

Research Article

Forest Health Consumption Satisfaction Evaluation with IPA and Factor Analysis

Bin Liu , Runyu Wang, and Jiehua Lv 

College of Economics and Management, Northeast Forestry University, Harbin 150040, China

Correspondence should be addressed to Jiehua Lv; lvjehua2004@126.com

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To evaluate the current status of forest health and consumption of the elderly, this work used the questionnaire survey method to collect 587 valid questionnaires about the status of forest health and consumption of the elderly in the capital cities of the three northeastern provinces. This work constructs an importance performance analysis (IPA) quartile and factor analysis satisfaction evaluation system by processing the satisfaction and importance distribution data of the three dimensions of infrastructure, leisure and entertainment, and medical rehabilitation. First, this work extracts four common satisfaction factors based on factor analysis. They are satisfaction of forest characteristic physiotherapy entertainment project, satisfaction of forest rehabilitation basic service project, satisfaction of forest rehabilitation infrastructure construction project, and satisfaction of forest health culture consumption project. Secondly, by calculating the factor scores, it can be found that the forest health consumption satisfaction of the elderly population in the three northeastern provinces is the highest in Shenyang, followed by the Northeast, Harbin is slightly lower than the Northeast, and Changchun is the lowest. At present, the elderly population in the capital cities of the three northeastern provinces is relatively satisfied with the supply of forest sanitation services, and only Shenyang has a driving effect on the comprehensive satisfaction of the capital cities in the three northeastern provinces. It was found that Shenyang's satisfaction with forest characteristic physiotherapy and entertainment projects and forest health cultural consumption projects and Harbin's satisfaction with forest reclamation basic service projects and forest reclamation infrastructure construction projects have positive effects on forest reclamation infrastructure construction projects of the three provincial capital cities in Northeast China. However, Changchun City showed opposite effects on the four satisfaction factors. Finally, based on the in-depth analysis of the conclusions, this work puts forward suggestions for the development of the forest health industry and its aging market in the three northeastern provinces.

1. Introduction

The reform and upgrading of the pension industry need to be solved urgently as people's living standards rise and ageing deepens [1, 2]. Three northeastern provinces saw a 16.39 percentage of the aged population, exceeding the national average in the National Bureau of Statistics' seventh census. However, in Northeast China, the health care industry, as the core of the silver hair economy, cannot well adapt to the development trend of the new health care industry with multi-industry integration. There is a contradiction between the supply of traditional forms of pension industry and the increasing demand for aging [3–8]. The ageing system market is being challenged by an unbalanced supply and

demand [9–12]. Residents should receive targeted health care while engaging in general recreational and entertainment activities in the forest, according to a notification issued by the State Forestry Administration. In order to create a forest health system that incorporates food, housing, transportation, tourism, entertainment and culture, sports, health care, and medical treatment, it is critical to unite the many health demands of middle-aged and senior residents. There is a positive and varied development trend in the merger of the forest health care and pension industries [13]. Northeast of China is not only a region with serious aging but also a region rich in forest resources in China [6, 14]. There have been some encouraging developments in the area of forest health and pension integration.

In order to learn more about the state of the pension and health care industries in the three northeastern provinces, questionnaires were sent to the capitals of each of the three provinces, and data on how satisfied the elderly are with and how important forest health care is to them was collected. The data of demographic characteristics of consumer sample groups were collected. In order to better understand the senior population's satisfaction with forest health care, IPA quartile and factor analysis satisfaction evaluation systems were developed [15–18]. The study is aimed at building a pension system for the forest health care business for the three northeastern provinces, namely, Harbin, Shenyang, and Changchun of China.

The unique contribution of the paper includes the following:

- (1) The various dimensions of supply and demand imbalance in the service supply of forest health industry in the elderly population were explored using IPA
- (2) The factor analysis was performed using PCA to process the satisfaction assignment, and satisfaction factor score was calculated for three northeastern provinces
- (3) The consumption satisfaction factor score of forest health service supply for the elderly was calculated

2. Data and Method

2.1. Index System Construction. Methods of theoretical research and framework model construction are used to construct a questionnaire index system that is consistent with the model and reflects the satisfaction of elderly consumers with forest health service providers. This paper also incorporates findings from many scholars who have investigated and researched forest health base construction [19–21]. There are finally three assessment factor layers and 15 evaluation indices determined after preinvestigation and adjustment. In the end, the questionnaire is made available on the Internet.

- (1) In the supply factor layer of infrastructure services, according to reference [22], the infrastructure services of forest health base are mainly reflected in accommodation, catering, transportation, entertainment facilities, and other infrastructure. Therefore, six secondary evaluation indexes are selected in the factor layer, which are basic accommodation services, leisure entertainment and pension facilities, basic catering facilities, traffic convenience inside and outside the scenic area, safety planning, and public service facilities
- (2) In the supply factor layer of leisure and entertainment services, according to the research of reference [23, 24] and other scholars, forest health and leisure and entertainment services are mainly manifested in forest characteristic accommodation, forest characteristic activities, and forest characteristic sports.

Therefore, five indicators are selected: folk custom, commercial shopping area, folk custom characteristic activities, forest walking, and tourism vacation

- (3) At the supply factor level of medical rehabilitation services, combined with reference [25] on forest rehabilitation bases from the perspective of medicine, four secondary indicators are selected, namely, forest sports rehabilitation, forest health lecture hall, forest rehabilitation training, and forest health culture center [26]. Among them, the content and interpretation of specific secondary indicators in the three element layers are shown in Table 1. The observation problems for three dimensions are as follows: (1) please score the consumer satisfaction and emphasis degree of each item in the basic service part of forest health according to the previous consumer experience. (2) According to your previous consumption experience, please score the consumer satisfaction and emphasis degree of each item in the auxiliary construction part of forest health and maintenance, such as cultural entertainment, tourism, and leisure. (3) Please score the consumer satisfaction and emphasis degree of each item in the medical service part of forest health based on the previous consumer experience

2.2. Research Method

2.2.1. IPA. Two-dimensional model of the importance-satisfaction relationship analysis or IPA is represented in Figure 1 which enables collection of data on the same dimension's importance and satisfaction. The IPA is an extremely useful technique that help managers in an organization explore attributes that can be improved and evaluate elements of the marketing program. This helps in the development of efficient market strategies providing useful information to the managers. As an example, it helps to determine which features in an organization requires additional resources than the others and vice versa. Also, it enables identification of factors that impact customer satisfaction. The IPA quartile, as shown in Figure 1, is constructed by taking the average of each dimension's mean points, such as importance mean and satisfaction mean [27]. The continuation zone can be found in the first quadrant. Areas of oversupply can be seen in the second quadrant. Three and four symbolize inclusive reform and critical reform sectors.

