

ORIGINAL RESEARCH

# A Study of Elderly Patients' Preference for "Internet + Nursing Service" Based on Discrete Choice Experiments

Cui Liu, MM; Zhixia Zhang, MD; Qiuxia Chen, BM; Fang He, BM

## ABSTRACT

**Objective** • To investigate the preference of elderly patients for "Internet + Nursing Service", so as to provide reference for accurately matching their service needs.

**Methods** • Based on discrete choice experiments, the elderly patients' "Internet + Nursing Service" choice preference questionnaire was prepared, and 410 elderly patients were interviewed face-to-face. The Conditional Logit Model was used for quantitative analysis of the experimental data.

**Results** • The six attributes included in the study had a significant impact on the elderly patients' preference for "Internet + Nursing Service" ( $P < .05$ ). Among non-economic attributes, "medical insurance reimbursement ratio -70%" has the highest utility (.263,  $P < .001$ ), with "hospital size - larger (.205,  $P < .05$ )" and "medical insurance reimbursement ratio -50%" (.188,  $P < .05$ ) ranking second and third, respectively. The relative importance of the attribute of medical insurance

reimbursement proportion is the highest (26.44%), and the relative importance of service content is the lowest (9.78%). If the proportion of medical insurance reimbursement increases from 30% to 70%, patients are willing to pay 202.9 yuan, and the probability of choosing "Internet + Nursing Service" increases by 6.1%.

**Conclusion** • Patients prefer to choose a higher proportion of medical insurance reimbursement, a larger medical institution, a higher level of nurses, low single service costs, a basic package, and "Internet + Nursing Service" led by the government and hospitals. Improvement of the price and medical insurance payment policy is recommended, along with the enhancement of the ability of primary nursing services, strengthening of the management of Internet enterprise platforms, and scientific assessment of the needs of patients for personalized nursing services. (*Altern Ther Health Med.* [E-pub ahead of print.])

**Cui Liu**, MM, Nurse-In-Charge, Institute of Nursing Research, Hubei Province Key Laboratory of Occupational Hazard Identification and Control, School of Medicine, Wuhan University of Science and Technology, Wuhan, Hubei, China. **Zhixia Zhang**, MD, Associate Professor; **Qiuxia Chen**, BM, Chief Nurse; Department of Nursing, Tianyou Hospital Affiliated to Wuhan University of Science and Technology, Wuhan, Hubei, China. **Fang He**, BM, Associate Chief Nurse, Department of Nursing, Tianyou Hospital Affiliated to Wuhan University of Science and Technology, Wuhan, Hubei, China.

Corresponding author: Qiuxia Chen, MM  
E-mail: [liucui0320@163.com](mailto:liucui0320@163.com)

## INTRODUCTION

By the end of 2022, China's elderly population aged 60 years and above had reached 280 million, accounting for 19.8% of the country's total population.<sup>1</sup> The increase in the number of elderly people with advanced age, disability, and

chronic diseases poses a great challenge to China's medical and health care. The increase in the elderly population has led to an increase in the demand for medical resources and emphasized the need for health management and social support. This trend requires us to delve deeper to provide appropriate solutions to ensure the well-being and health of the elderly. On 12 February 2019, the National Health Construction Commission issued the Notice on Promoting the Pilot Work of "Internet + Nursing Service", which encourages medical institutions to rely on the Internet and other information technologies to provide personalized and differentiated hospital discharges, advanced age, incapacitation, or special groups of people suffering from illnesses and mobility problems with "Internet + Nursing Services."<sup>2</sup> International experience and domestic practice has proved that the promotion of "Internet + Nursing Service" is an important way to cope with the aging population and meet the health needs of the elderly under the new situation.<sup>3</sup> At present, domestic scholars have conducted a number of studies on the demand and willingness to use

“Internet + Nursing Service” for elderly patients, but most of them are status surveys and influencing factor analyses,<sup>4-8</sup> and there is a lack of quantitative research on the selection preferences and willingness to pay (WTP) for each influencing factor. Discrete choice experiments (DCE) typically involves being presented with a range of hypothetical options with different characteristics and attributes to see which option an individual would prefer. This method can help researchers understand the importance that people place on different features and services, and how they weigh different options. In this study, the DCE method was chosen because it allows us to systematically explore elderly patients’ preferences for Internet + care services, considering that such services may involve multiple characteristics and attributes. Through DCE, we can better understand patients’ needs for personalized medical services and provide targeted recommendations for future policies and practices.

Therefore, the main goal of this study is to gain an in-depth understanding of elderly patients’ needs and preferences for Internet + care services, and how these needs affect the future development of medical care. Through the application of DCE, we will explore the attractiveness of different service characteristics and attributes to elderly patients and provide targeted suggestions for developing more personalized and efficient medical care policies and practices. The importance of this study is that as the elderly population increases, meeting their medical needs becomes increasingly important. By gaining a deeper understanding of their needs and preferences, we can better meet their care expectations and improve the quality of care, thereby improving the quality of life for older patients.

