Dynamic pricing model of medical services in public hospitals in China

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For improving the current pricing mode of medical services, the present study seeks to explore the pricing elements and processes, and establish the dynamic pricing model of involving both the government and hospitals. The pricing process and mathematical model shows the logical relationships between medical prices and pricing elements. The causal relationship model reveals how to accomplish dynamic equilibrium between elements. The simulation model has been built based on system dynamics theory. Results of the simulation and sensitivity tests, show that different grades of hospitals while applying the pricing model may better perform their respective responsibilities and continuously improve core strengths.

Keywords: Dynamic pricing model, medical services, public hospitals, system dynamics.

THE reform of medical service pricing system is the priority at present in China[1]. The current medical pricing system in China depends on the medical service items[2,3]. And this pricing is dominated by the government. However, the hospitals, as providers of medical services, play a small role in the pricing process. Hence, the existing pricing mode is an important reason for over charging by the hospital.

First, hospitals are forced to buy large-scale equipment for expanding the scale of services and providing inappropriate treatment[4]. As a result, hospital costs go up. Secondly, the technical services and knowledge value of doctors are not fully reflected in the process of pricing and adjustment[5]. So doctors will not have enough motivation to deal with the uncertainty and use different medical technologies and products according to varying needs of the patients. Inevitably, unnecessary demands are often used to increase revenue, such as check-ups, unreasonable prescription and recurring charges[6]. Thirdly, the medical service items and standards drawn up remain unchanged for many years[7]. As a result, hospitals cannot get proper compensation. In addition, there is also no pricing basis for new treatment technologies[8].

To improve the current pricing mechanism, some researchers have proposed corresponding pricing strategies from different perspectives. The price of medical services should reflect the value of this complex technology, such as service technology, labour intensity and service risk. Finance departments should work together with pricing departments to develop plans to guide medical prices[9]. Based on market conditions, the health competent authorities should allow medical institutions to have certain floating price[10]. According to the principle of combining unified leadership and hierarchical management, the management responsibility must be gradually decentralized, so that health authorities and medical institutions may have greater involvement in the pricing research of medical devices and decision making. Through increasing the service price gap among the medical staff in accordance with technical positions or levels in hospitals, it is effective to guide patients to choose a reasonable hospital, improve the technological level and increase the allocation efficiency of health resources[11,12].

In addition, numerous articles have focused on qualitatively analysing the competition mechanism or management modes of medical service pricing, while there is not much literature available on quantitative methods such as system dynamics theory to study the pricing models. System dynamics is a methodology and mathematical modelling technique for framing, understanding and discussing complex issues and problems[13,14]. It deals with internal feedback loops and time delays that affect the behaviour of the entire system. These elements help describe how even seemingly simple systems display baffling nonlinearity[15,16]. Originally developed to help corporate managers improve their understanding of industrial processes, system dynamics is currently being used throughout the public and private sector for policy analysis and design[17]. Some experts have applied system dynamics method in the medical service system, such as the human resource allocation of medical emergency system, the game analysis on excessive medical care and the compensation for medical manpower mobilization[18]. However, few scholars have tried to use this method to establish the pricing model of medical services in public hospitals.

Therefore, according to the health conditions in public hospitals in China, the present study explores the dynamic pricing model of medical service, as well as building its simulation model based on system dynamics theory.

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Analysing the cyclical process of pricing model

This study will help improve the current pricing mode of medical services dominated by the government, and set up the pricing method involving both the government and hospitals. Figure 1 depicts this pricing process and shows the relationships between variables. Character i represents the type of medical service. Character t denotes time.

Step 1. Balancing the cost of medical service i.

From a government perspective, it should build the guidance cost of medical service i in period (t–1), i.e. $C_{\mathrm{G}it-1}$ to play the role of limiting and guiding the cost for meeting people's demand for medical services. Therefore, the government always has to control medical service prices of large hospitals in the current pricing mechanism. However, this is one of the main reasons for medical resource shortages in large hospitals. To balance the cost of medical service i, the same grade of public hospitals should calculate the average cost of medical service i in period (t–1), i.e. $C_{\mathrm{H}it-1}$ according to the real expenditure. Because pricing of medical services must take both $C_{\mathrm{G}it-1}$ and $C_{\mathrm{H}it-1}$ into consideration, the weighted cost of medical service i in period (t–1), i.e. C_{it-1} should be calculated using the average weight coefficient α_i of $C_{\mathrm{G}it-1}$ and the average weight coefficient β_i of $C_{\mathrm{H}it-1}$.

Step 2. Calculating the time value.