2.2.2. Factor Analysis Satisfaction Evaluation. Factor analysis, which is based on correlation and the concept of dimension reduction, can reduce numerous variables under study into a small number of more complete ones that are neither related nor visible immediately. Factor analysis has the advantage of being able to represent the effects of several variables on the correlation of samples adequately because the factors are independent. Information weight supplied by the contribution rate of factor variance is effective in ensuring impartiality because there are less human factors. Analysis of common factor variances, such as their

TABLE 1: Indicators and variable settings.

Dimension	Indicator	Configuring
Infrastructure service supply	Basic accommodation services	X_1
	Leisure entertainment and pension facilities	X_2
	Basic catering services	X_3
	Traffic convenience inside and outside scenic area	X_4
	Safety program	X_5
	Public service facilities	X_6
Leisure entertainment service supply	Homestay inn	X_7
	Commercial shopping area	X_8
	Folklore characteristic activities	X_9
	Forest walking	X_{10}
	Tourism resort	X_{11}
Medical care service supply	Forest sports rehabilitation	X_{12}
	Forest health lecture	X_{13}
	Forest rehabilitation training	X_{14}
	Forest health culture center	X_{15}

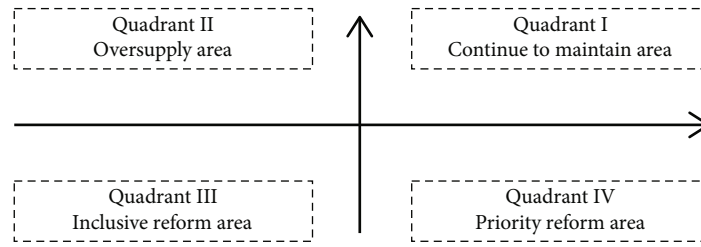


FIGURE 1: IPA quartile.

maximum variance approach and principal component analysis (PCA), is used to discover which types of factors can be found. PCA is extremely useful in expediting the computation by reducing the dimensionality of the dataset. Thus, the accuracy of classification gets enhanced. In PCA, the correlated features are eliminated as it does not contribute towards decision-making. Thus, the performance of the model gets improved significantly. Additionally, the index values in each component are determined by the rotational component matrix's absolute load value, and the factors are given names based on those index values. It is estimated by combining the coefficient matrix of each factor's score. Additionally, the ratio of rotating sum of square load to cumulative sum of square load is used as a coefficient and factor score as a variable to construct the composite score function. A higher contribution rate indicates a city's positive pull on the three urban comprehensive factors in this dimension; a lower contribution rate indicates the opposite. The contribution rate is expressed by the proportion of matching factor scores in the urban area.

2.3. Data Source. This study collects data in the form of questionnaire. Based on the analysis of the current service

supply of forest health, a questionnaire of forest health consumption status of the elderly population in three northeastern provinces was made, which was composed of basic information and the five-level Likert scale of satisfaction and importance (assignment of 1-5 points of index satisfaction and importance, "1" is very dissatisfied; "2" is dissatisfaction; "3" is general; "4" is satisfaction; "5" is very satisfied). The research sites are located in the capital cities of the three northeastern provinces, Harbin, Shenyang, and Changchun. After a month of collection, a total of 610 questionnaires were collected, with 587 valid questionnaires, and the effective rate was 92.23%. The questionnaire has high efficiency, which is convenient for empirical reliability and validity test on this basis, and provides statistical significant support for model establishment.

2.3.1. Descriptive Statistical Analysis. The basic information data of 587 questionnaires are sorted out, and the results are shown in Table 2. Firstly, in terms of the sample areas, the number of samples in Harbin, Shenyang, and Changchun accounts for 27.77%, 33.22%, and 39.01%, respectively. This quantitative difference is acceptable, which can provide a good precondition for the subsequent comparison and

TABLE 2: Basic information collection of questionnaire.

Indicator	Index characteristic	Index sample	Index frequency
Age	55~60	284	48.38%
	61~65	128	21.81%
	66~70	125	21.29%
	71~75	34	5.79%
	75~80	15	2.56%
	Over 80 years old	1	0.17%
Sexuality	Male	368	62.69%
	Female	219	37.31%
Place of abode	Harbin	163	27.77%
	Shenyang	195	33.22%
	Changchun	229	39.01%
Current status of work	Not engaged in a profession or work	354	60.31%
	Still engaged in a profession or work	233	39.69%
Current living condition	Living with children	429	73.08%
	Living with old companions	118	20.10%
	Widowed or divorced, solitary	31	5.28%
	Miscellaneous	9	1.53%
Current main income source	Wage or retirement wage	278	47.36%
	Social security	207	35.26%
	Child support	87	14.82%
	Miscellaneous	15	2.56%
Monthly profit	Under 3000 yuan	184	31.35%
	3000-4000 yuan	266	45.32%
	4000-5000 yuan	110	18.74%
	5000 yuan or more	27	4.60%
Household monthly consumption	Under 3000 yuan	316	53.83%
	3000-4000 yuan	209	35.60%
	4000 to 5000 yuan	42	7.16%
	5000 yuan or more	20	3.41%

inference of the article. In terms of gender and age structure, older persons aged 55 to 70 account for 92.38 percent of the main consumers. Male consumers are twice as much as female consumers. Over half of the sample population, 60.31 percent are not currently engaged in an occupation or work. At present, most people live with their children, accounting for 73.08%, and 20.10% live with their spouses. In addition to wages or retirement wages and social security, the main sources of income of the sample aged groups are more than 80%. At this stage, the monthly income and household consumption of the sample aged groups are mainly below 3000 and between 3000 and 4000 yuan (middle consumption and middle-lower income level), and both are more than 70%.