## METHODS

### Data sources

Using multi-stage sampling method, elderly inpatients from a public tertiary A hospital in Wuhan were selected as the research data source from January to March 2023. Based on the information of elderly patients in the HIS electronic case system, select departments with a large number of elderly patients, and then randomly select research subjects in a 10% proportion from the selected departments. First, the particular hospital was selected as the data source for the study. Second, the study sample was selected from the hospital’s elderly inpatients through random sampling. This process may involve randomly selecting a number of patients from hospital records or selecting patients based on specific criteria, such as admission time range. Once the sample was identified, the researcher began data collection through medical record review, face-to-face interviews, or extracting specific data to answer the research questions. Finally, the data collected were analyzed and interpreted in order to answer the research questions and interpret the meaning of the results. Multi-stage sampling helps to select representative samples in large-scale studies, especially when the target group is large and widely distributed. It can reduce sampling errors and better represent the target population. It is crucial

to ensure that the sampling process at each stage is random and fair to ensure the reliability and validity of the study. Inclusion criteria: (1) age  $\geq$  60 years old; (2) the Glasgow Coma Scale (GCS) score is greater than 14 points and can effectively communicate with researchers; (3) volunteer to participate in research. Exclusion criteria: those who still cannot understand the experimental content after detailed explanation by the investigator.

A total of 410 questionnaires were distributed, excluding samples that did not pass the consistency test. 395 valid questionnaires were collected, with an effective recovery rate of 96.3%.

### Research methods

The discrete choice experiment (DCE) is rooted in the random utility theory and is an attribute-based utility measurement method.<sup>9</sup> It can simultaneously consider the comprehensive impact of multidimensional attributes on the study population’s choice intention, and is a powerful tool for exploring population preferences.<sup>10,11</sup> In the theory of random utility, the utility obtained by the respondent  $n$  choosing option  $j$  in  $t$  scenarios is  $U_{njt}$ , which includes a fixed utility and a random component. The fixed utility is an observable systematic part and can be explained by the product’s attributes and corresponding preference coefficients. The random component, often called the error term or random utility, is an unobserved value that reflects the inherent attractiveness and represents unexplained variance or randomness with respect to the underlying utility is a vector of the associated preference parameters. Its statistical significance, sign, and size of reflect whether the attributes are important, respectively.

The research steps of DCE mainly include: determining the attributes and levels of inclusion in the study, generating a selection set, collecting data, and analyzing data.<sup>12</sup>

DCE is a common research method used to measure people’s preferences for different choices or decisions. The basic principle involves creating a series of virtual choice situations in which participants are asked to make decisions. These situations are composed of several attributes or characteristics, each with different levels or options. First, the researcher identified the specific area and problem of the study and determines the attributes and attribute levels relevant to the problem. They then created virtual situations, each containing a different combination of attributes. Participants were asked to make a choice in each scenario, selecting the option they felt was most appropriate based on their preferences and needs. Finally, by analyzing participants’ choice patterns, researchers inferred their preferences for different attribute levels. This method is widely used in many fields and helps researchers better understand people’s decision-making behavior and preferences.

### Determine the attribute and level of “Internet + Nursing Service”

At present, it is recommended internationally that multi-stage methods such as literature review, qualitative interviews,

and expert consultation to determine attributes and levels are best practices.<sup>13</sup> The number of attributes included at the same time should not be too large, as 4-8 are often included in the health field, with a level of 2-4.<sup>9,10</sup> Based on the above principles, the researchers first searched the policy documents and the literature on patients' needs and preferences for "Internet plus nursing services", and initially obtained the potential attribute pool of this study. The search databases include PubMed, Web of Science, CNKI, Wanfang, and VIP databases, and the search terms include patients, Internet plus nursing services, door-to-door services, online appointment services, demand preferences, willingness to use, influencing factors, Internet + nursing services, home care services, patient preferences, etc. Subsequently, from August to September 2022, a one-on-one structured interview was conducted on 15 elderly inpatients from a tertiary comprehensive hospital in Wuhan. The interview focused on the patients' understanding of "Internet plus nursing service", willingness to use it, and the key attributes and issues to be considered when choosing. In depth interviews enable researchers to understand trustworthy attributes and levels, avoiding common hypothesis biases in DCE.<sup>14</sup> Finally, eight experts in the field of "Internet + Nursing Services" were consulted to ensure that the core outline of the research project was outlined with the least attributes. In the end, this study included six attributes: hospital size, service content, single service cost, service platform, medical insurance reimbursement ratio, and service provider, each with 2 to 3 levels (see Table 1).

### Generating choice sets

Based on the attributes and levels included in this experiment, a full factorial analysis ( $3^5 \times 2^1$ ) would generate a large number of combination options, increasing the complexity of the experiment. This study uses Stata 16.0 D-efficiency departmental analysis to optimize the design of the experiment, generating a total of 16 choice sets, which are randomly divided by Stata into two versions, A and B, with 8 choice sets in each version of the questionnaire, to initially form the elderly patients' "Internet + care services" choice preferences questionnaire. At the same time, in order to test the consistency of the respondents' answers before and after the two times, this study randomly chose the first choice set in each version of the questionnaire to repeat the inclusion of the questionnaire as the ninth choice set, and finally each version of the questionnaire consists of nine choice sets. The respondents were randomly selected to answer one version, and test data were not included in the analysis of results. For an example of a single choice set, see Table 2.

