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Concrete Analysis and Research Investigation of Doctor-patient Relationship under Evolutionary Game Model

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Abstract: With the progress and development of society, people's requirements for medical care are improving, and the tension and conflict of doctor-patient relationship has become a popular topic of public opinion in the whole society. Therefore, this paper starts from information asymmetry, trust crisis, moral hazard and other directions, and uses the evolutionary game model to specifically explore the doctor-patient relationship. The research results show that there is a balance and imbalance of cooperation and conflict between doctors and patients, and the factors that determine this include service attitude, welfare system, supervision by relevant departments, communication problems between doctors and patients, and social factors. Among them, the government should increase the supervision of hospitals, and the communication between doctors and patients should be strengthened to effectively ease the tension between doctors and patients, thereby reducing the social burden. This article will focus on discussing the causes of the doctor-patient conflict and how to alleviate the tense doctor-patient conflict and create a good medical environment as a member of society.

Keywords: information asymmetry, trust crisis, moral hazard, evolutionary game model, doctor-patient relationship

1. Introduction

With the rapid development of Chinese society and the continuous improvement of people's living standards, people's requirements for the medical services are also increasing. Due to the lack of communication between doctors and patients, the contradiction between the two sides has been intensified, and the doctor-patient relationship has become a popular topic. Doctors, who have firm beliefs and are not afraid of hard work to save the lives of others. What is the reason that brought the profession of doctors to the dangerous? What makes the current relationship between doctors and patients so bad now? The discussion of these issues is of great significance to the doctor-patient relationship. This study takes evolutionary game theory as the model framework, and analyzes the doctor-patient relationship through information asymmetry, trust crisis, moral hazard and other directions. This research will sort out the general doctor-patient relationship. This paper will discuss

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the doctor-patient game under the impression of three factors: low information department, trust crisis, and moral hazard.

According to previous scholars' research on the relationship between doctors and patients, the time and focus of the research are different. The research on doctor-patient relationship in China started relatively late, and the research mainly focused on the nature, influencing factors and countermeasures of doctor-patient relationship. A brief evaluation is made based on studies in China and other countries. In other countries, the research on the doctor-patient relationship started earlier, with model research as the core to study the meaning and model of the doctor-patient relationship [1]. However, Chinese and foreign research on doctor-patient relationship has not formed a stable core target group. Chinese doctors and patients mainly focus on civil disputes, doctor-patient relationship, patients, etc., while foreign research mainly focuses on doctor-patient relationship, general practice path [2]. Some studies have conducted evolutionary game analysis on the tripartite behaviors of doctors, the government and netizens, proving that the doctor-patient relationship is caused by multiple reasons [3]. Among them, one of the main contradictions leading to the doctor-patient relationship is the communication between doctors and patients [4]. In the research and process, it is necessary to base on the theory of sociology and psychology for the current situation, enlightenment of doctor-patient relationship. It is worrisome that the current situation of the deterioration of the relationship between doctors and patients is worrisome; the reasons for its formation are multiple, the ways of improvement should be all-round, efforts should be made by the whole society, the process is long, and humanized medical services are necessary [5].

2. Basic Assumptions and Model Construction

2.1. Basic Assumptions and Matrix Analysis of Doctor-patient Game under Asymmetric Information

First, The assumption of individual rationality. Both sides of the game obey the rational principle, and both pursue the maximization of interests. Second is the Common knowledge assumption. Both sides of the game not only know that the other side is rational but also know that the other side knows that they know that the other side is rational. Then, Under the assumption of incomplete information, the profit function of both parties in the game is not public information, and both parties only know the approximate range of the other party's profit. Last, Static game assumption. Both sides of the game make the same or different decisions at the same time, so the two sides of the game cannot know the behavior of the other side.

3. Patient Medical Market Specifics

3.1. Graph Analysis

Hospitals in China are roughly divided into public and private. Whether they are public or private, they are subject to strict scrutiny by relevant state departments in terms of establishment and review. The hospital’s main utility in society is to exercise social medical services and to collect medical expenses, so as to maintain the medical development of the hospital. In terms of patients, there are the following execution methods when faced with illnesses: First, going to the hospital to see a doctor, but it will cost medical expenses, or they can choose not to see a doctor, but the illness will be delayed, so the cost is zero.