Table 3 shows the average of the indicators for the assignment data from 587 valid surveys. The IPA quadrangle can be easily constructed in Section 2.1. At the same time, a rating scale is set up in the following manner: a score of 0 to 1 is considered poor, a score of 1 to 2 is considered average, a

score of 3 to 4 is considered good, and a score of 4 to 5 is considered exceptional.

The lowest average attention index is 3.5707, while the highest is 3.9336. Average satisfaction ranges from 3.9730 to 3.9830. To get a good measure, the sample group's two dimensions are awarded scores between 3 and 4. The average value of the happiness index assignment data, on the other hand, is higher than the attention index value.

3. Result and Analysis

3.1. Empirical Result

3.1.1. Reliability Test. Reliability test is a basic test for reliability test in questionnaire survey. It is measured by the value of Cronbach's α (reliability coefficient). In this paper, SPSS23.0 was used to calculate the reliability coefficient of 587 valid questionnaires. The Cronbach's α was 0.875 and 0.857, respectively, which were greater than 0.8. Therefore,

TABLE 3: Descriptive statistical analysis of sample index assignment data.

Dimension	Indicator	Configuring	Mean attention	Mean satisfaction
Infrastructure service supply	Basic accommodation services	x_1	3.9336	3.9761
	Leisure entertainment and pension facilities	x_2	3.7530	3.8313
	Basic catering services	x_3	3.8484	3.8024
	Traffic convenience inside and outside scenic area	x_4	3.7189	3.7700
	Safety program	x_5	3.7734	3.7632
	Public service facilities	x_6	3.7189	3.8518
Leisure entertainment service supply	Homestay inn	x_7	3.8620	3.9830
	Commercial shopping area	x_8	3.7632	3.8893
	Folklore characteristic activities	x_9	3.6337	3.9029
	Forest walking	x_{10}	3.8518	3.7342
	Tourism resort	x_{11}	3.5707	3.8109
Medical care service supply	Forest sports rehabilitation	x_{12}	3.5911	3.9574
	Forest health lecture	x_{13}	3.8995	3.8092
	Forest rehabilitation training	x_{14}	3.8109	3.8842
	Forest health culture center	x_{15}	3.6474	3.8927

the reliability test showed that the reliability of the questionnaire was high.

3.1.2. Validity Test. For validity analysis, the Kaiser-Meyer-Olkin (KMO) indicators are commonly used in statistics. The KMO test helps to understand the suitability of the data for conducting factor analysis. The statistic measures the proportion of variance among variables that have common variance. The lower the proportion value is the data is considered to be more suited for factor analysis. Similarly, SPSS23.0 was used to calculate the KMO values of the questionnaire index importance and satisfaction scale assignment data, and the KMO values were 0.863 and 0.851, respectively, which were greater than 0.85. In addition, based on the Bartlett ball test, the Sig values were significant (Sig = 0.000, Sig < 0.05). In summary, it is considered that the validity test is suitable for factor analysis.

3.2. IPA. Combined with the 15 coordinate points obtained in Table 3 and the theoretical basis of the IPA model in Section 2.2.1, SPSS23.0 was used to construct a quarter map of the attention and satisfaction of the supply of forest health services for the elderly population in the three northeastern provinces. The mean values of the 15 coordinate points (3.75843, 3.85724) were used as the origin (Figure 2).

Through Figure 2, it can be clearly seen that the four quadrant regions contain 4, 3, 4, and 4 of the 15 indicators.

(1) *Quadrant I:* continue to maintain the area, showing a high degree of consumer attention and satisfaction. Homestay, basic accommodation services, commercial shopping areas, and forest rehabilitation training four indicators are included. Two of the four indicators are related to the supply of accommodation experience services. It can be considered that the

elderly consumption sample groups in the three northeastern provinces at the present stage have a high degree of recognition of the accommodation experience service supply of the current forest health supply. In addition, the commercial shopping in the dimension of leisure and entertainment is obviously at the edge of the first quadrant. At present, the consumers' recognition of the commercial shopping service supply in the forest health experience only reaches the lower standard of the region, and the subsequent development should invest more time and energy to improve and improve the recognition; finally, the high recognition of forest rehabilitation training also reflects the main cognition and needs of the elderly population for the function of forest rehabilitation in the health care dimension, that is, rehabilitation training under the action of forest rehabilitation factors

(2) *Quadrant II:* in the oversupply area, the regional index has higher consumption satisfaction and lower consumption attention. Forest sports health, folk activities, forest health, and recuperation culture center three indicators are located in this area. Through the observation of the three positions, it can be found that the degree of attention decreases in turn from forest sports rehabilitation, folk custom activities, forest health, and recuperation cultural centers, and so is satisfaction. There is an oversupply problem in the supply of indicators in this region. Low attention can also be understood as the demand for this indicator is not high. The market pursues the balance between supply and demand, and the closer it is to the equilibrium point, the higher the economic utility is. However, excessive supply will only