Because medical service costs change with time, the pricing system should be adjusted depending on consumer price index (CPI_{t-1}) and the growth rate of local GDP (GRGDP_{t-1}) in period (t–1). CPI_{t-1} may represent the price change trend of residents consuming goods or services in period (t–1). In addition, this index change can also reflect the degree of inflation or deflation to a certain extent. GRGDP_{t-1} may reflect the change of local economy and human resource costs. In order to balance comprehensive effects of GRGDP_{t-1} and CPI_{t-1}, the price index of medical resources in period t, i.e. E_t should be calculated using weight coefficient, including the average weight coefficient γ of GRGDP_{t-1} and the average weight coefficient λ of CPI_{t-1}.

Step 3. Considering the technical value coefficient of medical service i in period t, i.e. V_{it}.

It is undeniable that technical skill of doctors represents the core of medical services. However, this factor is almost neglected, including the service time, the technical difficulty and the degree of risk. So while considering the market economy, the technical value of medical staff must be reflected in the process of medical service pricing.

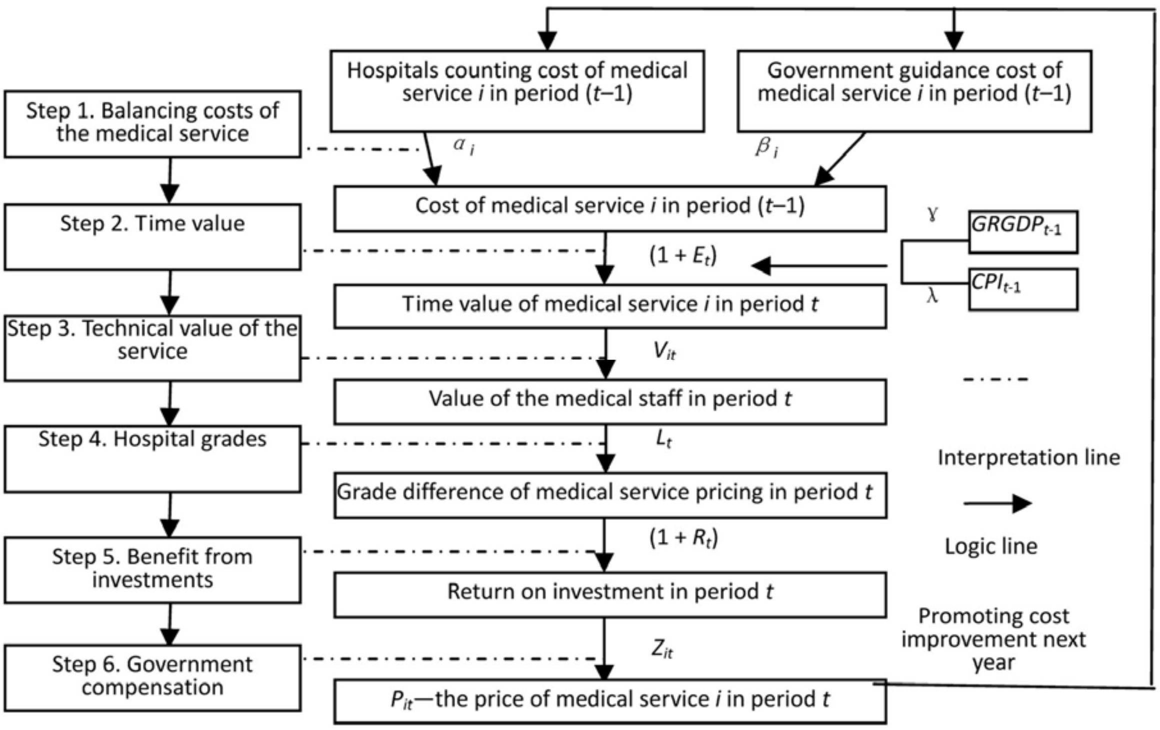

Figure 1. The modelling process of medical service i in period t based on involvement of both. The figure depicts the pricing process of medical service i in period t and shows the logical relationships between variables. According to the pricing process, medical service i is priced by government and hospitals co-decision rather than only by the government. For comprehensive effects of GRGDP_{t-1} and CPI_{t-1}, the coefficient $1 + E_i$ multiplied by the corresponding service cost is used to calculate the weighted cost in period t, including the cost in period (t–1) and increased cost in period t. The coefficient $1 + R_t$ multiplied by the weighted cost is used to calculate the sum of the cost and its investment profit in period t.

