Social Security and Administration Management (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/socsam.2024.050306
ISSN 2523-5796 Vol. 5 Num. 3

Theoretical Analysis of the Impact of DRG Payment on Prescription Behaviors of Physicians in Chinese Public Hospitals

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Keywords: DRG payment; Public Hospitals; Prescribing Behavior; Principal-Agent Theory

Abstract: In recent years, Diagnosis-Related Groups (DRG) payment has become one of the effective strategies for China to mitigate the rapid growth of medical expenses. Based on the principal-agent theory and the theory of incentive compatibility, this paper conducts an in-depth analysis of the impact of DRG payment on the prescription behavior of physicians in public hospitals in China. The paper posits that the DRG payment system can have a significant influence on physicians' prescription behavior, and this influence exhibits pronounced differences across hospitals of varying levels. Therefore, the DRG payment system plays a crucial role in the rational allocation of medical resources in China.

1. Introduction

DRG payment is designed to curb the unreasonable growth of medical expenses and has been widely applied in developed countries and some low-and middle-income countries[1]. The fundamental concept of DRG involves distinguishing between different types of diseases, differentiating cases with the same type of disease but different treatment methods, and distinguishing cases with the same type of disease and treatment method but different individual characteristics[2]. After years of pilot practice, China fully implemented CHS-DRG (China Healthcare Security-DRG, developed by the National Healthcare Security Administration) payment in 2021, which is currently mainly applied in the fields of healthcare insurance payment management and healthcare service performance evaluation[3]. As drugs constitute the primary consumption of medical resources in China, the excessive growth rate of drug costs has become a key factor in the unreasonable increase of medical expenses, affecting the healthy operation of China's healthcare insurance funds. By 2020, the proportion of drug costs in China still accounted for more than 30%. DRG payment focuses on the two dimensions of "clinical process" and "resource consumption". Theoretically, if DRG payment can restrain the prescription behavior of physicians in public hospitals and reduce the cost of medication, it can alleviate the dilemma of unreasonable growth in medical expenses.

Glen[4] posits that physicians' prescription behavior is influenced by direct factors such as

healthcare insurance policies and management methods. Grytten[5], however, believes that the healthcare insurance payment system has little impact on physicians' medical behavior. Qualitative research by Junger et al.[6] found that the new healthcare insurance payment system encourages physicians to prefer more expensive medications. Chinese literature indicates that the implementation of DRG payment can reduce drug expenditure and medical costs, with significant differences in the degree and connotation of impact among hospitals of different levels. However, existing research samples mainly focus on the early policy pilot areas in China, and there are differences between the DRG payment systems in these areas and the currently promoted CHS-DRG payment policy. Moreover, most literature employs empirical research with a lack of theoretical research. Therefore, this paper conducts an in-depth analysis of the impact mechanism of DRG payment on the prescription behavior of physicians in public hospitals based on the theories of principal-agent and incentive compatibility.

2. Theoretical Analysis Framework

In the field of healthcare security, the principal-agent theory and the theory of incentive compatibility have been widely applied in the analysis of physician behavior and the allocation of medical resources. These two theoretical frameworks provide critical explanatory tools for understanding how incentive mechanisms operate within healthcare systems.

2.1. Principal-Agent Theory

The core of the principal-agent theory lies in explaining how the principal can design a set of mechanisms to align the agent's behavior with the principal's goal of maximizing interests. The principal-agent theory also holds significant importance in the research of healthcare security policies. Within this framework, healthcare insurance institutions act as the primary agents for patients, public hospitals as secondary agents, and physicians as tertiary agents. The multi-level agency relationships are as follows:

Agency Relationship Between Patients and Healthcare Security Department. *Principal:* Patients delegate their healthcare needs and interests to healthcare security department, expecting them to provide appropriate healthcare security. *Agent:* Healthcare security institutions are responsible for managing healthcare insurance funds, formulating healthcare insurance policies, and supervising healthcare service providers.

Agency Relationship Between Healthcare Security Institutions and Public Hospitals. *Principal:* Healthcare security institutions delegate the authority to manage healthcare insurance funds to public hospitals, expecting them to provide healthcare services that meet policy requirements and effectively control medical expenses. *Agent:* Public hospitals are responsible for providing healthcare services to patients according to healthcare insurance policies and regulations, and for settling and reimbursing as required by healthcare security institutions.