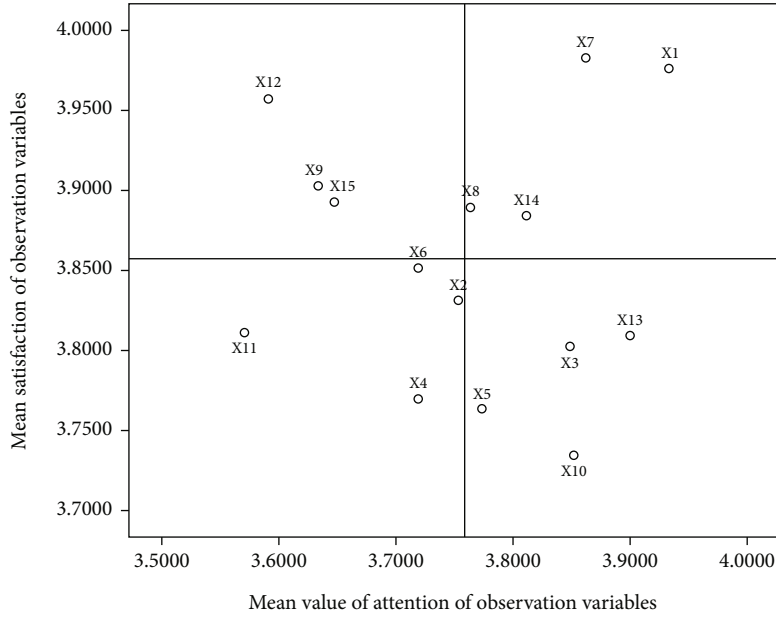


FIGURE 2: IPA quartet of importance and demand for forest health services for aged population.

increasingly deviate from the balance, bringing counterproductive economic benefits. The enthusiasm of the elderly population for forest sports, health and recuperation cultural centers, and folk custom activities is lower than that of the youth and the middle-aged population as a whole, which is also one of the reasons for excessive supply. For regional indicators, how to adjust the output content of such services to improve the attention of the elderly population needs is the key to its subsequent development and reform

- (3) *Quadrant III*: The region is an inclusive reform area with low consumer attention and demand. It includes public service facilities, tourism vacation, leisure and entertainment, and pension facilities; the scenic area traffic convenience related four indicators. The four indicators come from the two dimensions of infrastructure service supply and leisure entertainment service supply. At present, the service supply and consumption demand in the market are at a low level, and there is no serious tilt and imbalance. Improving and optimizing the quality and connotation of such service supply to bring higher attraction and driving consumption to pay attention to demand to achieve the common improvement of both supply and demand are the follow-up development directions
- (4) *Quadrant IV*: four indicators for basic catering services, forest walks, safety planning, and forest health workshops are included in this priority reform area. The four indicators show a high degree of consumer attention but harvest a lower consumer satisfaction. In the market economy system, the most intuitive

criteria for judging the quality of service supply are consumers' postconsumption perception and a series of consumer loyalty caused by it. Combined with the characteristics of market economy system, consumers' consumption perception is far lower than service expectation, which will bring more serious risks and consequences for the industry than excessive supply. It is an effective way to analyze the preference of the elderly consumer population for service supply and quickly improve the satisfaction of consumption perception to reach a high level of supply and demand balance

3.3. Construction of Satisfaction Evaluation System Based on Factor Analysis. From the KMO value of satisfaction assignment data calculated by empirical validity analysis in Section 3.1.1, we can know that the satisfaction scale is suitable for factor analysis.

3.3.1. Extraction of Common Factor and Total Variance of Interpretation. The satisfaction part of the scale data using SPSS23.0 processing can be output based on principal component analysis of 15 indicators of common factor variance and interpretation of the total contrast. The common factor variance represents the common degree of the initial variable; that is, the common factor can explain the variance of the observed variable. In this study, except the extraction value of safety planning is 0.388 (less than 0.5), the extraction value of observation variables is higher than 0.5, and the extraction value is higher than 0.6 accounted for two-thirds of the index. The common factor variance (common degree) of variables is acceptable, and the next common factor is extracted. The total variance table gives the cumulative variance explained by each common factor of the four common factor components. From Table 4, it can be seen that

TABLE 4: Total variance of interpretation.

Component	Initial eigenvalue			Extraction of square sum of loads			Square sum of rotation load		
	Footing	Variance proportion	Cumulative	Footing	Variance proportion	Cumulative	Footing	Variance proportion	Cumulative
1	5.002	33.346	33.346%	5.002	33.346	33.346%	3.037	20.248	20.248%
2	2.045	13.632	46.978%	2.045	13.632	46.978%	2.609	17.393	37.641%
3	1.082	7.210	54.188%	1.082	7.210	54.188%	1.952	13.011	50.652%
4	1.005	6.698	60.886%	1.005	6.698	60.886%	1.535	10.234	60.886%

the initial variances explained by the four common factors are 33.346%, 13.632%, 7.210%, and 6.698%, respectively. At the same time, the eigenvalues of the first four factors are greater than 1, and the eigenvalues of factor 1 are as high as 5.002. The cumulative variance explained by the common factor is 60.866% (>50%). Therefore, it is concluded that the four types of factors extracted can explain the information contained in the original variables to a certain extent.

3.3.2. Factor Naming and Interpretation. Factor load is the correlation coefficient between variables and common factors. The greater the absolute value of load between variables and factors, the higher the correlation between them, and this variable can also represent the factor. Compared with the unrotating component matrix, the rotated component matrix is more persuasive in explaining the meaning of each factor. Therefore, the original rotation matrix is orthogonally rotated by the method of Caesar normalized maximum variance. After seven iterations, the rotation component matrix of the variable factor load is finally obtained, as shown in Table 5.

The size of the factor load determines the ability and degree of the variable to represent this factor component. By observing the factor load values for each indicator given in Table 5, the indexes included in the four factors are divided and named. The indexes included in the four factors are divided and named.

- (1) The common factor 1 includes six index variables: residential accommodation, folk custom characteristic activities, forest sports rehabilitation, basic accommodation, forest health and recuperation cultural center, and safety planning. This factor also includes three service supply dimensions: infrastructure, leisure and recreation, and health and recuperation medical care, and its absolute value of load value is significantly higher than its index. Factor internal indicators reflect the connotation of forest culture, leisure and entertainment, and physical therapy, so it is named as the satisfaction of forest characteristic physical therapy entertainment project
- (2) In common factor 2, commercial shopping area, forest rehabilitation training, traffic convenience inside and outside the scenic area, and forest walk are included in the four indicators. The four load values are all higher than 0.6, which can be well representative for common factor 2. The four indicators

include shopping, transportation, training, and walkways and have the characteristics of forest rehabilitation, so the common factor is named forest rehabilitation basic service satisfaction

- (3) Common factor 3 includes three indicators: public service facilities, tourism vacations, leisure and entertainment, and pension facilities. The indicators also include the connotation of infrastructure and forest rehabilitation, so they are named as the satisfaction of forest rehabilitation infrastructure construction projects
- (4) The common factor 4 is composed of two index variables: basic catering service and forest health lecture. The variables belong to the dimension of infrastructure service supply. The factor is composed of related indicators of forest culture and health consumption project system, which is named as forest health culture consumption project satisfaction

3.3.3. Calculation Factor Score. The factor score function here represents the linear combination of four common factors and the original 15 variables. The principal component analysis extraction and the Caesar normalized maximum variance method are rotated to obtain the component score coefficient matrix, as shown in Table 6, which is the coefficient value of each linear combination of variables.