### Determination of sample size

The minimum sample size for DCE main effects was determined according to the minimum sample size formula  $N > 500c / (t \times a)$  proposed by scholar Orme,<sup>15</sup> where 500 is a fixed variable, c represents the maximum number of levels of the study attributes, t is the number of choice sets in each

**Table 1. Attributes and Levels of the Included Studies**

Attributes	Level	Description
Single service cost	150 Yuan	Out-of-pocket expenses per visit (excluding travelling expenses and one-time consumable costs)
	250 Yuan	
	350 Yuan	
Hospital Size	Large	Inpatient beds >500
	Medium	100-500 inpatient beds
	Smaller	Inpatient beds <100
Services	Basic services	Targeted care services. For example, changing urinary catheters, changing gastric tubes, etc.
	Individual services	Individualized paid services for different groups of people and different types of illnesses.
Service Provider	Junior Nurse	Nurse Practitioner with $\geq 5$ years of clinical experience
	Intermediate Nurse	Nurse Practitioner in charge with $\geq 5$ years of clinical experience
	Advanced Practice Nurse	Associate nurse practitioner or chief nurse practitioner with $\geq 5$ years of clinical experience
Medical insurance reimbursement rate	30%	In the future, after the state promotes the health insurance reimbursement policy, the insured person incurs eligible expenses, the health insurance reimbursement percentage
	50%	
	70%	
Service Platform	Government-led	A government-established platform where nurses from regionalized physical healthcare institutions register to provide home-based services to regional patients.
	Hospital-led	Platforms established by the entity hospitals themselves, where nurses of the hospitals register on the platforms and mainly serve patients entering and leaving the hospitals of the hospitals
	Enterprise-led	Platforms established by Internet enterprises, where nurses register in their personal capacity to provide door-to-door nursing services for patients in different regions.

**Table 2. Example of a Single Selection Set**

Option Set 1	Option 1	Option 2
Single service cost	250 per session	350 per session
Hospital size	Smaller	Larger
Services	Basic Package	Personalized Package
Service Provider	Intermediate Nurse	Advanced Nurse Practitioner
Medical insurance reimbursement rate	30 per cent	50%
Service platform	Government-led	Hospital-led
Your options are: Option 1 <input type="checkbox"/> Option 2 <input type="checkbox"/> Neither <input type="checkbox"/>		

version of the questionnaire, and a is the number of options included in each choice set (opt-out options have no corresponding attributes and levels and are not taken into account). In this study, c is 3, t is 9, and a is 2. The sample size is at least 84 cases, and considering 20% of invalid questionnaires, the final sample size is determined to be 100 cases. To reduce sampling error, an actual sample of 410 cases was included.

### Questionnaire

The questionnaire of this study consists of 2 parts: (1) Patient socio-demographic questionnaire, including gender, age, marital status, type of insurance, monthly income, etc. (2) A questionnaire on patients' preferences for "Internet + Nursing Services" with two versions, each with nine choice sets. To test respondent consistency, each version of the questionnaire included a repetition of the first choice set, resulting in each questionnaire consisting of nine choice sets. Both versions are designed to ensure the feasibility of the experiment and the reliability of the results. After the preliminary completion of the questionnaire, a pre-survey was conducted on 34 eligible elderly patients in a tertiary hospital in Wuhan, and the questionnaire was revised and improved according to the problems in the pre-survey to form a formal questionnaire. The survey was conducted by three uniformly trained investigators of the research group, using a uniform instruction, conducting one-on-one one-sided enquiry

questionnaires, and explaining the purpose and significance of the questionnaire survey to the respondents before the survey according to the principle of informed consent.

### Statistical methods

Excel 2019 duo was used for data entry and conditional model in Stata 16.0 was used for econometric analysis of the data. The outcome variable was chosen to be designated as the dependent variable and the different attribute levels were used as independent variables, with  $P < .05$  being considered a statistically significant difference. The single service cost attribute was designated as a continuous variable and other attributes were coded as dummy variables included in the model for parameter estimation. WTP was calculated by the ratio of the regression coefficients of the non-economic attributes to the regression coefficients of the attributes of the single service cost;<sup>12</sup> marginal effects were realized by the marginal effect mnemonic margins; single service cost was converted into a categorical variable, and the effects of each attribute were coded using the relative importance (RI)<sup>16</sup> formula to evaluate the relative importance of each attribute.

## RESULTS

### Basic information of the survey respondents

There are more women than men among the survey respondents, with the proportion of men and women being 47.3% and 52.7%, respectively. 69.1% of the population is married; the education level of junior high school and senior high school or junior college accounts for the most, with 41.8% and 31.4%, respectively. Urban residents are the main ones, with a proportion of 79.2%; monthly incomes are generally concentrated in the range of RMB 2000 to RMB 6,000; the majority of the patients suffer from chronic illnesses, and only 22.2% of them are not suffering from chronic illnesses. See Table 3 for details.

