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Study on the Service Convenience of Aging-Friendly Health Management Platform Based on KANO

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Abstract: *Given the world's accelerating rate of aging, age-friendly design for senior citizens has emerged as a key area of focus for design advancement. The purpose of this study is to apply the KANO and service convenience models to examine the needs of users about the use of health management platforms. Through questionnaire research, the study gathers 143 reliable data points, which are then thoroughly analyzed in four dimensions: benefit, post-benefit, access, and transaction. The results show that users consider emergency support, health behavior improvement, and health ins benefit, post-benefit, access, and transaction. The results show that users consider emergency support, health behavior improvement, and health insurance and claims to be the basic functional needs of health management platforms, and have higher expectations for membership reduction policies, mental health support, and health file establishment; the improvement of health data monitoring, information security and privacy protection, and expert consulting services will significantly enhance user satisfaction. The study provides a scientific basis and practical suggestions for the development strategy and optimization strategy of the future aging health management platform.*

Keywords: *Kano model; Age-friendly design; Service accessibility; Health information management platform; Service strategy*

1. Introduction

1.1 Research background

According to the World Social Report 2023 published by the United Nations, the world population has reached 8 billion, and the global population aged 65 and over is 761 million and is expected to more than double by the middle of this century, of which 217 million are aged 65 and over in China [1]. Although the age structure of the population and the rate of deterioration vary among countries around the world[2], the rapid expansion of the aging population base has become a major concern for countries around the world [3]. In China, where the social security system and local healthcare services have not yet been fully developed[4], the aging population in developing countries will have to bear greater economic pressure and physical burden than that of the aging population in developed countries[5].To achieve sustainable future development and provide economic support and policy security for the population, it is important to prioritize the rights and well-being of older people and to improve the overall well-being of older people in a rapidly evolving society through improved healthcare systems and digital public service platforms[6].

1.2 Purpose

Leonard L. Berry defines the service convenience model using five types: beneficence, post-beneficence, accessibility, transactionality, and reachability as a way to reflect the activities consumers experience when shopping for or using a service[7]. Based on the KANO model and the service convenience model, this study will take the four types of product and service quality characteristics, namely, Must-be Quality(M), One-dimensional Quality(O), Attractive Quality(A), and Indifferent Quality(I) as the criteria, and analyze the needs and concerns of users' usage data to clarify the development direction of the digital public service platform for aging health and provide guidance for targeted decision-making, to help the aging service better grasp the needs of the users and enhance the satisfaction and convenience of usage, to provide a better solution for the aging service. This will help the aging service to better grasp user needs, improve user satisfaction and operational convenience, and provide references and suggestions for the development of similar products.

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1.3 Research significance

Due to the developmental characteristics of the elderly, there are problems such as high disease rates, poor information reception, low social integration, etc. From an individual point of view, due to the deterioration of body functions and immunity decline often accompanied by chronic non-communicable diseases, the demand for the number of visits to the clinic, the number of medications, implantable treatments, and long-term companionship is significantly higher compared with that of young people[8]. In addition, the level of learning new things and cognitive information of the elderly is in the stage of degradation[3], when the service platform process is not concise, visual clarity and service is not timely, it will greatly increase the difficulty of the elderly operation and learning costs. From the medical point of view, the elderly population base is huge, for the complicated information data and management system, the society and the organization have a strong demand for digital public services of the intelligent digital medical system. From the service system, it is necessary to analyze the development of digital public services for the elderly group and the formation mechanism after considering various factors [1], to create a more inclusive age-friendly social atmosphere.

2. Literature review

2.1 Overview of the KANO model

The analysis of information on basic user needs is an important task in the first part of the product design process, and the results of the analysis can directly give clear and accurate specific needs for the subsequent steps[9]. To effectively analyze the impact of user needs on user satisfaction and to reflect on the relationship between product performance and user use, Noriaki Kano et al, a professor at the Tokyo Institute of Technology, proposed an effective tool that can obtain a classification of user needs and prioritization, KANO model consists of questionnaire methodology for surveying user feedback on the functionality provided by a product, system, or service[10]. A nonlinear two-dimensional quality model is utilized to effectively identify user satisfaction attributes[11], through a process of guidance and inquiry in order to find the parts of the product that can satisfy the unspoken latent needs of users[12]. It should be noted that to avoid the influence of external factors on decision-making, the uncertainty of the user's current mood on the data results should be taken into account in the process of designing the KANO questionnaire[13].

