core functional modules of the smart elderly care service platform's elderly-friendly transformation. The specific analysis results are shown in Table 5. Based on the above analysis, further statistical and sorting of various functional attributes were carried out, ultimately integrating them into the Kano result analysis table, with detailed content shown in Table 6.

Table 5
Kano model positioning comparison table

		Reverse question				
		Likes (5)	Entitled (4)	Doesn't matter (3)	Reluctantly accept (2)	Dislike (1)
Positive question	Likes (5)	Q	A	A	A	O
	Entitled (4)	R	I	I	I	M
	Doesn't matter (3)	R	I	I	I	M
	Reluctantly accept (2)	R	I	I	I	M
	Dislike (1)	R	R	R	R	Q

Table 6
.Kano Result Analysis Table

Kano category	Content
M (Essential Traits)	1. Adjust font size 2. Adjust icon size 3. Streamline interface framework 11. Reduce ad pop-ups 12. Emergency contact linkage 13. Anti-fraud and risk alerts 16. One-click help function 19. Emergency green channel
O (Expected Characteristics)	5. Language expression is simple and easy to understand 6. Real-time guidance function 9. Assisted input and output 14. Secure device and account binding 20. Appointment and registration assistance 24. Offline service coordination 26. Interaction space with friends and family
A (Charisma Traits)	7. On-screen reading function 17. Health data visualization reports 18. Intelligent medication reminders 21. Chronic disease management plan 23. Intelligent voice companionship
I (Indifference Characteristic)	4. Adjust color recognition 8. Reading and reading words and sentences 10. Operational vibration feedback 15. Basic offline functions available 22. Interest Communities and Activities 25. Digital Feedback Tutorials 27. Personalized Content Recommendations

The functions required by users of smart elderly care service platform for age-friendly transformation can be categorized into four types: essential, expectant, attractive, and non-differentiated. Essential features include adjusting font size, adjusting icon size, streamlining interface framework, emergency contact linkage, reducing ad pop-ups, fraud prevention and risk alerts, one-click help and emergency green channels—eight functions. Users regard these needs as essential core elements for products or services. Improvements in supply usually do not lead to significant satisfaction growth, but once supply is lacking, it can directly cause a sharp drop in user satisfaction. The expectation features include seven types: clear and understandable language, real-time guidance, auxiliary input and output, secure device and account binding, appointment and registration assistance, offline service integration, and interaction spaces with friends and family. Users want these features to be proactively provided, and whether these features are provided directly affects user satisfaction; The Charm features are relatively few, including screen reading aloud, health data visualization reports, intelligent medication reminders, chronic disease management plans, and intelligent voice companionship—five functions. These features are highly attractive to users; when these functions are provided, user satisfaction increases significantly, but not providing them does not reduce user satisfaction; There are seven indifference features, including color recognition adjustment,

word-to-click reading and reading, operational vibration feedback, offline basic functions, interest communities and events, digital feedback tutorials, and personalized content recommendations. Whether or not these features are provided, they do not directly affect user satisfaction. However, in the long run, non-differentiated functions have the potential to transform into charm-type features, so these types of features should not be completely ignored.

Overall, among all functions, four categories each account for a certain proportion, and both essential and desired functions have relatively rich content. This is likely because all survey respondents have experience using smart elderly care service platforms, and a certain proportion of users have long-term experience. They have their own experiences and insights about these platforms, allowing them to objectively organize these features based on their own needs.