### Results of consistency test analysis

The total number of samples that did not pass the internal consistency test of the questionnaire in this study was 15. The goodness of fit of the two models was compared by modelling the total sample size and the samples that passed the consistency test respectively. The results show that the Akaike information criterion (AIC) and Bayesian information criterion (BIC) values of model I are smaller than Model II, indicating that the model has a better goodness of fit (Table 4). Therefore, this study included only 395 samples for econometric analysis.

### Results of choice preference analysis of elderly patients

The six attributes included in this study had statistically significant effects on older patients' preference for "Internet + Nursing Service" ( $P < .05$ , see Table 5, Figure 1). Except for "single service fee" ( $-0.130$ ,  $P < .05$ ) and "service content personality package" ( $-0.176$ ,  $P < .05$ ) which had negative effects on patients' choice intention, other attributes had positive effects. Among the non-economic attributes, the

**Table 3.** Demographic Information of Respondents (n = 395)

Variable	Classification	Number (n)	Composition ratio (%)	Mean ± standard deviation ± S)
Gender	Male	187	47.3	
	Female	208	52.7	
Age (years)	60~	148	37.5	72.8 ± 8.5
	70~	159	40.3	
	80~	84	21.2	
	≥ 90	4	1.0	
Marriage	Married	291	73.6	
	Widowed	88	22.3	
	Other	16	4.1	
Education level	Primary school and below	119	30.1	
	Junior high school	145	36.7	
	High School or Secondary School	110	27.9	
	College and above	21	5.3	
Place of residence	Urban	259	65.5	
	Rural	136	34.5	
Monthly income (yuan)	< 2000	84	21.2	
	2000-3999	137	34.7	
	4000-5999	107	27.1	
	≥ 6000	67	17.0	
Chronic disease	None	88	22.2	
	One	81	20.5	
	Two	124	31.3	
	≥ Three	103	26.0	

**Table 4.** Comparison of Results of Consistency Test Analyses

	Model I <sup>a</sup>	Model II <sup>b</sup>
Sample size	395	410
Observations	9,480	9,840
Log likelihood ratio	-3,195.113	-3,331.390
AIC	6,412.335	6,684.781
BIC	6,478.977	6,751.832

<sup>a</sup>Excluding sample size that did not pass the consistency test

<sup>b</sup>Total sample size.

**Table 5.** Conditional Logistic Regression Analysis Results (n = 395)

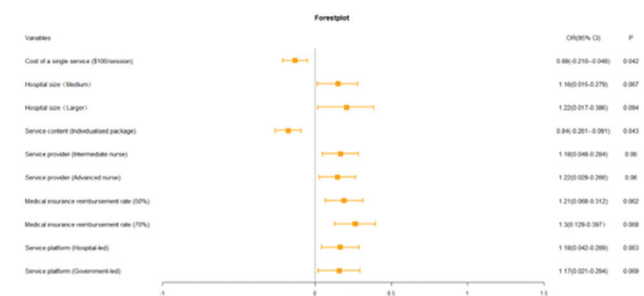
Variable Name	Coefficient (SE)	95% CI	OR
Cost of a single service (\$100/session)	-0.132 (0.042) <sup>a</sup>	(-0.210, -0.048)	0.88
Hospital size (R: smaller)			
Medium	0.150 (0.067) <sup>a</sup>	(0.015, 0.279)	1.16
Larger	0.205 (0.094) <sup>a</sup>	(0.017, 0.386)	1.22
Service content (R: Basic package)			
Individualized package	-0.176 (0.043) <sup>b</sup>	(-0.261, -0.091)	0.84
Service provider (R: Primary Nurse)			
Intermediate nurse	0.167 (0.060) <sup>a</sup>	(0.048, 0.284)	1.18
Advanced nurse	0.148 (0.060) <sup>a</sup>	(0.029, 0.266)	1.22
Medical insurance reimbursement rate (R:30%)			
50 percent	0.188 (0.062) <sup>a</sup>	(0.068, 0.312)	1.21
70 percent	0.263 (0.068) <sup>b</sup>	(0.129, 0.397)	1.30
Service platform (R: Enterprise-led)			
Hospital-led	0.165 (0.063) <sup>a</sup>	(0.042, 0.289)	1.18
Government-led	0.158 (0.069) <sup>a</sup>	(0.021, 0.294)	1.17
opt-out	-0.899 (0.104) <sup>b</sup>	(-1.102, -0.695)	-

<sup>a</sup> $P < .05$

<sup>b</sup> $P < .001$

Note: Sample size = 395; Observations = 9,480; Log likelihood = -3,195.113; R is the reference level

**Figure 1.** Conditional Logistic Regression Analysis Results



utility brought by “medical insurance reimbursement ratio - 70% is the highest (0.263,  $P < .001$ ), which is 1.3 times the reimbursement ratio of 30%. “Hospital scale - large (0.205,  $P < .05$ )” and “medical insurance reimbursement ratio-50%” (0.188,  $P < .05$ ) ranked second and third respectively, and their values were 1.22 and 1.21 times the reference level. Patients preferred to choose “Internet + Nursing Service” with low single service cost, larger hospital scale, basic package, higher nurse level, higher proportion of medical insurance reimbursement, and government-led.