Agency Relationship Between Public Hospitals and Physicians. *Principal:* Public hospitals delegate the task of providing healthcare services to physicians, expecting them to provide effective treatment to patients in accordance with hospital regulations and medical standards. *Agent:* Physicians are responsible for diagnosing and treating patients, and ensuring the quality and safety of healthcare services.

2.2. The Incentive Compatibility Theory

The "incentive compatibility" theory posits that due to information asymmetry and uncertainty, agents may behave in ways that deviate from the interests of the principals. To mitigate this issue,

the principal needs to design a mechanism that tightly aligns the interests of both parties, thereby incentivizing the agent to act in a manner that maximizes the principal's interests, which is referred to as "incentive compatibility" [7]. Leonid Hurwicz further developed this theory by proposing the design of incentive-compatible economic mechanisms. He argued that each rational economic agent pursues the maximization of their own interests, and therefore, there must be an institutional constraint to ensure that individual self-interested behavior aligns with the goal of maximizing collective interests [8].

Given the potential for incentive misalignment in principal-agent relationships and among multiple levels of agency, it is necessary to construct a reasonable incentive and constraint mechanism that guides agents to maximize their own interests while also achieving the interests of the principal, thereby forming a "shared prosperity and loss" mechanism of interest sharing. Applying the theory of incentive compatibility can assess the degree to which physicians' prescription behavior is influenced by incentive mechanisms, as well as whether the incentives align with policy objectives in terms of physicians' prescription behavior.

2.3. Analysis Framework

The analytical framework of this paper is based on the Principal-Agent Theory and the Incentive Compatibility Theory, aiming to examine the impact of incentive and constraint mechanisms in healthcare security policies on physicians' prescribing behavior. The theoretical analysis framework of this paper is illustrated in Figure 1:

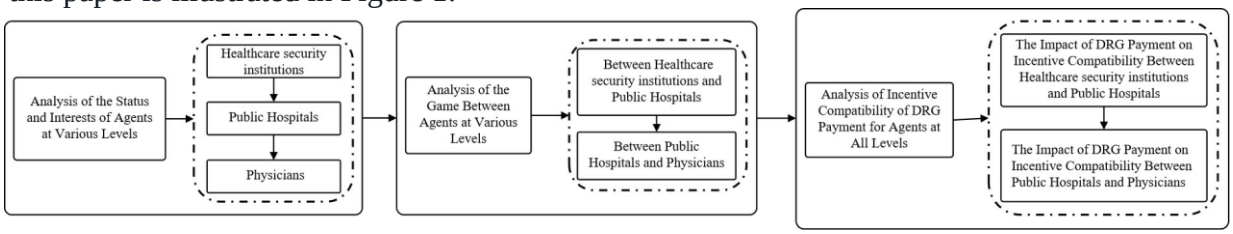

Figure 1: Theoretical Analysis Framework

3. Status and Interest Demands among Agents at Various Levels

3.1. Healthcare Security Department

In China, the healthcare security department is the entity responsible for formulating and implementing the DRG payment policy. In this paper, the healthcare security department serves as the primary agent for patients, with its main responsibilities being the management of healthcare insurance policies, and the provision of healthcare security and financial support to patients. The interests and demands of the healthcare security department primarily include ensuring the sustainability of healthcare security policies, reasonably controlling medical expense expenditures, and simultaneously safeguarding the medical rights and interests of patients.

3.2. Public Hospitals

In China, public hospitals are organizations with the attribute of public welfare legal persons; hence, they are required to prioritize the pursuit of maximizing social benefits. Concurrently, as independent economic entities, they inevitably strive to maximize their own interests. Serving as the secondary agent for patients, the interests and demands of public hospitals mainly encompass enhancing the hospital's economic efficiency, as well as improving the quality and reputation of healthcare services.

3.3. Physicians

As the tertiary agent for patients, the primary responsibilities of physicians encompass providing medical services, formulating treatment plans, and offering medication recommendations. The interests and demands of physicians in Chinese public hospitals mainly revolve around securing reasonable medical income and achieving a positive professional reputation.