Four satisfaction factor evaluation score formulas are

$$\begin{aligned}
 F_1 = & 0.227X_1 + 0.044X_2 - 0.076X_3 + 0.011X_4 + 0.108X_5 \\
 & - 0.067X_6 + 0.320X_7 - 0.105X_8 + 0.304X_9 - 0.004X_{10} \\
 & - 0.040X_{11} + 0.251X_{12} - 0.080X_{13} - 0.102X_{14} + 0.241X_{15},
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 F_2 = & -0.003X_1 + 0.143X_2 + 0.015X_3 + 0.346X_4 + 0.119X_5 \\
 & - 0.094X_6 - 0.003X_7 + 0.401X_8 - 0.127X_9 + 0.255X_{10} \\
 & - 0.089X_{11} - 0.150X_{12} - 0.123X_{13} + 0.293X_{14} + 0.206X_{15},
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 F_3 = & -0.136X_1 + 0.240X_2 - 0.182X_3 - 0.139X_4 + 0.119X_5 \\
 & + 0.474X_6 - 0.026X_7 - 0.197X_8 + 0.173X_9 + 0.068X_{10} \\
 & + 0.434X_{11} + 0.070X_{12} + 0.126X_{13} - 0.003X_{14} - 0.306X_{15},
 \end{aligned} \tag{3}$$

TABLE 5: Rotation component matrix.

Indicator	Component			
	1	2	3	4
Homestay inn	0.800	0.149	0.072	0.003
Folklore characteristic activities	0.751	0.029	0.286	-0.020
Forest sports rehabilitation	0.731	-0.006	0.183	0.270
Basic accommodation services	0.682	0.130	-0.043	0.279
Forest health culture center	0.661	0.363	-0.215	0.087
Safety program	0.446	0.060	0.269	0.337
Commercial shopping area	0.026	0.786	0.082	0.244
Forest rehabilitation training	0.018	0.696	0.300	0.198
Traffic convenience inside and outside scenic area	0.207	0.694	0.105	0.068
Forest walking	0.163	0.638	0.349	0.009
Public service facilities	0.052	0.261	0.769	0.171
Tourism resort	0.106	0.249	0.714	0.167
Leisure entertainment and pension facilities	0.208	0.506	0.510	-0.123
Basic catering services	0.203	0.204	-0.018	0.788
Forest health lecture	0.169	0.120	0.345	0.683

TABLE 6: Component score coefficient matrix.

Indicator	Component			
	1	2	3	4
Basic accommodation services	0.227	-0.003	-0.136	0.106
Leisure entertainment and pension facilities	0.044	0.143	0.240	-0.268
Basic catering services	-0.076	0.015	-0.182	0.621
Traffic convenience inside and outside scenic area	0.011	0.346	-0.139	-0.073
Safety program	0.108	-0.119	0.119	0.167
Public service facilities	-0.067	-0.094	0.474	0.009
Homestay inn	0.320	-0.003	-0.026	-0.171
Commercial shopping area	-0.105	0.401	-0.197	0.105
Folklore characteristic activities	0.304	-0.127	0.173	-0.196
Forest walking	-0.004	0.255	0.068	-0.141
Tourism resort	-0.040	-0.089	0.434	0.004
Forest sports rehabilitation	0.251	-0.150	0.070	0.076
Forest health lecture	-0.080	-0.123	0.126	0.501
Forest rehabilitation training	-0.102	0.293	-0.003	0.048
Forest health culture center	0.241	0.206	-0.306	-0.061

$$\begin{aligned}
F_4 = & 0.106X_1 - 0.268X_2 + 0.621X_3 - 0.073X_4 + 0.167X_5 \\
& + 0.009X_6 - 0.171X_7 + 0.105X_8 - 0.196X_9 - 0.141X_{10} \\
& + 0.004X_{11} + 0.076X_{12} + 0.501X_{13} + 0.048X_{14} - 0.061X_{15}.
\end{aligned} \tag{4}$$

Combining Table 4 and taking the scores of four types of satisfaction factors as variables, the proportion of the explained variance after rotation of the four factors in the total cumulative explained length difference as the coefficient to construct the comprehensive score function, as shown in Equation (5). Through the calculation and comparison of comprehensive score and factor score, the

comprehensive score evaluation of forest health consumption satisfaction of the elderly population in the three north-eastern provinces was carried out.

$$\begin{aligned}
F &= (20.248F_1 + 17.393F_2 + 13.011F_3 + 10.234F_4) \div 60.8 \\
&= 0.333F_1 + 0.286F_2 + 0.214F_3 + 0.168F_4.
\end{aligned} \tag{5}$$

3.3.4. Satisfaction Evaluation of Forest Health and Maintenance Consumption via Factor Score. The satisfaction assignment data for 15 indicators from 587 questionnaires into the calculation formula for the divided and named 4

TABLE 7: Satisfaction factor score of forest health service supply for the elderly population.