To sum up, from the tense situation of the doctor-patient relationship, from the analysis of the hospital's function in society and the patient's enjoyment of medical treatment, it can be concluded that:

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First, The slopes and intercepts of patients' preferences for different hospitals (represented as demand curves here) are different (as shown in curves C1D1 and C2D2 in Figure 1, for patients, the actual curve is C1 ED2. It can be understood as: patients with the same A patient of a certain disease may go to a different hospital due to the difference in the quality of hospital services and in different cases due to different choices (ie, at point E, the mutual transition of the C1 D1 and C2 D2 curves).

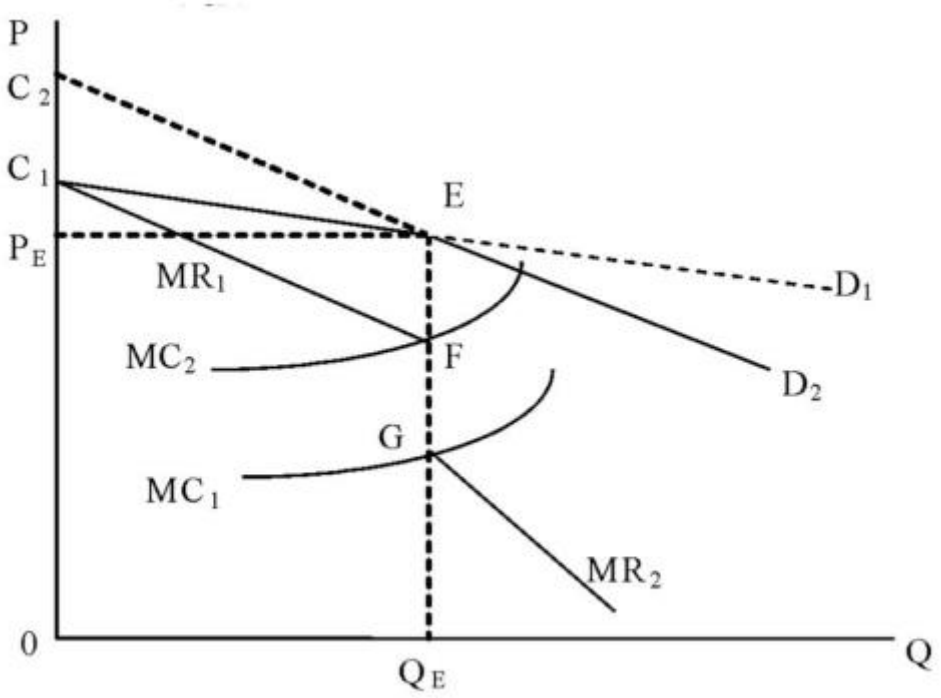

Figure1: The line chart builds by referencing to micro-economic demand curve

Next, Here, the price rigidity of the medical market is shown in figure 1. The marginal revenue MR1 and MR2 of the two hospitals C1D1 and C2D2 have a rigid break at point E, which intersects with the marginal cost curves MC2 and MC1 at F and G, respectively. Last, It is shown in the chart as follows: In the medical market, medical projects have such a phenomenon: medical benefits vary within a certain range (between FG), and the demand remains unchanged (QE). Moral hazard in the case of doctor-patient information asymmetry Based on the price rigidity principle of the medical market, in Figure 1, when the medical benefit changes between FG, the medical demand is unchanged (QE).

According to the moral hazard in the case of asymmetric doctor-patient information and the price rigidity principle of the medical market, it is analyzed in Figure 1 that when the medical benefit changes between FG, the medical demand is unchanged (QE). According to the current social situation, in every country (especially developed countries), there are strict divisions for domestic hospital rating and corresponding medical charges. However, many hospitals still proceed from their own interests, and subjectively allow patients to receive more unnecessary medical services. The Internet jokes that this phenomenon is "wasting money", which is the moral hazard brought by medical services [6]. In addition, the induced demand for medical services is a manifestation of the moral hazard of the hospital. In the case of asymmetric information between doctors and patients, due to the existence of the induced demand in the hospital, the medical fee increases within a certain range. From this perspective, it can be very good. Explain why China's current medical expenses are rising sharply [7].