2.2 Review of Research on Design for Aging

In the past 10 years, many scholars at home and abroad have conducted research on the psychology of using healthy living communities and digital management platforms for the aging population. Cheng Jiaxuan et al[14] analyzed the physiological functions and psychological emotions of elderly users from the carrier of aging-adapted intelligent recreational equipment and proposed the design elements of equipment that need to satisfy the functional tasks, emotional experience, and meaningful value by using the theory of embodied cognition; Han Xiaohong et al [15] used the decision laboratory analysis method to correlate the factors affecting the use behavior of elderly patients of smart medical services. Decision lab analysis to correlate the factors affecting the use behavior of elderly patients of smart medical services, emphasizing the changes in the medical service system and social support effects to improve the health information literacy of elderly patients and reduce the perceived costs of elderly patients; Hou Bingchen et al [16] established a model of the public space network and the behavioral network of the elderly and proposed the three-point design of unclogging the paths, linkages and enrichment nodes by researching for the research subjects. Gao Xun et al[17] considered the security problems of the elderly in the process of using the Internet, and completed the design study of anti-fraud plus care software with an interactive mechanism that promotes the active participation of the elderly in learning; Leong et al[18] studied the degree of interaction between the elderly and the community and the expression of personal values, and emphasized that the design field should make up for the concern of the elderly in realizing their values. Allegra W. Smith[19] conducted an architectural innovation of user experience design by combining interviews and observation for the elderly group over 60 years old to improve designers' understanding of computer use by the elderly and develop implementation guidance; Fan[20] compared the differences between older and younger populations based on the relationship between thinking out-loud language patterns and user experience, and analyze the impact of their pattern variability on the design of collaborative human-computer user experience

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tools; Phlix et al[21] highlighted the additional need for diversity-sensitive design for older adults in their attempts to create a community of later life that meets the needs of a diverse population; Comincioli et al[22] argued that a first step in achieving the goal of healthy aging is to address the existing language inherent in the language used to address aging issues and to develop guidance for implementation. existing inherent biases and stereotypes in the language used to address the issue, with the expectation that an interdisciplinary discourse of design for aging will eliminate the ageism that exists in the design industry.

2.3 Review of Studies Addressing Ease of Service Delivery

A great deal of attention has been paid to research on the impact of service convenience on consumer spending and behavioral orientation , Chowdhury[23] proposed an extended theory of technology acceptance model and concluded that service convenience and service quality have a significant impact on user attitudes and behavioral intention; Widowati et al[24] found that accessibility has a positive and significant effect on user trust and perceived service quality has a positive effect on repurchase intentions by studying Shopee e-commerce; Sturgeon[25] analyzed consumer-oriented models of healthcare delivery in the United Kingdom and other geographic areas and concluded that convenience of service and quality of care are the main reasons why patients choose healthcare services; Perry et al[26] focused on the barriers to accessing healthcare services for disadvantaged groups in deprived areas, urban transportation and geographic accessibility had a significant impact on hospital attendance; Yi et al[27] focused on the smart service system of Beijing hospitals and concluded that while ensuring the satisfaction of payment convenience, appointment convenience and information confidentiality, there is a need to strengthen the convenience services for specific groups such as the elderly and those who do not know about the smart services of hospitals; Sun et al[28] by investigating the fitness positive correlations between the structures in the structural model of fitness centers, , it was concluded that service convenience, mediated by service quality and satisfaction, was a key driver of service quality and significantly contributed to the development of brand word-of-mouth and customer patronage intentions; Bi et al[29] drew on socio-emotional choice theory to argue that social attributes in the development and management boards of tourism websites have a positive impact on all four dimensions of satisfaction with service convenience; Seiders et al[30] conceptualized service convenience as a second-order, five-dimensional structure and found that service convenience plays a prominent role in different stages of the user's purchase decision process; Farquhar et al[31] based on a critique of existing convenience models, proposed a definition of “convenience” as “paying for convenience”, suggesting that convenience of use can be diversified at the level of product attributes and at the level of consumer segmentation.

3. Research methodology

3.1 Research model

This study adopts a quantitative analysis method, collects user data by distributing questionnaires, classifies and analyzes the results of users' demands for the health digital public service platform through the KANO model, explores the priority of functions/services, and classifies the results of the research into four categories of attractive features, desired features, necessary features, and non-differentiated features, so as to validate the critical guidance of user feedback evaluation analysis for improving the design process [32]. The Better-Worse coefficient was calculated by the percentage of the categorization of the functional attributes to determine the degree of feasibility that the feature can be increased in satisfaction or eliminated to complete the overall content of this research model.