### Evaluation results of relative importance of each attribute

In this section, single service cost is converted into a categorical variable, and after coding the effect of each attribute, it is included in the conditional regression model to calculate the relative importance information of each attribute. Figure 2 shows that the relative importance of each attribute is ranked in the order of health insurance reimbursement rate, hospital size, service provider, service platform, single service cost, and service content. Among them, the attribute of health insurance reimbursement rate has the largest proportion of relative importance (26.44%), and the attribute of service content has the smallest proportion (9.78%).

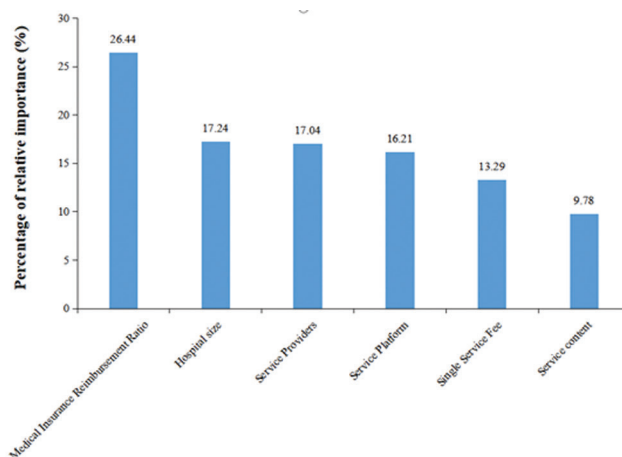
### Results of marginal effect analysis

The baseline level was 30% of medical insurance reimbursement, small-scale hospitals, basic packages, enterprise-led, and primary nurses. When all variables remained unchanged, the probability of patients choosing “Internet + Nursing Service” decreased by 3.0% for every 100 yuan increase in the single service cost. When the proportion of medical insurance reimbursement increased from 30% to 50% and 70%, the probability of patients choosing “Internet + Nursing Service” increased by 4.4% and 6.1%, respectively. When the hospital scale changed from small to medium and large, the predicted probability of patient selection increased by 3.4% and 4.7%, respectively. However, when the service content was changed from basic package to personalized package, the probability of patient selection decreased by 4.1%. When the service platform changed from baseline level to hospital-led and government-led, the selection probability of patients increased by 3.9% and 3.7%. Compared with the baseline level, the selection probability of patients increased by 3.8% and 3.5% when nurses changed to intermediate and advanced, as shown in Table 6.

### Results of willingness to pay (WTP)

The analyzed results of WTP and 95% confidence interval of elderly patients are shown in Figure 3. The respondents’ WTP for the proportion attribute of medical insurance reimbursement is the highest. Firstly, if the proportion of medical insurance reimbursement is increased from 30% to 70%, the respondents are willing to pay about 202.9 yuan for it. Secondly, if the hospital scale is changed from small to large, the respondents are willing to pay 155.6 yuan for it. When the service provider changes from primary

**Figure 2.** Evaluation Results of the Relative Importance of Each Attribute

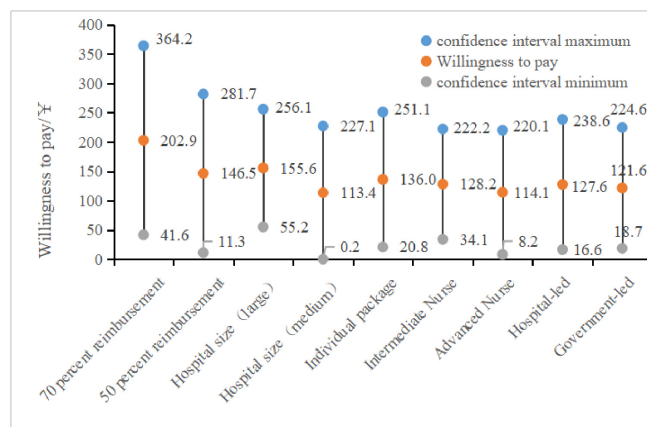


**Table 6.** Results of Marginal Effect Analysis (n = 395)

Variable Name	Coefficient (SE)	P value	95% CI
Cost of a single service (\$100/session)	-0.030 (0.010)	<.05	(-0.049, -0.012)
Hospital size (R: smaller)			
Medium	0.034 (0.016)	<.05	(0.003, 0.065)
Large	0.047 (0.022)	<.05	(0.004, 0.090)
Service content (R: Basic package)			
Individualized package	-0.041 (0.010)	<.001	(-0.061, -0.021)
Service provider (R: Primary Nurse)			
Intermediate nurse	0.038 (0.014)	<.05	(0.011, 0.066)
Advanced nurse	0.035 (0.014)	<.05	(0.007, 0.062)
Medical insurance reimbursement rate (R: 30%)			
50 percent	0.044 (0.015)	<.05	(0.016, 0.073)
70 percent	0.061 (0.016)	<.001	(0.030, 0.093)
Service platform (R: Enterprise-led)			
Hospital-led	0.039 (0.015)	<.05	(0.010, 0.067)
Government-led	0.037 (0.016)	<.05	(0.005, 0.069)

Note: R is the reference level

**Figure 3.** Elderly Patients’ Willingness to Pay



nurse to intermediate nurse, the respondents are willing to pay 128.2 yuan more. If the service platform is changed from enterprise-led to hospital-led and government-led, the respondents’ WTP is 127.6 yuan and 121.6 yuan, respectively. Since the regression coefficient of personality package is negative, if the service content is changed from basic package to personality package service, the patient is willing to accept a compensation of 136.0 yuan.