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4. The Game Model Between Doctors and Patients Because of Information Asymmetry

4.1. Analysis of Game-Tree

The strategic space of the hospitals includes: providing high-quality medical care (choosing the lower profit space) and providing low-quality medical services (choosing higher profit margins); Patients' strategic space includes medical treatment and non-medical treatment, there's a reality that patients choose not to seek medical treatment, and different patients abandon medical treatment to various degrees because they cannot afford the high cost of treatment (generally for treatment-resistant major diseases and unprecedented medical costs) which has been effectively alleviated by the introduction of domestic policies such as medical subsidies and medical reimbursement for rural and poor people [8]. It is just because of the introduction of these welfare policies that the rigidities of the medical market have been enhanced because medical insurance makes the state bear a certain percentage of medical expenses which made the distance between FG in Figure 1 increase in a certain proportion.

4.2. Payment of the Hospital

Firstly, The hospital has obtained social benefits and relatively small profits when it provides high-quality medical services at a higher cost, and the hospital's income is 10; Also, The cost and investment required to provide low-quality medical services are lower, and due to the incomplete symmetry of information which makes the social benefits are not as high as those provided with high-quality medical services, but part of the low social benefits are hidden, and the benefits are 14 which are higher than providing high-quality medical services; Then, The benefit is 0 when the patient does not seek medical treatment as there're neither cost nor revenue for the hospital.

4.3. Patients' Payment

First of all, the patient's consumption of high-quality medical services in the hospital can meet their needs of health, and the effectiveness is 10; Moreover, you also need to pay medical expenses if you consume low-quality medical services. In recent years, the continuous reform of medical care and vigorous supervision of hospitals in China can treat diseases to a certain extent, but what patients can get have been reduced which made them cannot make ends meet, the value is -2. Lastly, the patient may not be able to pay for medical treatment according to the actual situation, but he is also afraid that delaying the condition will cause greater damage to his health which makes him have to spend money to treat the disease, and the utility at this time is -5 [8].

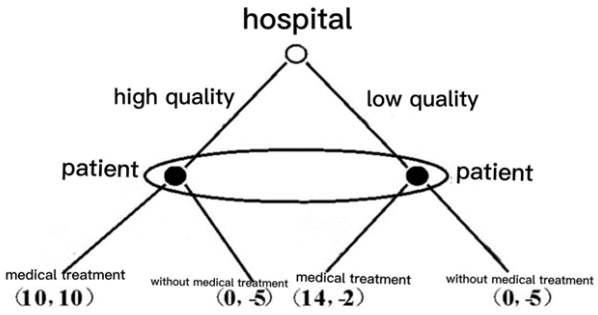

Figure 2: The line chart builds by referencing to game tree

As shown in figure 2, patients only know that the hospital provides high-quality or low-quality medical services, but they cannot distinguish them with asymmetric information. In this case, the

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patient's judgment of the quality of medical care in the hospital depends on his subjective probability. In this model, it can be seen that what the government and society hope for is (high-quality, medical treatment), at this time both parties get the highest total benefit of (10 + 10 = 20), and the rest do not meet the hope of optimal social medical welfare. However, driven by interests, the following contrary results often occur in reality:

The patient's expected payment for choosing medical treatment is E=10p-2(1-p) =14p - 2.

In the first place, when E is ≥0, the patient chooses to seek medical treatment, at this time p≥1/6; Conversely, when p <1/6, the patient chose not to seek medical attention.

On one hand. When P≥1/6, choosing medical treatment is the patients' optimal strategy, and the optimal strategy of the hospital at this time is to provide low-quality medical services. Therefore, in the case where the hospital has an information advantage, the Bayesian equilibrium is P≥1/6, (low quality, medical treatment). The gain is (14, -2), and the total benefit is 14 - 2=12, which is much lower than 20 in the case of (high-quality, medical treatment).