3.2 Questionnaire design

Questionnaire research plays a crucial role in social decision-making and policy formulation[33]. For each service point, a questionnaire was designed and data were recovered in two directions, positive and negative questions, to measure the user's response when confronted with the presence or absence of a quality characteristic, respectively. The questionnaire content includes: respondents' basic information and the use of health digital public service platform in the process of the four contents of the beneficiary, post-beneficiary, access and transactional specific service points, for each of which were set up for no less than six questionnaires, examples of questionnaire questions are shown in Table 1. the use of the Likert scale of 1 to 5 degrees of scalar scaling method for the, from the 1 point (very

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dissatisfied) to the 5 point (very satisfied) is divided into five grades. With the increased prevalence of online research methods [34], an online platform was used for questionnaire distribution and data collection, user privacy protection was explained in the pre-filling stage, and the number of participants in the research was stimulated to increase and motivation was increased through prize giving.

Table 1: Example of a questionnaire

question	very dissatisfied	dissatisfied	ordinary	satisfied	Very satisfied
Your satisfaction with having health data to monitor					
Your satisfaction with the lack of health data monitoring					

As guided by the direction and purpose of the study, hypothesized computational efficacy calculations should be executed to ensure the accuracy and scientificity of the problem -solving in order to arrive at a reasonable sample size[35]. The expected effect size was set at medium (Cohen'sd=0.5), significance level (Alpha Level) was set at 0.05, and statistical efficacy (Power Level) was set at 0.80. With these parameter settings, the sample size was calculated by using the sample size formula.

$$n = \left(\frac{Z_{\alpha/2} + Z_{\beta}}{\text{Effect Size}} \right)^2$$

The minimum requirement for a single group of samples was derived as 64, and in order to prevent the emergence of insufficient sample size or invalid reflections, it was decided to double the sample size, so the sample size was set at 128, and a total of 150 questionnaires were distributed in this study, and 143 valid questionnaires were recovered, and the recovery scores were higher than the estimated minimum sample size, which indicated that the sample size was sufficient to meet the requirements of statistical efficacy.

3.3 Data collection

Such non-experimental non-intervention research methods need to be examined for common methodological bias in the data due to issues such as measurement environment, topic directionality, thematic consistency, and human variables during questionnaire collection[36]. The data of this study is a retrospective survey of feedback data on the usage experience of elderly users until June 2024, and after collecting and organizing the data for the documents, the results were analyzed for reliability and Barthes Spherical Value Test, and the specific test results are shown in Table 2:

Table 2: Confidence analysis and Bartlett's test of spherical values

Test Type	guiding principle	result
Cronbach's alpha coefficient value	α>0.8 indicates good reliability	0.967
Bartlett's test of sphericity	p<0.05 indicates suitability for factor analysis	0.000

The results indicate that the alpha value is 0.967, which is greater than the standard value, and the p-value is 0.000, which is less than the standard value, so it is concluded that the reliability of the measurement items in this study is good and suitable for factor analysis.

Table 3: KANO Model Positioning Comparison Table

-		negative question				
		very satisfied(5)	satisfied(4)	ordinary(3)	dissatisfied(2)	very dissatisfied(1)
positive question	very satisfied(5)	Q	A	A	A	O
	satisfied(4)	R	I	I	I	M
	ordinary(3)	R	I	I	I	M
	dissatisfied(2)	R	I	I	I	M
	very dissatisfied(1)	R	R	R	R	Q

Usually the priority of product feature development is: Must-be Quality(M), One-dimensional

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Quality(O), Attractive Quality(A) and Indifferent Quality(I), and the Reverse Quality(R) are completely meaningless to develop. According to the importance value of the features, the first four features are selected for reference. After obtaining the data, according to the KANO model positioning control table, see Table 3, the functions and services were mapped onto the four attributes to form a categorized comparison table of the KANO model evaluation results, see Table 4. According to the positioning, results are conducive to determining the priority of the product development function.