(2) Analysis of Mixed User Demands

Relying solely on the traditional Kano model, functional demand levels can only be divided based on the frequency of requirement attributes. However, if the frequency values of the two attributes differ little, segmentation becomes difficult, making it difficult to achieve fine-grained segmentation of requirement categories^[27]. To more accurately reveal the intrinsic relationship between each demand attribute and user satisfaction, this study introduced scholars such as Lee M^[28]. The proposed hybrid class analysis method conducts secondary validation and correction of the classification results of the traditional Kano model, with the core goal of accurately identifying requirements with mixed attribute characteristics. This method mainly determines the value through two quantification indicators: Total Strength (TS) and Category Strength (CS): if a certain requirement attribute does not have a dominant category, it is classified as a mixed category; When the category strength CS does not reach the threshold, the attribute is also classified as a mixed category, and the total strength TS serves as the core criterion for determining its final category. The calculation formula is as follows:

$$TS = \frac{M + O + A}{M + O + A + I + R + Q}$$

1

$$CS = \frac{[\max (M, O, A, I, R, Q) - \text{secondmax} (M, O, A, I, R, Q)]}{M + O + A + I + R + Q}$$

2

Table 7

Overall classification results of Kano for age-friendly modification content on smart elderly care service platforms

Attributes	A	O	M	I	R	Q	Kano category	TS value	CS value	Mixed categories	Better coefficient	Worse coefficient
1. Adjust font size	35	65	130	68	2	0	M	0.7667	0.2067	M	0.3356	-0.6544
2. Adjust icon size	38	62	128	70	2	0	M	0.7600	0.1933	M	0.3356	-0.6376
3. Streamlined interface framework	40	60	126	72	2	0	M	0.7533	0.1800	M	0.3356	-0.6242
4. Adjust color recognizability	54	48	73	117	2	1	I	0.5932	0.1492	I	0.3493	-0.4142
5. Clear and easy-to-understand language expression	45	115	40	95	5	0	O	0.6667	0.0667	O	0.5424	-0.5850
6. Real-time guidance function	42	124	38	91	4	0	O	0.6823	0.1104	O	0.5627	-0.5492
7. On-screen reading function	122	26	15	119	4	0	A	0.5700	0.0105	A	0.5248	-0.1454
8. Reading and reading of words and sentences	73	65	23	131	3	1	I	0.5439	0.1959	I	0.4726	-0.3014
9. Auxiliary input and output	57	108	47	75	1	1	O	0.7336	0.1142	O	0.5749	-0.5401
10. Operational vibration feedback	53	50	74	116	2	0	I	0.6000	0.1424	I	0.3515	-0.4232
11. Reduce ad pop-ups	15	70	133	70	1	1	M	0.7517	0.2172	M	0.2951	-0.7049
12. Emergency contact linkage	14	78	129	66	1	0	M	0.7674	0.1771	M	0.3206	-0.7213
13. Fraud prevention and risk warnings	15	66	137	71	1	1	M	0.2803	0.0069	M	0.2803	-0.7024
14. Secure binding between device and account	49	97	86	60	3	0	O	0.5000	0.0103	O	0.5000	-0.6267
15. Basic offline functions are available	71	73	42	111	3	1	I	0.4848	0.0137	I	0.4848	-0.3872
16. One-click help function	25	90	133	51	1	0	M	0.3846	0.0034	M	0.3846	-0.7458
17. Health data visualization reporting	116	50	26	103	2	1	A	0.5627	0.0103	A	0.5627	-0.2576
18. Intelligent medication reminders	122	60	27	81	2	0	A	0.6276	0.0069	H(A,O)	0.6276	-0.3000
19. Emergency Green Channel	43	99	101	62	3	0	M	0.4656	0.0103	M	0.4656	-0.6557
20. Appointment registration assistance	53	111	44	72	2	1	O	0.5857	0.0103	O	0.5857	-0.5536