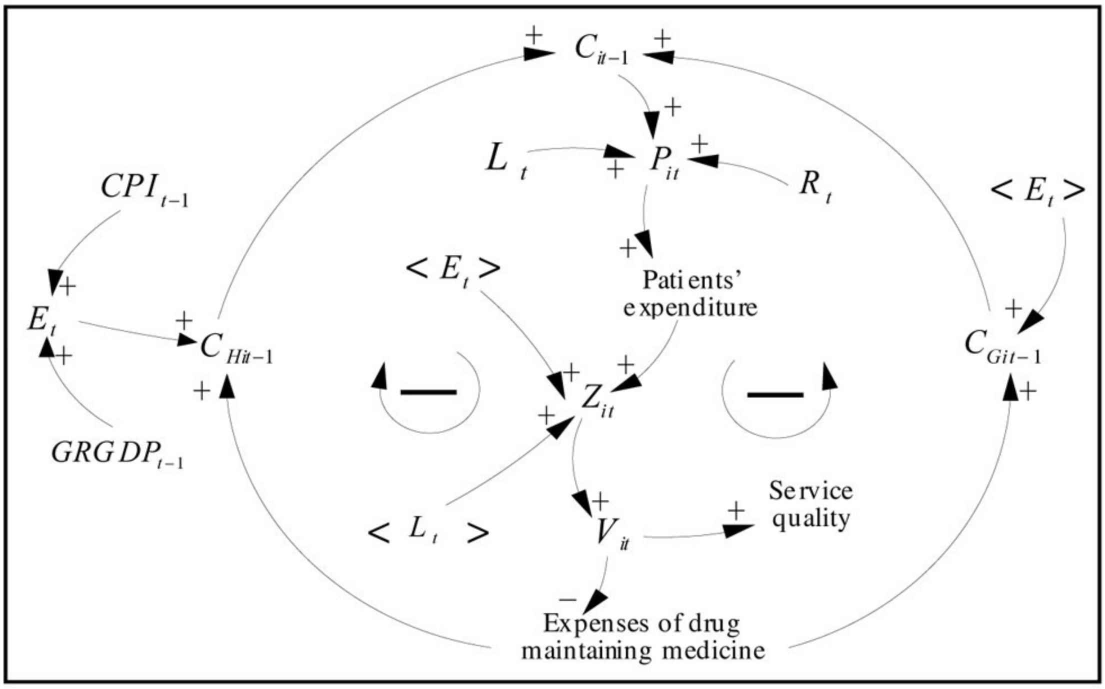

Figure 2. Dynamic equilibrium of the pricing process of medical service *i*. The figure is the causal relationship model of the pricing process of medical service *i* based on system dynamics theory. The arrow with '+' in the model represents a positive correlation relationship between variables, which means that the arrow tail variable can cause the arrow head variable to change in the same direction. The arrow with '–' signifies negative correlation relationship between variables, which means that the arrow tail variable can cause the arrow head variable to change in the opposite direction. The figure ascertains the behaviour of the system over a certain period and reveals how to accomplish dynamic equilibrium system parameters in the pricing process.

Step 4. Considering the grade of hospitals.

Medical services must be priced in accordance with grade coefficient of hospitals in period t, i.e. L_t. The investments of capital for construction, human resources and technical levels are all significantly different among different grades of hospitals leading to different treatment costs. That will give rise to different technical contents and service qualities[19].

Step 5. Calculating the average rate of return on investment in period t, i.e. R_t.

As a result of government limited investments, public hospitals should have a certain return on investment to ensure normal development.

Step 6. Calculating the compensation for medical service i in period t, i.e. Z_{it}.

China's out-of-pocket payments for medical services are higher than other countries with similar or higher GDP. If the government can effectively compensate for the needs of hospital development, public hospitals will not have to impose unnecessary treatment or examination on patients merely for profit. In general, Z_{it} value should be different depending on economic development of the area or grade of the hospitals.

As a result, the price of medical service i in period t, i.e. P_{it} is established according to the above steps. The cycle repeats the next year.

Analysing the dynamic equilibrium of medical service pricing based on the causal relationship model

In order to accomplish dynamic equilibrium among the parameters of the pricing system, here we apply the system dynamics theory to establish its causal relationship model based on Vensim simulation platform (Vensim PLE for Windows Version 6.3). This is a graphical model with all constituent components and their interactions. It reveals the rules of system operation and ascertains the behaviour of the system over a certain time period.

In Figure 2, a closed loop along the direction of the arrow is called the feedback loop. Each feedback loop links key variables and surrounding variables. When the number of symbols '–' is even (Figure 2), the feedback loop has a potentiation effect and its attribute is positive. When the number of symbols '–' is odd, the feedback loop has a balancing effect and its attribute is negative. There are two negative feedback loops in the model, as shown in Figure 2.