## Conclusion and Recommendation

The methodology adopted and the key results of this study are summarized as follows: First, the basic information of the respondents were investigated, including gender, marital status, education level, place of residence, monthly income, and chronic disease status. Secondly, a consistency test analysis was conducted and 395 valid questionnaire samples were selected for subsequent quantitative analysis. Next, the elderly patients' choice preferences for "Internet + nursing services" were analyzed, and it was found that all of the six attributes had a significant impact on patients' choice intentions, among which the medical insurance reimbursement ratio had the greatest impact on choice intentions. Furthermore, the relative importance of each attribute was evaluated and it was found that the Medicare reimbursement ratio attribute had the highest relative importance. Finally, a marginal effect analysis was performed to reveal the impact of changes in each attribute on the probability of patient selection. For example, an increase in the cost of a single service will reduce the probability of selection, while an increase in the proportion of medical insurance reimbursement will increase the probability of selection. These results provide important insights into understanding elderly patients' choice behavior toward "Internet + nursing services."

## Discrete Choice Experiment (DCE) is suitable for evaluating the choice preference of elderly patients for "Internet + Nursing Service"

DCE integrates a complete economic theory foundation and a reliable empirical methodology system, and its flexible questionnaire design can better simulate real choice scenarios, so that the experimental bias is smaller and the research results are more accurate and scientific.<sup>12,15</sup> In this study, DCE provides quantitative information on the preference intensity, marginal effect, and WTP of elderly patients for each attribute, which makes up for the limitations of qualitative interviews and conventional questionnaires, and to a certain extent enriches the empirical research on "Internet + Nursing Service", and provides an accurate response to the demand of elderly patients for "Internet + Nursing Service".

## Economic factors have an important impact on elderly patients' preference for "Internet + Nursing Service"

In this study, elderly patients have the highest WTP for the attribute of medical insurance reimbursement rate, and have a negative preference for the attribute of single service cost, which is similar to related studies in China.<sup>5,7,17</sup> At present, although the state has issued specific policies,<sup>18,19</sup> which explicitly entails the delivery of service items directly to your doorstep, that meet the requirements within the scope of health insurance payment, it takes time to implement, and most of the regions are still left at the expense of the patients. Some studies have shown that the cost of "Internet + Nursing Service" is 5-20 times higher than the cost of the same service in a physical hospital.<sup>2</sup> Most of the patients' families have a serious financial burden, and the cost of services and

reimbursement by health insurance are often their priorities determined by the constraints of their financial conditions.

Relevant departments should actively coordinate with each other to accelerate the promotion and improvement of the costs and health insurance payment policy of "Internet + Nursing Service", so as to reduce the financial burden of patients and truly benefit the people.

## Respondents' preference for services with larger hospitals and higher-level nurses

Compared with the baseline level of smaller hospitals and service providers who are junior nurses, respondents preferred service programs with larger healthcare institutions and higher levels of nurses, which is similar to the findings of scholars Yan Yongyang<sup>5</sup> and Yi Weiqing.<sup>17</sup> The work experience and qualification of nurses directly affect the quality of home nursing services. Senior nurses are generally better than junior nurses in terms of professional skills and adaptability,<sup>20</sup> and senior nurses are more competent in "Internet + Nursing Service". Larger hospitals have higher quality service resources, and have more advantages in information technology construction, management level and medical technology. The patients' preference is consistent with the expected results, which is in line with the psychological needs of the respondents in reality.

In the process of exploring Internet services, the support and leading role of high-quality nursing resources in large medical institutions is given full play, and the capacity of primary care services in the jurisdiction is enhanced through medical linkage. At the same time, we will strengthen the construction of the talent team of the Internet platform, provide precise and standardized training for nurses of "Internet + Nursing Service", and comprehensively improve their ability and level of "Internet + Nursing Service".

## Government- and hospital-led internet service platforms are more favored by elderly patients

Compared with enterprise-led service platforms, patients are more willing to accept government- and hospital-led platforms. This may be related to the fact that enterprise-operated platforms are profit-oriented, lack high-quality physical healthcare organizations as carriers, have uneven care service technologies, and have weak social credibility.<sup>21</sup> The government-led platform adopts the operation model of "government + medical institutions + third-party organizations", and the quality of home service is regulated by the three parties, which is safer and eliminates the perceived risk of patients. Hospital-led platforms mostly adopt the mainstream mode of joint operation between hospitals and third parties. Enterprises play an operational advantage, while entity hospitals play a diagnostic and treatment advantage, and nurses for door-to-door services are provided by entity hospitals with perfect qualifications, so the safety of nursing is guaranteed.