On the other hand. When p < 1/6, the patient chooses not to seek medical treatment, at this time, the payment of both parties is (0, - 5) no matter what kind of medical services the hospital provides, and the Bayesian equilibrium is P<1/6, (high quality, no medical treatment) or (low quality, no medical treatment). The return is (0, -5) and the total return is -5 which is also much lower than 20 in the case of (high-quality, medical treatment).

In the case that the hospital has incomplete symmetry of the information, whether the patient chooses to seek medical treatment or not which cannot achieve the social benefit purpose of the medical cause that the government and society hope [9]. And patients choose not to seek medical treatment, for society, the total return is the lowest, -5, which is the worst state [10].

5. Conclusion

The main reasons for doctor-patient contradictions based on the above discussion are as follows:

In terms of hospitals, hospitals neglect their social responsibility of saving lives and helping the injured to put the implementation of social responsibility in a secondary position and charging in the first place;

As far as doctors are concerned, doctors will provide low-quality services to patients driven by interests;

To the patients, patients will choose not to seek medical treatment to maximize their interests based on the two points above.

In order to alleviate the serious contradictions between doctors and patients, the following solutions are proposed in this article. From the aspect of individuals, if there is no understanding of medical facilities, distrust of doctors, and mainly attributing the responsibilities to doctors when there are problems which will lead to more serious doctor-patient conflicts, so it can effectively alleviate this phenomenon for the patients to improve their personal quality and personal understanding of medical knowledge; Regarding doctors and hospitals, they should try to avoid personal factors, Eliminate medical corruption (such as bribery phenomenon, eating by the patient's checking, taking the property given by patients, setting obstacles for the patients, asking them to give extra money, etc.) and give full play to the doctor's duty of saving lives and helping the injured, providing high-quality services for patients as much as possible, abiding by medical ethics, saving lives and helping the injured, and safeguarding the holiness and honor of medical skills.

This article briefly talks about how different entities alleviate the contradiction between doctors and patients under the doctor-patient game but it ignores influences made by several factors, such as economic environment, medical technology, policies and regulations, social factors, and other external forces to doctor-patient contradictions. Therefore, adding external factors is helpful to better

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study the doctor-patient contradiction and make efforts to correctly alleviate and solve it based on the discussion above.

Reference

[1] *Hua, S., Lantang,S., Tao, H., Wenmin C.: Multidimensional thinking on the status quo of doctor-patient relationship. Chinese Journal of Hospital Administration 19(9), 3(2003).*

[2] *Yue, Z., Jianwen,S., Jinfan,W.： A Comparative Study of Hot Spots and Trends in Chinese and Foreign Doctor-Patient Relationship Research Based on CiteSpace. Medicine and Philosophy. (19),57-62(2020)*

[3] *Xie, J., Qin, Q., Lu, J., Yang, L., & Jiang, M. Public Opinion Evaluation of Doctor-Patient Relationship Network Based on Evolutionary Game Theory. IEEE Access (8), 197147 - 197157 (2020)*

[4] *Stavropoulou, Charitini, and Glycopantis, Dionysius. Conflict and Non-Compliance in the Doctor-Patient Relationship: A Game-Theoretic Approach. LSE Health, the London School of Economics and Political Science, London, UK (2008).*

[5] *Shiqing,L.: Static Game Analysis of Incomplete Information of Doctor-Patient Relationship, CLC Number R197.323 (2020).*

[6] *Ying,L.: Summary of the Current Status of Doctor-Patient Relationship Research at Home and Abroad Century Bridge (2),91-94(2015)*

[7] *Hui,W., Jinhui,B., Renhao,W. Trans. Rasmusen. E. Game and Information. Beijing: Peking University Press, 2004*

[8] *On the Reform of Medical Insurance System [N]. Life Times, May 25th, 2007.*

[9] *Ruihua,Z and Lin.J Discussion on Social Factors Affecting Doctor-Patient Relationship. Chinese Health Service Management 17(8),2(2001)*

[10] *Xingming,W.： Policy Factors Affecting Doctor-Patient Relationship and Its Improvement Countermeasures. Chinese Health Service Management 26(12),821-822(2009)*