Table 4: Comparison table for categorization of KANO model evaluation results

dimension	Content of the question	percentage(%)				Kano Locator	Better ratio	Worse ratio
		A	O	M	I			
Benefit	Health data monitoring(Ben1)	30.07%	9.79%	27.273%	28.671%	A	41.606%	-38.686%
	Health risk assessment(Ben2)	16.084%	25.874%	32.168%	25.175%	M	42.254%	-58.451%
	Health Management Program Developmen(Ben3)	23.776%	17.483%	34.266%	22.378%	M	42.143%	-52.857%
	Multi-Assistive Function Support(Ben4)	23.776%	9.091%	17.483%	41.958%	I	35.606%	-28.788%
	Information Security Privacy Protection(Ben5)	28.671%	14.685%	26.573%	27.273%	A	44.604%	-42.446%
	Expert advisory services(Ben6)	31.469%	11.888%	26.573%	27.273%	A	44.604%	-39.568%
	Health Education Resources(Ben7)	30.07%	0.0%	0.0%	25.874%	A	53.75%	-0.0%
	Emergency support(Ben8)	23.776%	15.385%	39.86%	19.58%	M	39.716%	-56.028%
	Trial & Experience(ben9)	9.091%	45.455%	23.776%	18.881%	O	56.115%	-71.223%
Post-benefit	Membership Reduction Policy(Pb1)	20.28%	30.07%	25.874%	20.979%	O	51.799%	-57.554%
	Long-term health tracking(Pb2)	18.182%	24.476%	32.867%	23.776%	M	42.958%	-57.746%
	Health Behavior Improvement(Pb3)	15.385%	23.077%	42.657%	17.483%	M	39.007%	-66.667%
	Mental health support(Pb4)	9.091%	42.657%	25.874%	19.58%	O	53.237%	-70.504%
	Guidance on the medical process(Pb5)	39.161%	5.594%	25.175%	26.573%	A	46.377%	-31.884%
	Health Record Creation(Pb6)	20.28%	30.769%	26.573%	19.58%	O	52.518%	-58.993%
	Exchange platforms and communities(Pb7)	42.657%	6.294%	24.476%	23.077%	A	50.725%	-31.884%
	Chronic disease management support(Pb8)	15.385%	23.077%	31.469%	27.972%	M	39.286%	-55.714%
Access	Frequency of efficient information updates(Acc1)	24.476%	15.385%	18.881%	37.762%	I	41.304%	-35.507%
	User Interface Friendliness(Acc2)	22.378%	28.671%	25.175%	20.979%	O	52.518%	-55.396%
	Cross-platform device usability(Acc3)	22.378%	18.881%	14.685%	39.86%	I	43.066%	-35.036%
	Online Customer Service Support(Acc4)	18.881%	10.49%	39.161%	28.671%	M	30.216%	-51.079%
	Multilingual services(Acc5)	24.476%	7.692%	14.685%	51.049%	I	32.857%	-22.857%
	Convenient login and registration(Acc6)	18.881%	18.182%	30.769%	28.671%	M	38.406%	-50.725%
Transaction	Refund or Return Policy(Tra1)	23.776%	40.559%	15.385%	19.58%	O	64.789%	-56.338%
	Multiple Payment Methods Support(Tra2)	44.755%	3.497%	25.175%	23.776%	A	49.64%	-29.496%
	Health Insurance and Claims(Tra3)	18.881%	15.385%	41.958%	17.483%	M	36.567%	-61.194%
	Information transparency(Tra4)	23.776%	29.371%	25.874%	19.58%	O	53.901%	-56.028%
	Server Response Efficiency(Tra5)	17.483%	16.084%	25.175%	33.566%	I	36.364%	-44.697%
	Payment Process Convenience(Tra6)	18.881%	15.385%	29.371%	28.671%	M	37.121%	-48.485%

According to the calculation principle of KANO formula, the better-worse coefficient is calculated in SPSS for each dimension of question content as follows:

Better/SI=(A+O)/(A+O+M+I)

Worse/DSI=-1*(O+M)/(A+O+M+I)

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Better is the satisfaction coefficient, the value is usually positive, and represents "if provide a certain functional attribute user satisfaction will be increased", the value is closer to 1, that is, the greater the impact on user satisfaction, the stronger the effect of enhancement; Worse is the dissatisfaction coefficient, the value is usually negative, represents "if do not provide a certain functional attribute user satisfaction will be reduced", the value is closer to -1, that is, the greatest impact on user dissatisfaction, the stronger the effect of reduction. According to the better-worse coefficient, the coordinate distribution chart is derived, see Fig. 1. Based on the above data analysis and theoretical guidance, the function or service requirements with higher absolute coefficient scores should be prioritized for implementation, and we can draw the conclusions and guiding recommendations of this study.