Attributes	A	O	M	I	R	Q	Kano category	TS value	CS value	Mixed categories	Better coefficient	Worse coefficient
21. Chronic disease management plan	122	63	31	79	2	1	A	0.6271	0.0103	H(A,O)	0.6271	-0.3186
22. Interest Groups and Activities	50	41	55	146	1	1	I	0.3116	0.0069	I	0.3116	-0.3288
23. Intelligent voice companionship	125	27	17	66	4	0	A	0.6468	0.0137	H(A,I)	0.6468	-0.1872
24. Offline service docking	63	113	36	81	3	0	O	0.6007	0.0103	H(O,A)	0.6007	-0.5085
25. Digital Feedback Tutorial	83	46	63	146	2	1	I	0.3817	0.0103	I	0.3817	-0.3225
26. Interaction space with friends and family	63	121	27	82	4	0	O	0.6280	0.0137	H(O,A)	0.6280	-0.5051
27. Personalized content recommendations	44	47	33	143	2	0	I	0.3408	0.0069	I	0.3408	-0.2996

The TS value represents the improvement in user satisfaction for a particular feature in the smart elderly care service platform's elderly adaptation

The CS value reflects how much users recognize the current Kano category of a feature.

When the TS value $\geq 60\%$ and the CS value $\leq 6\%$, the attribute is classified as a mixed category. The results of the traditional Kano classification and the analysis results after mixed class optimization are shown in Table 7.

As shown in Table 7, after mixed class optimization analysis, the category of some requirement attributes will change. Medication intelligent reminders, chronic disease management plans, offline service integration, and interaction spaces with friends and family have shifted to a hybrid of expectation needs (O) and charm needs (A), indicating that users expect this feature to be both stable and user-friendly, while also providing greater convenience than expected—this is the core direction for enhancing product competitiveness. The shift of intelligent voice companionship into a hybrid category of charm-type needs (A) and indifference needs (I) indicates that their charm characteristics are not very prominent and should be optimized and improved.

(3) User Demand Better-Worse Coefficient Analysis

The above methods using traditional Kano models and mixed class analysis methods to confirm demand types are based solely on calculating the frequency of each demand and combining their proportions to classify categories [29], which still has certain limitations in classifying some demand attribute categories. In summary, based on the above model, the Better-Worse user satisfaction index method proposed by Berger C et al. [30] is used to analyze the impact of various functions of elderly adaptation on smart elderly care service platform renovations on user satisfaction. By judging changes in user satisfaction after adding or removing a feature, the key points and sequence of age-friendly renovations can be determined. The Better coefficient value is greater than 0 under normal conditions; the closer this value is to 1, the higher the user satisfaction after the feature is provided. The Worse coefficient is usually less than 0; the closer this value is to -1, the lower the user satisfaction when the feature is not provided. The calculation formulas for both are as follows:

$$\text{Better} = \frac{O + A}{M + O + A + I}$$

3

$$\text{Worse} = \frac{M + O}{M + O + A + I} \times (-1)$$

The Better and Worse coefficients for each requirement attribute are calculated according to the above formulas. The results are shown in Table 7. The average value of the Better weighting coefficient is 0.46, and the absolute average value of the Worse weighted coefficient is 0.48. To more intuitively present the distribution of each attribute, the Better coefficient is used as the horizontal axis, the absolute value of the Worse coefficient as the vertical axis, and the average of the two coefficients (0.46, 0.48) as the origin. Using Excel software tools, a four-quadrant Better-Worse coefficient diagram is constructed, as shown in Fig. 1.

In the first quadrant, the absolute values of Better and Worse user demand attributes are both higher than the average, proving that the demand for these features is linearly correlated with user satisfaction. They are priority items for age-friendly upgrades and can significantly improve or reduce user dissatisfaction. These include: secure device and account binding, easy-to-understand language expression, appointment registration assistance, real-time guidance functions, assisted input and output, and integration between family and friend interaction spaces with offline services. These seven items are the highest priority in four quadrants and all show high expectations, greatly impacting user satisfaction. In summary, developers should focus on these seven aspects to improve the age-friendly renovation level of smart elderly care service platforms.