City/region	F_1	Score ranking	F_2	Score ranking	F_3	Score ranking	F_4	Score ranking	Comprehensive score F	Score ranking
Shenyang	4.2190	1	3.6198	3	2.6714	4	2.9088	1	3.5005	1
Harbin	3.9671	4	3.6910	1	2.7801	1	2.6381	4	3.4150	3
Changchun	4.0623	3	3.5962	4	2.6764	3	2.7022	3	3.4080	4
Synthesis	4.0878	2	3.6304	2	2.7038	2	2.7531	2	3.4406	2

satisfaction factors and the calculation formula for the comprehensive satisfaction score were put. Finally, the average results of four satisfaction factors (F_1 - F_4) and comprehensive satisfaction scores (F) were obtained from the perspective of three provinces and the entire three northeast provinces, as shown in Table 7.

Through the observation of the four satisfaction scores and comprehensive scores in Table 7, it can be inferred that the comprehensive satisfaction of the elderly population in the three cities and the three provincial capital cities in Northeast China to the supply of forest health services is in a good degree (the scores are between 3 and 4). As shown in Figure 3, from high to low, the difference is not big, followed by Shenyang, 3.5005 points; northeast three provinces three provincial capital city synthesis, 3.4406 points; Harbin, 3.4150 points; and Changchun, 3.4080 points; from the calculation results, only Shenyang scored higher than the comprehensive scores of the three provincial capital cities. It can be considered that Shenyang has a positive pulling effect on the comprehensive satisfaction of the capital cities of the three northeastern provinces, but the other two cities show a certain reverse pulling effect on the numerical value.

From Tables 7 and 8, we can analyze the direction and size of the city's force on the region in four factor dimensions. In the common factor 1 forest characteristic physical therapy entertainment project satisfaction, the three provincial capitals of the three northeastern provinces are in good condition at the present stage (score in 4-5). Shenyang in this project satisfaction evaluation score is the highest, 4.2190. The second is the comprehensive evaluation of three capital cities in three northeastern provinces. The third place is Changchun City, and the score is 4.0623, lower than the comprehensive score of the three cities in the factor; the last is Harbin, with a score of 3.9671, which is the only area or city that has been evaluated well in this project. At the same time, the contribution rate of Harbin and Changchun is less than 1 except Shenyang, which is 1.0321 (higher than 1). It can be considered that Harbin and Changchun have reduced the comprehensive satisfaction of the three provincial capital cities in this project in the F_1 factor dimension, while Shenyang has a certain pulling effect on the F_1 factor. In the common factor 2, the satisfaction of basic forest rehabilitation service projects was in a good stage (scores were between 3 and 4), and Harbin was the highest (3.6910), which was higher than the comprehensive F_2 (3.6304) of the three provincial capitals. The contribution rate of this factor to the comprehensive was 1.0617, which was the obvious pulling effect. However, although the contribution rates of the two provincial capitals are less than 1, the contribution rates of

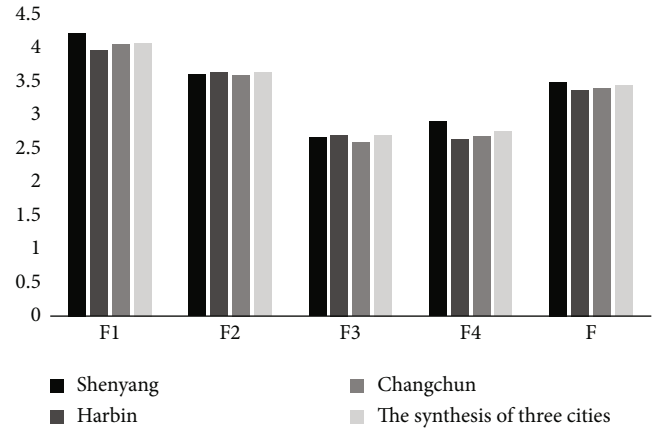


FIGURE 3: Consumption satisfaction factor score of forest health service supply for the elderly.

the two are similar and close to 1, and the difference between the two urban contribution rates is less than 0.1. Therefore, it is believed that the satisfaction of the three provincial capital cities in the F_2 factor dimension is very close; for the satisfaction of the forest health infrastructure construction project in common factor 3 and the satisfaction of the forest health and cultural consumption project in common factor 4, the scores of the two factors in the three provincial capitals and the three provincial capitals are low, both between 2.6 and 3, only at the medium level (the scores are between 2 and 3). Among them, Harbin has a pulling effect on the comprehensive F_3 factor of the three provincial capitals, while Shenyang has a pulling effect on the comprehensive F_4 .

4. Conclusion and Suggestion

4.1. Conclusion. At present, there is a certain dimension of supply and demand imbalance in the service supply of forest health industry in the elderly population. By using factor analysis to process the satisfaction assignment data of a total of 15 indicators in the three dimensions of infrastructure, leisure and entertainment, and health care, four common factors are obtained: satisfaction of interforest characteristic physiotherapy and entertainment projects, satisfaction of forest rehabilitation basic service projects, satisfaction of forest rehabilitation infrastructure construction projects, and satisfaction of forest health and cultural consumption projects; through the satisfaction factor score calculation can be drawn ranking: Shenyang (3.5005) > Northeast (3.4406) > Harbin (3.4150) > Changchun (3.4080). At present, the

TABLE 8: Contribution rate of capital cities of northeast three provinces to three provincial capitals.

City	F_1	Contribution rate to comprehensive F_1	F_2	Contribution rate to comprehensive F_2	F_3	Contribution rate to comprehensive F_3	F_4	Contribution rate to comprehensive F_4
Shenyang	4.2190	1.0321	3.6198	0.9971	2.6714	0.9880	2.9088	1.0566
Harbin	3.9671	0.9705	3.6910	1.0167	2.7801	1.0282	2.6381	0.9582
Changchun	4.0623	0.9938	3.5962	0.9906	2.6764	0.9899	2.7022	0.9815

elderly population in the capital cities of the three northeastern provinces is satisfied with the supply of forest health services. Shenyang has a pulling effect on the comprehensive satisfaction of the capital cities of the three northeastern provinces. However, the other two cities show a certain reverse pull-down effect in numerical value. In addition, by observing the comprehensive satisfaction factor, the overall satisfaction of forest health infrastructure construction projects and forest health and cultural consumption projects is low at the present stage, only reaching the medium level, and the satisfaction of forest characteristic physiotherapy and entertainment projects and the satisfaction of forest rehabilitation basic service projects are at a good and excellent level, respectively. The factor contribution rate reflects the current satisfaction degree of Shenyang in the forest characteristic physiotherapy and entertainment projects and forest health and cultural consumption projects (common factors 1 and 4). Harbin has a pulling effect on the corresponding satisfaction factors of the capital cities of the three northeastern provinces in the satisfaction degree of basic forest rehabilitation service projects and forest rehabilitation infrastructure construction projects (common factors 2 and 3) (the contribution rate is greater than 1). However, Changchun has a reverse effect on the four satisfaction factors (the contribution rate is less than 1).