The management of enterprise-led information platforms has been strengthened, and entity hospitals are encouraged

to actively join and participate in the programme, so that quality and safety can be effectively guaranteed. In the development of Internet healthcare, the government and hospital-led platforms will continue to play an organizational and leading role in coordinating and promoting the work of "Internet + Nursing Service".

### **Basic package services are preferred by elderly patients**

Compared to the personalized package, the respondents generally preferred the basic package service, and the results of this study are quite different from the previous studies.<sup>7</sup> The reason may be that previous studies did not link the personalized package with paid services, and without involving the influence of economic factors in advance, patients chose the personalized package compared to the basic package, which is in line with the psychological needs of the respondents in reality, and also verifies the random utility theory. In this study, the personalized package is a paid service and cannot be paid for by health insurance, which discourages patients from choosing the personalized package in the face of the high cost of home service. In addition, patients may have limited understanding of the personalized package. At present, cities are advocating the provision of personalized care services for different groups of people to meet the multi-level and multi-type care needs of patients as much as possible. However, the acceptance of patients and how it is actually used is yet to be assessed. In the next stage, while expanding the coverage of basic care services, how to further promote and implement personalized care services is a direction for further in-depth research in the future.

### **RECOMMENDED POLICY**

It is recommended that policymakers and healthcare providers take the following specific measures to better meet the needs of elderly patients for "Internet + nursing services". First, the formulation of Internet + medical policies should be actively promoted to ensure the application of Internet technology in the medical field. It's important to take the legal aspects into account and establish an appropriate regulatory framework for it. Secondly, the government can consider providing tax incentives or financial support to encourage health care providers and innovative companies to invest in the R&D and implementation of Internet + nursing services to reduce service costs. Third, establish remote care guidelines that clarify technical standards, data privacy, patient safety, and medical regulations to ensure high-quality health care. In addition, support training and education programs can help nursing staff and elderly patients to better understand and use these services, and establish an Internet medical information sharing platform to promote the safe sharing and interoperability of medical information. Finally, establish a monitoring and evaluation mechanism to track the effectiveness and patient satisfaction of "Internet + nursing services" in order to continuously improve and optimize services. These measures can help to improve the quality and accessibility of health care services to better meet the needs of older patients.

Among future research directions, the importance of personalized care services should be emphasized. Research could focus on developing smarter care models that provide personalized nursing services based on the needs and preferences of elderly patients. This includes making better use of big data and artificial intelligence technologies to analyze health data, predict risks, and provide personalized interventions. Additionally, remote monitoring and use of interactive tools can help to encourage patients to actively participate in care and interact with nursing professionals. The quality of life and satisfaction should be assessed to ensure that the services meet patient expectations while examining legal and ethical issues to protect patient rights. These research directions will help further develop and improve personalized care services to meet the growing needs of elderly patients.

### **SUMMARY**

Based on the discrete choice experimental method, this study conducted a quantitative evaluation of the "Internet + Nursing Service" choice preference, marginal effect, and WTP of elderly patients. The results showed that patients preferred to choose the "Internet + Nursing Service" led by the government with low single service cost, larger hospital scale, basic package, higher nurse level, and higher medical insurance reimbursement ratio. In order to actively respond to the aging population and meet the health needs of the elderly, China should rapidly improve the cost and medical insurance payment policies of "Internet + Nursing Service" to reduce the economic burden of patients. China should also support the leading role of high-quality nursing resources in regional large-scale medical institutions and help to improve the ability of grass-roots nursing service. At the same time, the management of Internet enterprise platform should be strengthened, the actual needs of patients' personalized nursing services should be scientifically evaluated, and the "Internet + Nursing Service" needs of elderly patients should be accurately connected. In the future, Chinese nursing researchers should consider national contexts in their study and combine clinical nursing practice, carry out DCE, give full play to its advantages in preference research, reasonably allocate scarce resources between limited nursing resources and wireless nursing service needs, and accelerate the development of nursing industry.

There are still some limitations in this study. In addition to the limitations of the discrete selection experimental method itself, this study did not explore the heterogeneity of the study population. In future, research will be carried out in combination with the demographic characteristics of older patients to conduct in-depth research on the heterogeneity of the population.

### **ETHICAL COMPLIANCE**

This study was approved by the ethics committee of Tianyou Hospital affiliated to the Wuhan University of Science and Technology. Signed written informed consents were obtained from the patients or their guardians.

## AUTHOR DISCLOSURE STATEMENT

All authors read and approved the final manuscript. The authors have no potential conflicts of interest to report relevant to this article.

## ACKNOWLEDGEMENT

CL and QC designed the study and performed the experiments, ZZ collected the data, FH analyzed the data, CL and QC prepared the manuscript. Special thanks to Hubei Provincial Health Commission

## FUNDING

This work was supported by the Hubei Provincial Health Commission (H20220097).