The weighting cost C_{it-1} will rise in the same direction with the growth of $C_{\mathrm{H}it-1}$ and $C_{\mathrm{G}it-1}$. Correspondingly, the charge system should be timely adjusted to accurately reflect the costs of health care. As a result, there will be higher medical service price P_{it} causing increase in

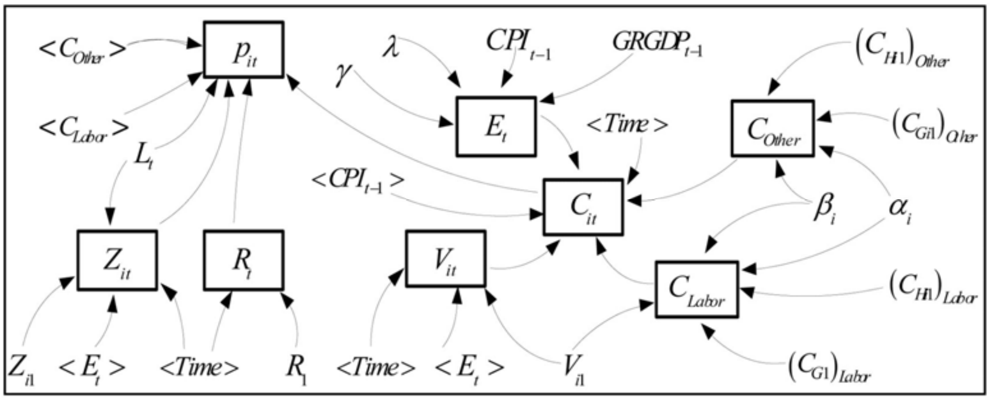

Figure 3. Simulation model of medical service pricing on Vensim simulation platform. The present study applied system dynamics theory to build the simulation model on Vensim simulation platform. The figure shows the relationships between variables and includes the complex mathematical functions.

patients expenditure. But, if government can compensate for the doctors' work, public hospitals will improve service quality rather than rely on higher diagnostic or prescription charges. Therefore, in order to increase technical value, the government must enhance medical compensation Z_{it} depending on patients expenses. Furthermore, as technical value coefficient V_{it} rises, the expenses of drug-maintaining-medicine can be limited effectively or even abolished. Though $C_{\mathrm{G}it-1}$ is built to limit and guide medical costs, the government has adjust it like $C_{\mathrm{H}it-1}$ per year according to hospital expenditure. So the expense depression of drug-maintaining-medicine will be helpful in reducing $C_{\mathrm{H}it-1}$ or $C_{\mathrm{G}it-1}$ during the next cycle. In addition, the price index of medical resources E_t, including CPI_{t-1} and GRGDP_{t-1}, also may cause $C_{\mathrm{H}it-1}$ or $C_{\mathrm{G}it-1}$ to change in the same direction. In general, the degree of adjustment of $C_{\mathrm{G}it-1}$ is lower than that of $C_{\mathrm{H}it-1}$ in order to void too much volatility. As a result, during the next cycle the weighting cost C_{it-1} will fall. Correspondingly, P_{it} will fall with C_{it-1}.

As the cycle repeats, the medical service price P_{it} will be in dynamic equilibrium under the combined effect of two negative feedback loops.

Establishing the system dynamics model of medical service pricing

Based on the above analysis, we apply the system dynamics method to establish the simulation model of medical service pricing on Vensim simulation platform. As shown in Figure 3, the simulation model includes complex logical relationships and functions.

The mathematical functions in the model should comply with the following algorithms.

Definition 1: Initial time = 1, Time step = 1. (1)

$C_{\mathrm{H}it-1}$ or $C_{\mathrm{G}it-1}$ is mainly composed of labour costs, C_{Labor} and other costs, C_{Other}. Other costs include material costs, management expenses, depreciation expenses and so on. In addition, the technical value of medical service i, as a specific cost type, is calculated according to C_{Labor}.

Definition 2: $t = 1,$ (2)

$$C_{\mathrm{G}i1} = (C_{\mathrm{Labor}} + C_{\mathrm{Other}})_{\mathrm{G}i1}, \tag{3}$$

$$C_{\mathrm{H}i1} = (C_{\mathrm{Labor}} + C_{\mathrm{Other}})_{\mathrm{H}i1},\ i = 1\ldots m, \tag{4}$$

$$\begin{aligned}\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1} = {} & (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Labor}} \\ & + (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Other}},\end{aligned} \tag{5}$$

$$\begin{aligned}C_{i1} = {} & (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Labor}} \cdot V_{i1} \\ & + (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Other}}.\end{aligned} \tag{6}$$

Here we use the Delphi method to determine the values of α_i and β_i. In this method, a group of experienced experts determine the value of each weight, and then use statistical methods to estimate the average value of each weight.