4.2. Suggestion

(1) Build high-quality forest health base, continuously promote supply-side reform, enrich the connotation of forest health development, and promote high-quality development of forest health industry. Consumer perceived quality and perceived value will affect consumer satisfaction and loyalty. High-quality forest ecological environment is not only the basis for the high-quality development of forest health and maintenance industry but also a strong manifestation of practicing the new development concept and the two mountains theory. The three eastern provinces are rich in forest resources, with the help of congenital advantages, balanced protection, and utilization. According to local conditions, it is necessary to innovate the health care model, continuously promote the supply-side reform of forest health care industry, meet the growing health care needs of the consumer groups dominated by the elderly, and promote the superior coupling between the supply side and the demand side. Establish scientific and efficient forest health evaluation system and strict industry access mechanism. It aids

in building a forest health base with high standards, starting from two aspects of software and hardware, while improving the supporting infrastructure, strengthening the construction of talent team, and introducing high-level professionals. To meet the basic needs of consumer traffic safety and health care, improve service quality, improve cultural experience, and enhance humanistic care

- (2) Adhere to people-oriented, using modern scientific and technological means to promote the diversified development of forest health industry. The eastern three provinces have superior forest endowments, but the development of forest health industry in the three provinces is different. Faced with the current massive consumption needs of the elderly population, all regions should adhere to people-oriented and adhere to consumer demand-oriented; according to the actual situation, relying on geographical advantages, take the initiative to develop appropriate forest health development strategy. On the basis of reserving differences, we should coordinate as a whole, take various measures simultaneously, strengthen regional cooperation, explore the law of industrial development, improve industrial efficiency, and cultivate economic growth points. According to the obvious characteristics of the elderly, the connotation and form of service supply of forest health industry in different consumer groups such as diseases, subhealth, and health preservation are excavated and supplemented to achieve the balance of different demand levels. Information technologies such as big data and cloud computing are used to empower the traditional forest health industry. Based on the physical condition of the elderly, a health monitoring system is developed to detect and analyze data from time to time and provide personalized rehabilitation program for each elderly. Using big data and cloud computing, this paper analyzes consumers' common preferences, develops new health care models such as cultural pension and tourism pension, and improves the loyalty of the elderly to forest health care consumption
- (3) Build characteristic health brand, promote forest health through multiple channels, and explore the potential consumer market. In view of the deepening aging in China, the consumption potential of the aging market is huge. We should adhere to the concept of green development, highlight the regional

characteristics of the three eastern provinces, identify industrial positioning, improve brand influence, build high-quality demonstration health bases, and create high-quality health industry chain. At present, the awareness of forest health among the elderly in China is generally low. It is imperative to promote forest health through multichannel publicity. At the macro level, the government should strengthen publicity and improve the overall public awareness; at the micro level, service providers can enhance the identity of the elderly to forest health by carrying out forest health culture lectures, experiencing forest tourism, and establishing health forums. Good first-hand chess makes up the short board in advance. With the help of short video, live delivery, and other Internet communication means, the forest health culture matrix of the three eastern provinces is built, and the brand image is improved throughout the country and the world, so as to tap the potential consumer market and promote the sustainable and healthy development of forest health

- (4) Give full play to policy advantages, change development ideas, and cultivate new competitive advantages of forest health differentiation in the three eastern provinces. Northeast China has high latitude and low temperature in winter, which is not conducive to the whole-season forest rehabilitation. Facing the climate disadvantage, adjust the management strategy actively; highlight the summer forest health, winter spring physiotherapy, and other characteristic projects; and promote the flexible development of industry. Taking Heilongjiang Province as an example, in October 2021, the people's government of Heilongjiang Province announced opinions on further stimulating the vitality of forest and grass development to help the high-quality development of the economy of the whole province. Opinions point out the increase support for social capital entering the forest and grass industry. The ecological tourism rehabilitation industry, ice and snow economic industry, and forest product processing industry are included in the land space planning at all levels. The annual land use plan is appropriate to tilt to the ecological tourism rehabilitation, ice and snow economic, and forest product processing projects. The objective is to strengthen government-enterprise cooperation, giving full play to policy advantages, helping the transformation, and upgrading of traditional health care industry. The government can provide appropriate tax relief, loan discount, and other policy support for forest health enterprises. At the same time, the ice and snow economy in the three eastern provinces is developed and the consumption potential is huge. With the help of the favorable opportunity of the Beijing Winter Olympics, more ice and snow elements are integrated into the development of forest rehabilitation; differentiated competition, diversified

development, and new advantages of industrial development are cultivated

- (5) Focus on the development of forest health and maintenance+, accelerate the formation of a well-off pattern, and promote the integrated development of forest health and maintenance. At the same time, the use of community resources plays to the advantages of natural location, forest tourism, forest research, and other innovative activities. By deepening the integration of colleges and forest health industry, a directional training of high-level health professionals is needed to ensure intellectual supply of forest health, build a platform for the transformation of scientific and technological achievements for the elderly, and continuously improve the scientific and technological efficiency of forest health industry; to further strengthen the cooperation with medical institutions and invite experts from well-known hospitals regularly to improve the quality of health care services; to carry out forest Tai Chi, forest-medicated baths and other health activities, and innovative health model, cultivating forest health culture and enhancing the natural experience of the elderly in forest health; under the condition of not destroying the ecological environment, the organic agricultural products, natural vegetation, and other forest resources are rationally developed. Let the forest health form part of people's daily life, truly realize the formation of a well-off pattern

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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References

- [1] X. Hao, D. Be, and L. Liu, "Challenges and countermeasures of health care for the aged in China," *Zhongzhou Journal*, vol. 1, no. 7, pp. 103–106, 2021.
- [2] H. Liu, "Trend of population aging in the world and China," *Scientific research on aging*, vol. 9, no. 12, pp. 1–16, 2021.