## REFERENCE

1. Yan W, Liu L, Huang WZ, et al. Study on the application of the Internet + nursing service in family rehabilitation of common bone and joint diseases in the elderly. *Eur Rev Med Pharmacol Sci*. 2022;26(18):6444-6450. doi:10.26355/eurrev\_202209\_29743
2. Yu HY, Xu SH, Chen YL, Li YX, Yang QH. Nurses' perceptions regarding barriers to implementing the Internet Plus Nursing Service programme: A qualitative study. *J Nurs Manag*. 2022;30(2):511-520. doi:10.1111/jonm.13533
3. Tian F, Xi Z, Ai L, et al; Investigation on Nurses' Willingness to "Internet + Nursing Service" and Analysis of Influencing Factors. *J Multidiscip Health*. 2023;16(251-260). doi:10.2147/JMDH.S396826
4. Gong Y, Zhou J, Ding F. Investigating the demands for mobile internet-based home nursing services for the elderly. *J Investig Med*. 2022;70(3):844-852. doi:10.1136/jim-2021-002118
5. Fan Y, Ma Y, Zhang Y, Sun C; A Retrospective Analysis of Internet-Based Sharing Nursing Service Appointment Data. *Comput Math Method M*. 2022;2022(8735099). doi:10.1155/2022/8735099
6. Nie X; Construction and Application of Comprehensive Nursing Information Service Platform Based on Internet of Things Technology. *J Healthc Eng*. 2022;2022(7178531). doi:10.1155/2022/7178531
7. Chae SH, Kim Y, Lee KS, Park HS. Development and Clinical Evaluation of a Web-Based Upper Limb Home Rehabilitation System Using a Smartwatch and Machine Learning Model for Chronic Stroke Survivors: Prospective Comparative Study. *JMIR Mhealth Uhealth*. 2020;8(7):e17216. doi:10.2196/17216
8. Lehnert T, Günther OH, Hajek A, Riedel-Heller SG, König HH. Preferences for home- and community-based long-term care services in Germany: a discrete choice experiment. *Eur J Health Econ*. 2018;19(9):1213-1223. doi:10.1007/s10198-018-0968-0
9. Bridges JF, Hauber AB, Marshall D, et al. Conjoint analysis applications in health--a checklist: a report of the ISPOR Good Research Practices for Conjoint Analysis Task Force. *Value Health*. 2011;14(4):403-413. doi:10.1016/j.jval.2010.11.013
10. Lancsar E, Louviere J. Conducting discrete choice experiments to inform healthcare decision making: a user's guide. *PharmacoEconomics*. 2008;26(8):661-677. doi:10.2165/00019053-200826080-00004
11. Walsh S, O'Shea E, Pierce T, Kennelly B, Keogh F, Doherty E; Public preferences for home care services for people with dementia: A discrete choice experiment on personhood. *Soc Sci Med*. 2020;245(112675). doi:10.1016/j.socscimed.2019.112675
12. Kampantellou E, Chester H, Davies L, et al; Members of the HOST-D (Home Support in Dementia) Programme Management Group. Carer preferences for home support services in later stage dementia. *Aging Ment Health*. 2019;23(1):60-68. doi:10.1080/13607863.2017.1394441
13. Coast J, Al-Janabi H, Sutton EJ, et al. Using qualitative methods for attribute development for discrete choice experiments: issues and recommendations. *Health Econ*. 2012;21(6):730-741. doi:10.1002/hec.1739
14. Wang Q, Abiuro GA, Yang J, Li P, De Allegri M; Preferences for long-term care insurance in China: Results from a discrete choice experiment. *Soc Sci Med*. 2021;281(114104). doi:10.1016/j.socscimed.2021.114104
15. Vizoso FJ, Eiro N, Cid S, Schneider J, Perez-Fernandez R. Mesenchymal Stem Cell Secretome: Toward Cell-Free Therapeutic Strategies in Regenerative Medicine. *Int J Mol Sci*. 2017;18(9):1852. doi:10.3390/ijms18091852
16. Lee A, Siu S, Lam A, Tsang C, Kung K, Li PK. The concepts of family doctor and factors affecting choice of family doctors among Hong Kong people. *Hong Kong Med J*. 2010;16(2):106-115.
17. Shirazi F, Heidari S, Fard SJ, Ghodsbin F, Koohepeyma MR. Pattern of Internet Use by Iranian Nursing Students. Facilitators and Barriers. *Invest Educ Enferm*. 2019;37(2):e06. doi:10.17533/udea.iee.v37n2e06
18. Jang A, Song CE. Internet of things platform technology used in undergraduate nursing student education: a scoping review protocol. *BMJ Open*. 2022;12(4):e058556. doi:10.1136/bmjopen-2021-058556
19. Hao W, Hao X, Yang C; Design and Optimization of Urinary Real-Time Nursing Model Based on Medical Internet of Things. Design and Optimization of Urinary Real-Time Nursing Model Based on Medical Internet of Things. *Comput Intell Neurosci*. 2022;2022:7067856. doi:10.1155/2022/7067856
20. Rouvinen H, Jokiniemi K, Sormunen M, Turunen H. Internet use and health in higher education students: a scoping review. *Health Promot Int*. 2021;36(6):1610-1620. doi:10.1093/heapro/daab007
21. Li X, Ren S, Gu F; Medical Internet of Things to Realize Elderly Stroke Prevention and Nursing Management. Medical Internet of Things to Realize Elderly Stroke Prevention and Nursing Management. *J Healthc Eng*. 2021;2021:9989602. doi:10.1155/2021/9989602