Step 1. The detailed background information is sent to Q selected experts. Then each expert j needs to independently estimate the weight α_{ij} of medical service i, and indicate the confidence level k_{ij} about α_{ij}. k_{ij} denotes the confidence level of an expert estimating weight $\alpha_{ij}.k_{ij}$. When an expert is absolutely certainty, $k_{ij} = 1$. Else, $k_{ij} = 0$.

Step 2. Calculating the sample mean $\overline{\alpha}_i$ of weight α_{ij}.

Definition: $\Omega = \{j\colon k_{ij} \geq S,\ i = 1, 2,\ldots,m;\ j = 1, 2\ldots,\Omega\},$ (7)

$$\overline{\alpha}_i = \frac{\sum_{j\in\Omega} \alpha_{ij}}{|\Omega|}. \tag{8}$$

Step 3. Calculating the variance $D(\alpha_i)$ of weight α_{ij}.

$$D(\alpha_i) = \frac{\sum_{j\in\Omega} [\alpha_{ij} - \bar{\alpha}_i]^2}{|\Omega| - 1}. \quad (9)$$

Step 4. Calculating deviation between the weight α_{ij} and sample mean.

$$\Delta\mu_i = \alpha_{ij} - \bar{\alpha}_i. \quad (10)$$

Step 5. Based on the result of $\Delta\mu_i$, the experts express their views for reducing the estimation error in the following steps.

Step 6. After further supplementary information is attached, the experts are invited to re-estimate α_{ij}. The above steps are repeated until $D(\alpha_i)$ is not more than a given standard $\eta(\eta > 1)$.

$$\alpha_i = \bar{\alpha}_i, \beta_i = 1 - \alpha_i. \quad (11)$$

The grade coefficient L_t is used to adjust overall medical costs and government compensation between different grades of hospitals. So P_{i1} is defined as follows

$$P_{i1} = [(\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Labor}} \cdot V_{i1} + (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Other}}] \cdot L_1 \cdot (1 + R_1) - Z_{i1} \cdot L_1. \quad (12)$$

Definition 3: $t = t + 1$. (13)

E_t is used to balance comprehensive effects of GRGDP_{t-1} and CPI_{t-1} in period $(t-1)$ through weight coefficients γ and λ.

$$E_t = \gamma \cdot \mathrm{GRGDP}_{t-1} + \lambda \cdot \mathrm{CPI}_{t-1}. \quad (14)$$

Similarly, γ and λ may be determined by the Delphi method. Only labour costs C_{Labor} change with E_t. The other costs C_{Other} change only with CPI.

$$C_{it} = (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Labor}} \cdot \prod_{x=2}^{t}(1 + E_x) \cdot V_{ix} + (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Other}} \cdot \prod_{y=1}^{t-1}(1 + \mathrm{CPI}_y). \quad (15)$$

The Z_{it} value should be adjusted according to the macroeconomic situation.

$$Z_{it} = Z_{i1} \cdot L_t \cdot \prod_{x=2}^{t}(1 + E_x). \quad (16)$$

As a result, the price of medical service i in period t, i.e. P_{it} is given as below

$$P_{it} = \left[(\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Labor}} \cdot \prod_{x=2}^{t}(1 + E_x) \cdot V_{ix} + (\alpha_i \cdot C_{\mathrm{G}i1} + \beta_i \cdot C_{\mathrm{H}i1})_{\mathrm{Other}} \cdot \prod_{y=1}^{t-1}(1 + \mathrm{CPI}_y)\right] \cdot L_t \cdot (1 + R_t) - Z_{i1} \cdot L_t \cdot \prod_{x=2}^{t}(1 + E_x), \quad (17)$$

$$\alpha_i > 0, \beta_i > 0, \alpha_i + \beta_i = 1, \gamma > 0, \lambda > 0, \gamma + \lambda = 1, V_{it} \geq 1, L_t \geq 1, t = 2 \ldots n. \quad (18)$$

Simulation and discussion

Based on the health status at Guangzhou, China, this article analyses the pricing process of lateral ventricle puncture. As shown in Table 1, the initial data of all parameters are determined through the investigation of 15 hospitals and the Delphi method. This model assumes that the simulation period is ten years.