- [3] X. He, "Analysis of the development of silver hair industry in Northeast China under the background of population aging," *Marketing industry*, vol. 1, no. 35, pp. 195-196, 2021.
- [4] X. Zhang, "The development of aging industry, to further develop the elderly consumer market in Heilongjiang province," *Market and population analysis*, vol. 1, no. 2, pp. 58-63, 2003.
- [5] M. Li, "Comprehensive revitalization and high-quality development of Northeast China-achieving the "double carbon" goals and coping with aging," *Journal of Harbin Institute of Technology (Social Sciences Edition)*, vol. 23, no. 6, pp. 144-153, 2021.
- [6] H. Wang, J. Liu, and Y. Fang, "Multi-scale spatial-temporal evolution and influencing factors of population aging in Northeast China," *Regional research and development*, vol. 40, no. 6, pp. 147-153, 2021.
- [7] R. Wang, "Exploring the problem of population aging in Northeast China," *Theory*, vol. 1, no. 3, pp. 65-67, 2019.
- [8] Q. Liu, "The old-age security strategy under the background of population aging-the northeast region as an example," *Social security research*, vol. 1, pp. 577-585, 2006.
- [9] X. Yang, "Problems and suggestions for the development of aging in China," *Social Welfare (Theoretical Edition)*, vol. 1, no. 8, pp. 3-9, 2021.
- [10] Y. Zheng, "Analysis of population aging and coping problems in China, Japan and South Korea," *Modern Communication*, vol. 1, no. 22, pp. 207-209, 2021.
- [11] F. Prince, "From the perspective of positive aging, the dilemma and path construction of the coordinated development of Guangdong-Guangxi health and housing industry," *Journal of Panzhihua University*, vol. 39, no. 1, pp. 29-37, 2022.
- [12] W. Fang, "The impact and path of population aging on industrial structure servicization-evidence from 49 countries," *Comments*, vol. 12, no. 6, pp. 110-120, 2021.
- [13] Z. Tao, "Forest health and healthy pension," *Nowadays, Science Park*, vol. 1, no. 4, pp. 87-91, 2020.
- [14] C. Y. Chang, S. Bhattacharya, P. M. Raj Vincent, K. Lakshmana, and K. Srinivasan, "An efficient classification of neonates cry using extreme gradient boosting- assisted grouped-support-vector network," *Journal of Healthcare Engineering*, vol. 2021, Article ID 7517313, 14 pages, 2021.
- [15] C. Yuan, "New advantages of forest resources in northeast forestry region," *Journal of Northeast Forestry University*, vol. 1, no. 12, pp. 65-67, 2007.
- [16] P. Tian and S. Chen, "Research on the path to improve the satisfaction of science popularization venues based on IPA and fs QCA-taking the science and technology museum of China as an example," *Science popularization research*, vol. 16, no. 6, pp. 80-88, 2021.
- [17] H. Ma, Y. Liu, M. Yan, and J. Xi, "Research on tourist satisfaction of tourism public service based on SEM and IPA model," *Resources and environment in arid areas*, vol. 35, no. 6, pp. 192-199, 2021.
- [18] H. Chen, "Research on tourist satisfaction of summer tourism market based on IPA analysis - taking Yuexi county, Anhui province as an example," *Journal of Bohai University (Philosophy and Social Sciences)*, vol. 43, no. 6, pp. 57-61, 2021.
- [19] J. Yu, Y. Geng, Q. Yu, H. Chang, and L. Xia, "Empirical study on forest recreationers' expectation and recreation experience satisfaction based on IPA method-taking Harbin forest recreation market as an example," *Forestry Economic Issues*, vol. 33, no. 6, pp. 540-547, 2013.
- [20] Y. Pan, J. Zeng, Y. Wen, Q. Yan, and Y. Liu, "Research on suitability evaluation index system of forest health base construction," *Forestry resource management*, vol. 1, no. 5, pp. 101-107, 2017.
- [21] T. Geng, F. Hong, Y. Zeng, and M. Hu, "Study on the relationship between place perception and health benefit assessment of forest recreationists - taking Longquanshan Urban Forest Park in Chengdu as an example," *Forestry economy*, vol. 43, no. 3, pp. 21-36, 2021.
- [22] Z. Song, *Study on Suitability Evaluation of Forest Health Bases [D]*, East China University of Technology, 2021.
- [23] T. Shelatkar, D. Urvashi, M. Shorfuzzaman, A. Alsufyani, and K. Lakshmana, "Diagnosis of brain tumor using light weight deep learning model with fine-tuning approach," *Computational and Mathematical Methods in Medicine*, vol. 2022, Article ID 2858845, 9 pages, 2022.
- [24] Y. Xie, W. Xiong, and G. Qin, "Analysis on the characteristics of supply products of forest health bases in China-based on the survey of 77 forest health bases," *Forestry industry*, vol. 58, no. 9, 2021.
- [25] Z. Zhang, *Research on the Planning and Design of Forest Health Base Based on Therapeutic Factors*, Hunan University of Technology, 2018.
- [26] V. Kumar, G. S. Lalotra, P. Sasikala et al., "Addressing binary classification over class imbalanced clinical datasets using computationally intelligent techniques," in *Healthcare*, vol. 10, no. 7p. 1293, MDPI, 2022.
- [27] D. Chen, Y. Wang, and Y. Guo, "Research on the development of forest tourism experience products based on tourist satisfaction: taking 49 national forest parks in Shandong province as an example," *Forestry economy*, vol. 43, no. 8, pp. 62-79, 2021.