In the second quadrant, the Better value of user demand attributes is below average, and the absolute value of Worse is above average, indicating that providing such features has a small effect on improving user satisfaction but helps reduce dissatisfaction. It includes seven items: one-click help function, emergency contact linkage, reduced ad pop-ups, anti-fraud and risk alerts, font and size adjustment, icon size adjustment, and streamlined interface framework. This category is an essential requirement and an indispensable part of the elderly-friendly transformation of smart elderly care service platforms. Companies should provide these to prevent user dissatisfaction. The emergency green channel is located at the junction of the first and second quadrants, and enterprises should not overlook the role of this function and should pay close attention.

In the third quadrant, the absolute values of Better and Worse for user demand attributes were both below the average, indicating that the availability of these features had no significant impact on changes in user satisfaction or dissatisfaction. The content included operational vibration feedback, color recognition adjustment, interest communities and activities, digital feedback tutorials, and personalized content recommendations. These functional needs exhibit both non-differentiated and low-appeal features, making them functions that can be temporarily considered in platform age-friendly upgrades, but they can also stimulate the conversion of these needs to a higher level of demand, thereby improving user experience.

In the fourth quadrant, the Better value of user demand attributes is higher than average, but the absolute value of Worse is below average, indicating that whether such functions are provided can greatly affect user satisfaction but have little effect on reducing user dissatisfaction. This includes seven items: offline basic functions available, phrase reading and reading, screen reading function, health data visualization report, chronic disease management plan, intelligent medication reminders, and intelligent voice companionship. These functional requirements exhibit attractive characteristics and are distinctive features of the platform's age-friendly transformation, maximizing user appeal and thereby increasing user loyalty. Therefore, developers should also value providing these needs to improve user satisfaction.

Insights and Strategies

Differences in content for age-friendly upgrades on smart elderly care service platforms can have varying impacts on user satisfaction. In summary, the three types of analysis methods show that users' content needs for age-friendly renovations on smart elderly care service platforms can be divided into four categories: essential, expectant, charming, and indiscriminate. Developers should determine the priority of age-friendly renovation content based on the order of $M > O > A > I$ ^[30], and optimize the functions and services of the smart elderly care service platform's age-friendly renovation. Based on the above results, this study proposes the following specific strategies.

(1) Directly addressing users' core demands to ensure effective supply of essential demands

This study identified eight essential functional requirements: adjusting font size, adjusting icon size, streamlining interface framework, reducing ad pop-ups, emergency contact linkage, fraud prevention and risk alerts, one-click help function, and emergency green channel. Essential needs are a pain point for users ^[31], and are a category of essential needs in the elderly-friendly transformation of smart elderly care service platforms. Companies should improve and optimize these needs during development to meet users' basic needs.

According to the Better-Worse coefficient analysis: first, the absolute values of Worse for one-click help, emergency contact linkage, reduced ad pop-ups, and anti-fraud and risk alerts are relatively high, proving these four functions are key factors causing low user satisfaction. The abundance of ad pop-ups that are difficult to close is a problem that most elderly people find difficult to solve, and many ads are highly induced, causing elderly users to be frequently influenced and redirected to other consumption traps. To address such issues, platforms should prohibit the insertion of ad pop-ups or display obvious closure marks to guide elderly users to close them, and promptly display risk warnings if users accidentally redirect to pages, optimizing the platform's privacy and protection, and building a safe and trustworthy platform environment to minimize user risks. Second, elderly users pay close attention to the interface design of smart elderly care service platforms. The platform should adjust the font size and icon size of the elderly-friendly version to meet their sensory needs and satisfy their visual needs. Additionally, the platform's interface design should not be too complex; each section should be simplified, with a focus on core functions to facilitate information access for the elderly. Finally, the platform can simplify user operations based on user needs to encourage continued use, and set up emergency contact linkage features to help users seek help from friends and family in a timely manner.

(2) Clarify user wishes and needs to improve the quality of expected content

This study identified seven desired function requirements: clear and understandable language expression, real-time guidance functions, auxiliary input and output, secure device and account binding, appointment registration assistance, offline service integration, and interaction spaces with friends and family. Expectation-driven needs are the focus of users and a key project for the elderly-friendly transformation of smart elderly care service platforms. Companies can focus on enhancing these functions to meet user needs, thereby improving their competitiveness and increasing user satisfaction.