In China, public hospitals are divided into three grades. Grade-1 hospitals provide health prevention, medical treatment and rehabilitation services for communities. Grade-2 hospitals mainly undertake common comprehensive health services. Grade-3 hospitals provide a higher level of comprehensive health services and undertake scientific research. Hence the costs of different grades of hospitals are different. Correspondingly, L_1 and $C_{\mathrm{H}i1}$ of Grade-3 hospitals are the highest. Based on the technical characteristics and difficulty of lateral ventricle puncture, the value of V_{i1} is same and equal to 1.2. Based on the investigation of lateral ventricle puncture, its clinical pathway is similar. And the technology of this service is also mature and has little difference among different grades of hospitals. So V_{i1} of this service can be considered equal and constant. However, for other medical services, the value is related to the specific service and grades of hospitals, and may be determined through investigation and analysis. For hospitals in the same region, the effect of GRGDP_1 or CPI_1 is not different. China's medical services cater to public welfare. Therefore, R_t value must comply with the premise of no more than the average profit rate of other service industries. In addition, here we assume that the government will compensate hospitals depending on the specific medical project. Therefore Z_{i1} is also equal for all hospitals. And average weight coefficients are determined by the Delphi method.

Compared with the current price of lateral ventricle puncture, as shown in Table 2, the simulation results have the following characteristics. First, according to the differences in hospital responsibility and scale, the price gap between different hospitals in this model is larger than

Table 1. Simulation parameters of lateral ventricle puncture

	C_{Gi1} (¥)		C_{Hi1} (¥)											
	C_{Labor}	C_{Other}	C_{Labor}	C_{Other}	CPI_1	$GRGDP_1$	V_{i1}	L_1	R_1	Z_{i1} (¥)	α_i	β_i	γ	λ
Grade-1	10	99	12	112	2.2%	7.5%	1.15	1	1.5%	8	0.6	0.4	0.6	0.4
Grade-2	13	109	16	118	2.2%	7.5%	1.15	1.04	1.5%	8	0.5	0.5	0.6	0.4
Grade-3	16	118	20	126	2.2%	7.5%	1.15	1.07	1.5%	8	0.4	0.6	0.6	0.4

Note: α_i, β_i, γ and λ are determined by Delphi method. Other data are from the 2007–2013 Guangdong Health Statistical Yearbook and questionnaires completed by medical experts and managers of 15 hospitals.

Table 2. Comparing simulation results with current price

	Grade 1(¥)				Grade 2(¥)				Grade 3(¥)			
Time (year)	C_{it}	P_{it}	$C_{it}+Z_{it}$	Current price	C_{it}	P_{it}	$C_{it}+Z_{it}$	Current price	C_{it}	P_{it}	$C_{it}+Z_{it}$	Current price
1	116.6	110.4	118.4	120	130.2	129.1	137.4	135	144	147.8	156.3	150
2	119.6	112.9	121.4		133.6	132.2	141		147.8	151.5	160.5	
3	122.6	115.6	124.5		137.1	135.4	144.7		151.8	155.3	164.8	
4	125.8	118.3	127.7		140.7	138.8	148.5		155.8	159.2	169.3	
5	129	121.1	130.9		144.4	142.2	152.4		160.1	163.3	173.8	
6	132.3	123.9	134.3		148.2	145.6	156.5		164.4	167.4	178.6	
7	135.7	126.8	137.8		152.2	149.2	160.6		168.9	171.7	183.4	
8	139.3	129.8	141.4		156.2	152.9	164.9		173.5	176.1	188.5	
9	142.9	132.9	145		160.4	156.7	169.4		178.3	180.7	193.7	
10	146.6	136	148.8		164.8	160.6	173.9		183.3	185.3	199	

Note: According to the difference in hospital responsibility and scale, public hospitals in China are divided into three grades.

that in the current pricing system. The gap gradually increases with time. In the current pricing scheme, the prices of most medical items are not in accordance with the grades of hospitals. As a result, for the same medical services, large hospitals seem to be overcrowded, but community hospitals are empty. However, the larger price gap will be helpful for patients to choose the reasonable hospital grade in line with their own conditions Patients generally select grade-1 hospitals because P_{it} is the lowest here; it is even lower than C_{it} that may meet the needs of the patients for basic medical services. Critically ill patients will be guided grade-2 or grade-3 hospitals according to the severity and type of disease. So the government should establish reasonable referral system to help community hospitals provide basic medical services, including child health, geriatric rehabilitation, chronic disease prevention, etc. Therefore, the different grades of hospitals may make full use of the limited health resources and continuously improve core strengths. Studies have shown that the current medical price system cannot play this role because of the little difference between different grades of hospitals[20].