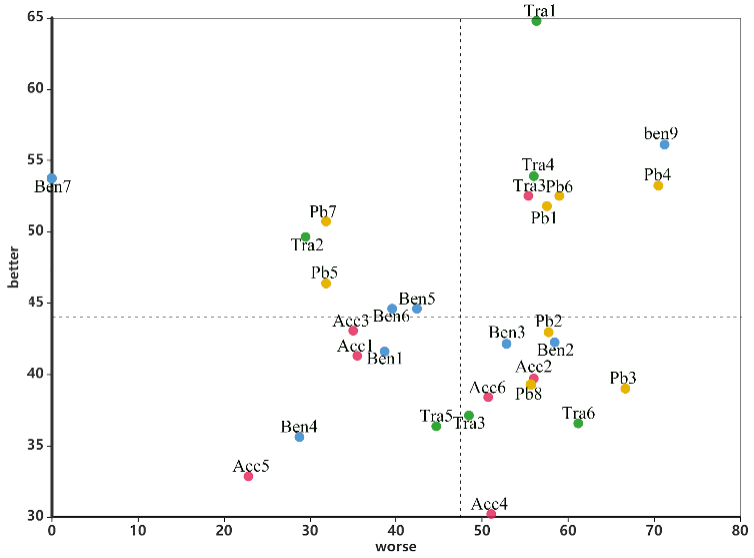

Figure 1: Scattered Coordinate Distribution Map

4. Conclusion

Through the research on the use demand of aging users for age-adapted health management platforms, analyzed using the KANO model and the service convenience model, this study draws the following conclusions:

4.1 Benefit

In the case of benefit-related utilization needs, "Health data monitoring(Ben1)","Information Security Privacy Protection(Ben5)","Expert advisory services(Ben6)" and"Health Education Resources(Ben7)" are classified as Attractive Quality(A), When such ancillary value-added features are offered, user satisfaction and loyalty rise dramatically. "Trial & Experience(ben9)" is classified as One-dimension Quality(O). It is the focus of generating an advantage over competitors and a demand indicator in the growth period, which can be used as a key development direction to provide design references for healthcare platforms. "Health risk assessment(Ben2)","Health Management Program Development(Ben3)" and"Emergency support(Ben8)" are classified as Must-be Quality(M), This suggests that aging users have high expectations for features in the Health Management and Safety Services category, with a concomitant decrease in user satisfaction when such features are not provided.

4.2 Post-benefit

In the case of post-benefit related utilization needs, "Guidance on the medical process(Pb5)" and"Exchange platforms and communities(Pb7)" are classified as Attractive Quality(A), This type of functionality is not overly desired by users, but will greatly increase satisfaction when it is refined. "Membership Reduction Policy(Pos1)","Mental health support(Pos4)" and"Health Record Creation(Pos6)" are classified as One-dimension Quality(O), This suggests that older users have high expectations of these features and want a good user experience in these areas.

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4.3 Access

In the case of access-related utilization needs, “User Interface Friendliness((Acc2)” is classified as One-dimension Quality(O), These are competing demands on the quality of the platform that have a direct impact on process clarity and ease of operation, and every effort should be made to meet these expectations. “Frequency of efficient information updates(Acc1)”,“Cross-platform device usability(Acc3)” and“Multilingual services(Acc5)” are classified as Indifferent Quality(I), Whether or not such features are provided does not produce fluctuating changes in user satisfaction. It should be noted that such results are related to the concentration of the research sample, and since the distribution of the questionnaire was focused on the Chinese aging population over 60 years of age, the findings are applicable to the aging-appropriate health management platforms in China.

4.4 Transaction

In the case of transaction-related utilization needs, “Multiple Payment Methods Support(Tra2)” Classified as Attractive Quality(A), User satisfaction does not decrease when such services are not provided, but it increases dramatically when they are provided, providing guidance for the development of health management platforms that want to increase user satisfaction quickly. “Refund or Return Policy(Tra1)” and“Information transparency(Tra4)” Classified as One-dimension Quality(O), corresponds to the emotional experience of user pleasure and satisfaction, which is positively proportional to user satisfaction. “Health Insurance and Claims(Tra3)” and“Payment Process Convenience(Tra6)” Classified as Must-be Quality(M), need to be prioritized and reflect basic user expectations about insurance policies and payment processes.

Based on the above analysis and conclusions, this study analyzes the expectations and requirements of elderly users regarding the convenience of their services for the aging healthcare platform, and the conclusions of this study can provide a scientific basis and practical suggestions for the development strategy and optimization strategy of the future aging healthcare platform. Based on these classification results, healthcare platforms need to ensure the perfection of essential attributes during the product development and iteration phase, followed by improving the user experience and overall satisfaction by improving the charm attribute and desired attribute function points.

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