According to the Better-Worse coefficient analysis: the absolute value of Worse for device-account security binding and clear language expression is relatively high, indicating that these two types of features have a significant impact on user dissatisfaction. Therefore, the platform should improve precise matching and binding of device-account security to ensure the information security of user devices, increase user trust in the platform, and further screen and evaluate language within the platform. Adjusting and optimizing or providing annotations for words that are difficult to understand or overly complex to make it easier for elderly users to access information more directly and meet their needs. The Better value of interaction spaces with friends and family and offline services is relatively high. If these functional needs are met, it will greatly enhance user satisfaction. The platform can create personalized interaction spaces based on users' contacts, open online communication channels among family and friends, and promptly notify users of updates through message prompts, providing emotional support to meet users' emotional needs. Providing offline service integration functions makes it easy for elderly users with mobility difficulties or urgent needs to resolve issues quickly and promptly, greatly meeting users' various offline service needs. Additionally, real-time guidance, input and output assistance, and appointment registration assistance are all features users expect. Companies should actively develop real-time guidance features to assist users, such as homepage signage guidance, voice operation prompts, or AI assistant assistance to enhance user experience. Appointment registration assistance greatly simplifies the process for elderly users to visit hospitals for check-ups or medical treatment, and timely feedback can improve users' sense of gain.

(3) Identify users' latent needs and expand attractive functional content

Five features are attractive, including screen reading aloud, health data visualization reports, intelligent medication reminders, chronic disease management plans, and intelligent voice companionship. Attractive needs are where users are interested and can bring surprises to users in the elderly-friendly transformation of smart elderly care service platforms. Platforms can leverage these features to enhance user satisfaction by leveraging the features of the elderly version.

According to the Better-Worse coefficient analysis: intelligent voice companionship is a highly attractive feature that can highlight the platform's features for the elderly version. Enterprises can independently develop AI projects, using large AI intelligent voice functions to answer and meet various user questions or needs. In the use of intelligent voice companionship features, AI can help enhance various cognitive skills and strengthen the emotional connection between users and the platform. Chronic disease management plans and intelligent medication reminders showed higher Better value in these two types of needs. In today's information age, users no longer need to manually input text; they can directly input their initial files via voice input, generating initial files, and the system will automatically generate recommendations and management plans based on the data for users to choose from. This feature reduces users' cognitive burden, establishes a family linkage management mechanism, and better supervises plan execution. The intelligent medication reminder function allows users to scan the barcode on the medicine box with their phone; the system automatically recognizes and reminds them on time, making daily management easier and reducing their burden. Additionally, the screen reading

function greatly reduces cognitive load and eye fatigue for elderly users, boosts their confidence in independent operation, and alleviates anxiety among the elderly when facing digital products. Health data visualization reports can automatically integrate and analyze users' health data, transforming dull and professional health data into intuitive and easy-to-understand charts, helping elderly users understand their own health status, enhance their health awareness, and assist the elderly in self-health management.

(4) Dynamically analyze platform scenarios and optimize the non-differentiated demand function

This study identified seven non-differentiated required functions, including adjusting color recognition, reading and reading of words and sentences, vibration feedback during operation, availability of basic offline functions, interest communities and activities, digital feedback tutorials, and personalized content recommendations. Non-differentiated needs do not significantly change user satisfaction, but in the future, they may shift toward attractive, expectant, and essential functional needs^[32]. Therefore, these features cannot be completely ignored; platforms can flexibly adjust them based on user needs or combine them with other categories of features to enhance user performance.