Secondly, P_{it} in this model may vary gradually with market factors. But current medical prices are static and do not change with medical costs[21]. The hospital could take the advantage of information to carry out induced demand, such as provide the patient with excessive medical services and unreasonable prescription.

Moreover, the $P_{it} + Z_{it}$ value must be higher than C_{it} and keep constantly changing with the change in C_{it}. This will help the community hospitals provide better basic medical services and large hospitals to focus on treating major diseases and do research on high-end medical technologies.

We also studied the sensitivity test of the parameter γ. This model assumes that γ value equals to 0.1, 0.3, 0.5, 0.7 and 0.9 in turn in grade-1 hospitals. Correspondingly, E_t is equal to 0.0271, 0.0373, 0.0475, 0.0577 and 0.0679 in turn. When γ increases the proportion of the parameter $GRGDP_{t-1}$ in local economic structure also increases. The sensitivity test of γ can help effectively study the relationship between simulation results and proportion of $GRGDP_{t-1}$. Judging from the results of the sensitivity test, as shown in Figure 4, the slope of the parameters P_{it}, C_{it} or Z_{it} correspondingly increases. However, Figure 4 shows that the amplitude variation of each parameter is different at each time point. And the maximum amplitude of the parameters P_{it}, C_{it} and Z_{it} is 0.531%, 1.323%, 9.697% respectively in the simulation period. That is, the sensitivity of P_{it} or C_{it} to γ is weaker, while that of Z_{it} is stronger. This indicates that the government compensation Z_{it} has a good regulatory role to guarantee the stability of

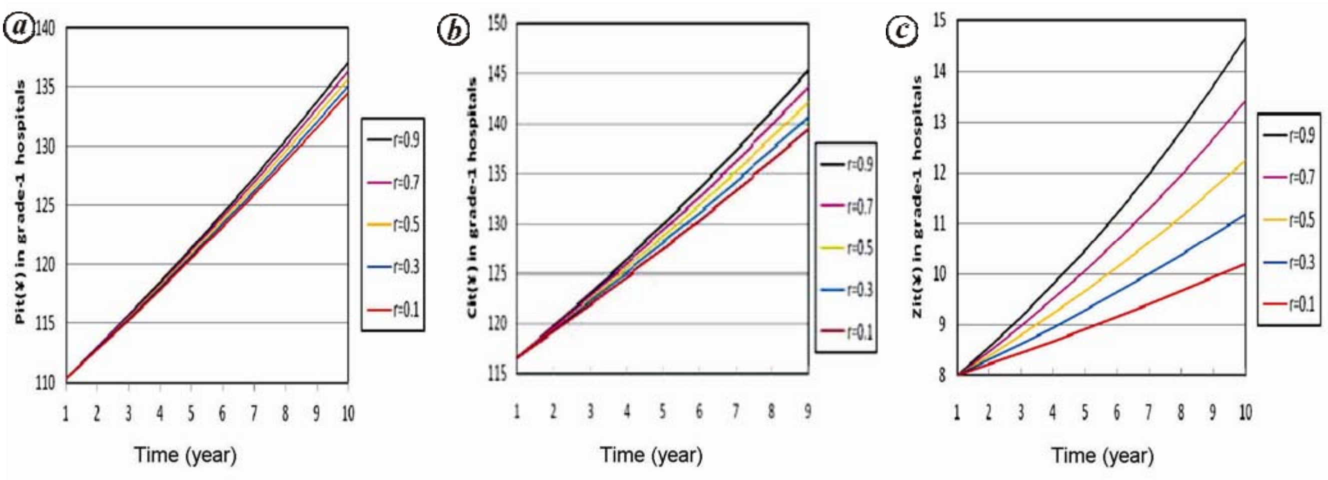

Figure 4. The sensitivity test of parameter γ in grade-1 hospitals. The parameter γ take values of 0.1, 0.3, 0.5, 0.7 and 0.9 in turn. The sensitivity of the parameter P_{it} or C_{it} to γ is weaker, while that of the parameter Z_{it} is stronger.

