ISSN: 2414-1895 DOI: 10.6919/ICJE.202206_8(6).0056

Research on Nursing Home Business Model based on Multi-objective Decision Model

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Abstract

For nursing homes, we need to establish a business model that can make the three goals of minimizing the consumption cost of the elderly, maximizing the benefits of the social pension institution and maximizing the social welfare basically reach a balance, and the interests of the elderly, the interests of enterprises and social welfare reach a balance. From the perspective of the government, only by providing a reasonable bed pricing model for pension institutions and enterprises can the three purposes be unified. We chose to use a multi-objective decision making approach to develop a balanced business model that achieves all three objectives.

Keywords

Multi Objective Decision Making Method; Nursing Home Business Model; Bed Pricing Model.

1. Introduction

In the elderly care industry, the bed arrangement and business model of nursing homes have always been an issue that the relevant industry needs to consider carefully. In this paper, we discuss how to design a business model that meets various conditions. We established a multi-objective decision method model, mainly through planning a reasonable bed pricing model, designed a pension service bed operation business model that can not only meet the basic social needs, but also sustainable development of pension service cause, and promote social employment at the same time.

2. The Proposal and Analysis of Nursing Home Business Model

2.1 The Problem Background

In recent years, with the change of people's concept of elderly care, institutional care has been gradually accepted by people because of its medical professionalism and comfort. Many children who are busy with their work are willing to send semi-disabled or disabled elderly people to professional pension institutions for maintenance. At the same time, a reasonable price of nursing home beds and an excellent business model of nursing home bed operation are, to some extent, important factors for people to choose or government to support this nursing home.

2.2 Ask Questions

To establish an appropriate mathematical model, the government as the main object, design a society can not only meet the basic needs, and can efficiently lasting development of old-age security programs and at the same time can also affect the social change of the pattern of employment in this

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respect endowment service beds operating business model (endowment service are main source of income currently operating income, government subsidies, social donations, etc.).

2.3 Problem Analysis

In view of the problems, to meet the requirements of the social demand is the need to meet your different income families to the demand of different types of beds, minimize the cost of staying in the old man, the sustainable development of pension services is the need to pension agency can guarantee a reasonable profit and government subsidies is controlled in the range of relatively reasonable, the endowment agencies benefit maximization, also need to satisfy the social welfare maximization, Promotion of employment is analyzed separately. From the perspective of the government, only by providing a reasonable bed pricing model for pension institutions and enterprises can the three purposes be unified. Here we choose to use the multi-objective decision making method to develop an equilibrium that can achieve the three objectives.

3. Model Assumes

(1) The government's fund subsidies and preferential policies to support the service development of pension institutions have been put in place; At the same time, pension institutions have also put government preferential subsidies and related policies into their own construction and operation.

(2) As it is impossible to control the outflow or inflow of the elderly to the operation cost, this factor will not be considered in the model.

(3) As the non-economic benefits of pension institutions cannot be accurately measured by numbers, this factor is not taken into account.

(4) From an ideal perspective, the maximum willingness to pay should be less than or equal to the total income of the elderly.

(5) Ignore the impact of the epidemic on the pension model, because the epidemic is only temporary and its temporary impact can be ignored.

4. The Establishment and Solution of Multi-objective Decision Model

4.1 The Objective Function

In the theory of welfare economics, we use the difference with production income to approximate the producer surplus, and use government subsidies to represent the consumer surplus, and these two components make up social welfare. Social welfare includes many elements such as corporate profits and government subsidies. Therefore, maximization of social welfare is set as the most critical element when we formulate the pricing of old-age beds.

Let q represent the number of elderly people living in pension institutions, n represent the number of beds, $\bar{p}$ represents the average monthly charge of the elderly in the pension institution in the year, $\bar{p}_1$ represents the monthly price that the elderly are willing to pay for various services in the year, S represents the average annual amount of government social subsidies, S_b represents the annual allowance for each old person's bed, S_0 represents the government's preferential policies into economic value, S_d represents the economic value of social donations, Y represents the total income of the pension institution, C represents the total cost of the pension institution, and M represents the expenses actually paid by the elderly, $M_{\max}$ represents the maximum amount the old person is willing to pay. The social welfare maximization (W) function can be expressed as:

$$\max W = Y - C + M_{\max} - M$$

$$\max W = 12p\bar{q} - C + S$$

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$$s.t.\begin{cases} 0<=\bar{p} \\ S=qS_b+S_0+S_d \\ n>=q \end{cases}$$

4.2 The Constraint

(1) Payment constraints. Assuming that the elderly pay a yuan for the pension institution at most every month, then $\bar{p} \leq a$.

(2) Profit constraints. The essence of pension institutions is social welfare, and their maximum profit margin should be controlled within a certain range. Therefore, assuming that its maximum profit rate is b, then r≤ b.

(3) Constraints on fiscal subsidies. The government's subsidy to pension institutions is affected by the macro-control of policies and the adjustment of corresponding budgets. We need to assume that the maximum subsidy amount of a government to pension institutions is $S_{\max}$, then 0≤S≤$S_{\max}$.

(4) Demand price constraint. As commodities, old-age care services and old-age care beds are also affected by price supply and demand. We can assume that the relationship between bed price and demand set by old-age care institutions is Q = F(p).