The offline basic function usability and word-sentence reading content attributes have higher Better values, reflecting a trend toward charm-oriented demand functions in the Better-Worse four-quadrant chart, proving these two content areas have their advantages and unique appeal to users. Enterprises can combine offline basic functions with one-click help functions to build user sense of security, trust, and service reliability. Word-to-read reading can be integrated with health data visualization reports, turning an auxiliary feature into a key tool that deeply empowers users and builds the role of a "trusted health information partner." Adjusting color recognition is relatively inexpensive and can be flexibly adjusted according to user needs. Operation vibration feedback can provide feedback to users after key actions such as one-click help are completed, but it should be disabled during routine operations to avoid frequent vibration disturbances affecting users. Interest groups, events, and personalized content recommendations can be integrated with the interactive features of friends and family to form a more comprehensive community space, making it easy to provide personalized services for different users and enhancing user satisfaction and happiness. For digital feedback tutorials, users have not yet needed them, but with the ongoing informatization of the future era, users' needs for this feature may become more noticed.

Conclusion

Based on a systematic review and integration of user needs related to age-friendly renovations of smart elderly care service platforms, this study comprehensively applies methods such as the Kano model, mixed category analysis, and Better-Worse coefficient analysis to scientifically classify the 27 user needs and functions summarized. The study aims to clarify the priorities of age-friendly renovation content for smart elderly care service platforms and propose targeted renovation strategies based on four types of demand characteristics, thereby providing theoretical support for layered and focused age-friendly renovations of such platforms. This move not only helps improve the alignment between the elderly-friendly platform and the actual needs of elderly users, increasing user satisfaction, but also promotes the overall improvement of the renovation level, helping the elderly better integrate into modern digital society and bridge the digital divide.

However, this study still has several notable limitations that constrain the generalizability of its findings. First, the survey sample was only recruited from urban elderly users with prior experience of smart elderly care platforms in limited regions, excluding rural older adults and seniors who have never used digital elderly care services. Respondents are predominantly aged 60–70, while those over 80 account for merely 4.42% of the total sample. Such uneven sample distribution may produce biased demand characteristics and cannot fully reflect diverse digital needs of the elderly across the whole country.

Second, this research adopts only cross-sectional questionnaire data to capture static demand perceptions, without longitudinal tracking data to track changes in functional demands as elderly users use the platform over extended periods. Moreover, all measurements depend on subjective self-reported satisfaction, which may be subject to social desirability bias and fail to reflect objective real operational behaviors.

Third, we only extracted 27 functional attributes for integrated smart elderly care platforms and did not further separate scenarios including home-based elder care, community senior services and institutional nursing. Specialized platforms for single elderly care scenarios may form distinct demand hierarchies, which are not explored in this paper.

Fourth, the study only carries out static demand classification via the Kano model and Better-Worse coefficient, and lacks practical intervention experiments to verify whether the four-stage optimization framework proposed can effectively lift user satisfaction in real operational environments.

For subsequent research, scholars can expand sample coverage to rural areas and digitally inexperienced elderly groups, launch long-term follow-up surveys, subdivide various smart elderly care scenarios, and conduct practical tests to validate and optimize the demand optimization path proposed in this paper. This study enriches the application of the Kano model in age-friendly smart elderly care research and provides a systematic framework for identifying and classifying elderly user needs. The findings can help platform developers, service providers, and policymakers optimize age-friendly retrofits, improve long-term care services, and promote digital inclusion for older adults.

Declarations

ETHICAL APPROVAL

This questionnaire-based survey study was granted an ethical exemption by the research ethics review of Fujian Normal University. All procedures carried out in this research were performed in accordance with the relevant ethical guidelines for social science survey research.

INFORMED CONSENT

Prior to questionnaire distribution, the research purpose, content and anonymous data usage were fully explained to all participants. Implied informed consent was obtained when participants voluntarily completed and submitted the anonymous online questionnaire. No identifying personal information was collected in this study.