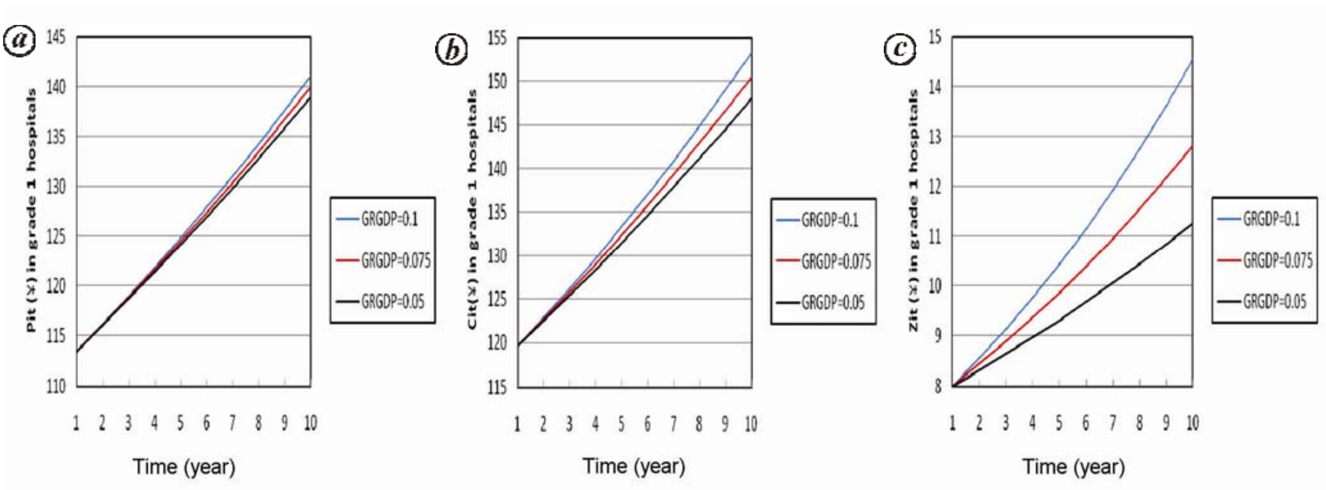

Figure 5. The sensitivity test of parameter GRGDP_{t-1} in grade-1 hospitals. The parameter GRGDP_{t-1} takes values of 5%, 7.5% and 10% in turn. The sensitivity of the parameter P_{it} or C_{it} to GRGDP_{t-1} is weaker, while that of the parameter Z_{it} is stronger.

medical costs and price, and to ensure good operation of the health-care market. Thus the government should continue to deepen reform of the classification of medical services for accomplishing effective compensation, such as distinguishing the public and non-public medical items, basic and special medical items, medical and non-medical technology projects, and so on.

In order to study the impact on the simulation results for the local economy fluctuations, we performed the sensitivity test of the parameter GRGDP_{t-1}. Here we assume that the GRGDP_{t-1} value in grade-1 hospitals equals to 5%, 7.5% and 10% in turn. As shown in Figure 5, there is no significant increase in costs or price of medical services when the local economy improves. In the simulation period the maximum growth amplitude of the parameter P_{it} is less than 0.788%, while that of C_{it} is less than 1.86%. However, the growth amplitude of Z_{it} will exceed 13.7% ten years later. That is, the sensitivity of P_{it} or C_{it} to GRGDP_{t-1} is weaker, while that of Z_{it} is stronger. Because of economic regionalization and lack of proper incentives in the pricing system, the fiscal condition of a region will decide the medical service pricing and degree of compensation of local public hospitals. The government should take into consideration both national and provincial economic levels to develop a coordinated medical compensation mechanism.

The results of the sensitivity test of grade-2 or grade-3 hospitals are similar.

Conclusion

The dynamic pricing model can systematically take into account the logic relationship between pricing factors of medical services, and seemly combine hospital value with the public welfare. Therefore, this pricing model has the following advantages:

First, the weighted cost determined by parameters α_i, β_i, $C_{\mathrm{H}it-1}$ and $C_{\mathrm{G}it-1}$ can effectively balance the benefit game between government and hospitals and play a guiding role with regard to medical costs. Secondly, the model may timely track the price changes of medical resources and reflect the price of medical services by E_t. Thirdly, the technical value of the medical services and grades of hospitals are integrated into the model, which can effectively promote hospitals to provide better services according to the respective responsibility. Finally, in order to reflect public welfare and local economic conditions, this model emphasizes that Z_{it} value should be determined depending on different diseases and regions.

The characteristics of this pricing model are dynamic. The adjustment of medical service price has to pay a certain cost. During the process of dynamic pricing, the pricing cost will rise with the increase of frequencies of price adjustment. Therefore, it is necessary to determine the adjustment criterion in practice. In future research, we will apply the fuzzy comprehensive evaluation method to establish the evaluation system of the price adjustment, and adopt the operations research theory to determine the optimal time interval.

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