According to the above formula, the bed service pricing model of Yide Social pension institution is as follows:

$$\max W = 12q\bar{p} - C + S$$
$$s.t.\begin{cases} 0 \leq \bar{p} \leq \overline{p_1} \leq A \\ S = qS_b + S_o + S_d \\ n \geq q \\ 0 \leq S \leq S_{\max} \\ Q = F(\bar{p}) \end{cases}$$

4.3 Model Application

H Nursing Home in Taizhou, founded in 2016, is a qualified, complete and professional nursing home service institution. The nursing home also has rehabilitation nursing room, medical clinic, emergency room, complete supporting facilities, equipped with ultraviolet therapy instrument, simple ventilator and first aid equipment. H nursing home has invested 2 million yuan in the initial construction, with 246 beds and more than 100 elderly residents. There are more than 60 elderly care service personnel, among all the service personnel, there are 4 people with doctor qualification, 9 people with professional nursing qualification.

4.3.1 Parameter setting

(1) The average charge of the elderly living in H pension institution is divided into three categories according to the health status of the elderly themselves, the elderly with moderate or mild disability and the elderly with high disability. The corresponding charges are 2340, 2640 and 3240 yuan per month respectively. According to this calculation, the average monthly charge of the elderly in H pension institution is 2751 yuan.

(2) The average willingness to pay. If the average income of the old person is 5000 yuan/month, set the index of the old person to 5000 yuan.

(3) Cost expenditure. According to the survey, the total cost of H nursing home in 2016 was 1.621 million yuan.

(4) Social donations. In 2016,H Nursing Home received donations of 42,310 yuan.

(5) Preferential policies converted into economic value. This branch cannot be numerically specified, so this model assumes 0.

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(6) Bed subsidy. According to relevant documents in Taizhou, taizhou municipal government provides nursing subsidies equivalent to 160 yuan per month for the disabled elderly in the pension institutions, and the nursing subsidies for semi-disabled elderly are 1440 yuan per year, equivalent to 140 yuan per month. According to the proportion of disabled and semi-disabled elderly people, it is roughly calculated that the average nursing subsidy for each elderly person is 1700 yuan per year.

(7) Maximum fiscal subsidies. In 2016, taizhou municipal government invested 3.824,500 yuan. In order to make the government's financial input more effective and take into account the economic development, this paper sets the maximum financial input of Taizhou for H nursing home to be 60% of taizhou social welfare center, that is, the maximum investment is 2,294,700 yuan.

(8) Demand price elasticity. In this paper, the price elasticity of service demand of pension institutions is set as -0.04, namely:

$$\frac{(q-100)/100}{(p-2851)/2851} = -0.04$$

(9) Profit margin ceiling. In 2016, reference research found that the average profit margin of China's top 10 listed companies was 27.79%. In this paper, we set it as the profit margin upper limit B of social pension institutions, that is, 27.79%.

$$\max W = 12q\bar{p} - 1581992 + S$$
$$\begin{cases} 0 \le \bar{p} \le 5560 \\ S = 12 \times 138q + 35520 \\ q \le 244 \\ 0 \le qS_b \le 1891200 \\ \dfrac{(q-100)/100}{(p-2851)/2851} = -0.04 \\ \dfrac{12q\bar{p} - 1581992}{12q\bar{p}} \le 27.79\% \end{cases}$$

Here, we substitute the data into SPSS and Matlab for calculation, and get the results in the following table.

Table 1. Calculation results

Number of elderly residents (persons)	Old-age service Price (YUAN)	Social Welfare (YUAN)	Profit amount (YUAN)	Profit margin (%)
0	74216.00	-1546472	-1581992	
50	34888.50	21627628	21511108	93.15
90	9978.50	9376108	9194788	85.32
92	8553.00	8045080	7860520	83.25
94	7127.50	6645628	6457828	80.32
96	5702.00	5177752	4986712	75.92
98	4276.50	3641452	3477172	68.54
100	2851.00	2036728	1839208	53.76
110	1428.50	363721	165240	9.45
115	0.00	-1377992	-1581992	

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4.4 Results Analysis

When the average price of the month is 1428.5 yuan, the number of residents is 110, the social welfare is 363,721 yuan, the government financial subsidy is 165,780 yuan, and the surplus of H nursing home is 165,240 yuan, and the profit rate is 9.4%. At this time, the social government is very good to the elderly and welfare institutions. According to the pricing principle at this time, it can better make the elderly feel at ease in the pension institutions, let the elderly's children rest assured, protect the rights and interests of the elderly, but also enable the society to carry out the construction of pension institutions more efficient and lasting.

5. Advantages and Disadvantages of the Model

5.1 Advantages of the Model

(1) When building the model, we set the parameters in a state that is easy to adjust, so as to meet the needs of further research.

(2) The data used in this paper are all from relevant websites and relevant references in China, with high accuracy and consistent with the research direction of this paper.

(3) The results of this paper are obtained by computer aided calculation after all the data are substituted into the formula. The calculation deviation is relatively small and the accuracy is high.

5.2 Weaknesses of the Model

(1) This paper ignores the impact of the epidemic on the pension model, which may have some deviation from the actual situation.

(2) The results obtained based on the data explored in this paper may not be applicable to nursing homes in different parts of the country, because there are certain differences in pension modes and situations in different places.

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