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Figures

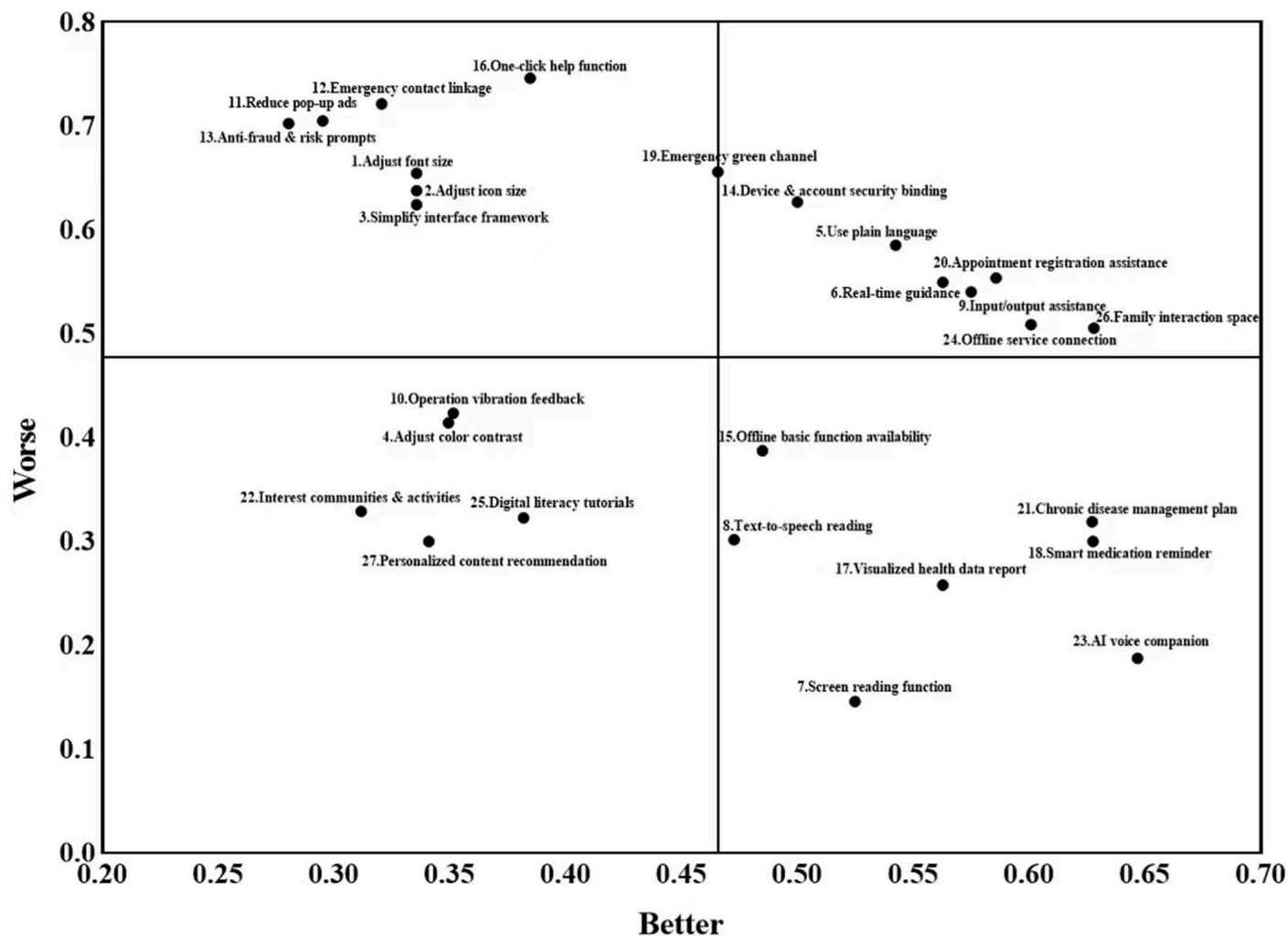


Figure 1

Four-quadrant distribution of Better-Worse coefficient values for each attribute

Supplementary Files

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- [Questionnaire.docx](#)