4. Game Analysis among Agents at Various Levels

4.1. Healthcare Security Department and Public Hospitals

There exists a game-theoretic relationship between the healthcare security department and public hospitals, with the core issue being the impact of the formulation and execution of the DRG payment policy on the hospital's economic interests and the quality of healthcare services.

The healthcare security department pays medical insurance fees to hospitals in accordance with policy requirements while also imposing appropriate regulation and constraints on the rational use of the medical insurance fund. Hospitals may take measures to reduce costs and increase efficiency, which could, however, affect the quality of healthcare services. Concurrently, hospitals may engage in negotiations with the healthcare security department to strive for more reasonable medical insurance payment standards.

4.2. Public Hospitals and Physicians

A complex game-theoretic relationship exists between public hospitals and physicians. Hospitals are required to balance the compensation and benefits for physicians to attract and retain talented medical staff, while also needing to control costs to ensure the hospital's economic interests. Conversely, physicians aim to achieve higher income and societal respect with less labor input.

5. Compatibility Analysis among Agents at Various Levels

5.1. Incentive and Constraint Mechanism of DRG Payment for Agents

As the policy-making body, the healthcare security department needs to actively implement policies to realize its own interests. However, within the multiple principal-agent relationships, if the policy's incentive and constraint mechanisms only motivate a subset of agents while neglecting the interests of other members, even with enhanced political embeddedness, the implementation of the policy may deviate from its original intent, thus failing to effectively fulfill its role. Therefore, the DRG payment mechanism must be designed to promote incentive compatibility among the various executing entities, providing positive guidance for their behavior under natural conditions, and preventing hospitals and physicians from engaging in actions that harm the interests of the principals for their own benefit. This is essential to ensure a mutual benefit for healthcare insurance institutions, public hospitals, and physicians. In China, hospitals can only maintain their viability by adhering to the legitimacy of policies. The DRG payment, through an incentive and constraint mechanism of "retaining surpluses and sharing reasonable excess expenditures," may alter the performance function of hospitals, reshape their operational models, and correspondingly change the attributes of physicians' medical behavior.

5.2. Incentive Compatibility between Healthcare Security Department and Public Hospitals

5.2.1. Incentive Compatibility

From the perspective of the healthcare security department, firstly, the incentive and constraint mechanism design of "retaining surpluses and sharing reasonable excess expenditures" in the DRG policy effectively motivates hospitals to proactively reduce costs and increase efficiency. Secondly, concurrent with the pilot implementation of the CHS-DRG policy, the healthcare security department has introduced a national centralized bulk procurement policy, providing physicians with more cost-effective medication options. Finally, in the process of advancing the DRG payment policy, the healthcare security department can leverage its administrative status, the pre-determined payment prices of the DRG payment policy, the principle of "same disease, same quality, same price" within the region, and regulatory assessments based on DRG indicators to impose dual constraints of institution and administration on hospitals, which plays a rigid role in promoting the implementation of the policy.

From the perspective of public hospitals, they need to actively respond to the legitimacy of the DRG policy to ensure their own survival and development. In China, there is a significant difference in the scale of public hospitals at different levels, leading to a notable disparity in the quantity of drug varieties and specifications. Compared to secondary and primary hospitals, tertiary hospitals have a broader range of medication options. Primary hospitals have the smallest variety of drugs, leaving physicians with little to no freedom in medication choices. It is evident that the different levels of public hospitals can directly impact the degree to which they achieve incentive compatibility with the healthcare security department.

5.2.2. Conflict of Interests

From the perspective of the healthcare security department, there are still irrational aspects in the design of the DRG policy. Firstly, the existing diagnostic and treatment norms, operational guidelines, and other relevant provisions on which the DRG payment system bases its financial incentives somewhat restrict the innovation of treatment plans by department leaders in top-tier tertiary hospitals, and do not significantly promote the improvement of their medical quality. Secondly, there is a conflict between the design of the DRG policy's financial incentives and the public welfare requirements of the health department. The health department stipulates that the performance assessment of public hospitals should not be linked to departmental income, but public hospitals can only maintain their survival by transmitting the financial incentives of DRG payments to physicians.

From the hospital's perspective, the high cost of drug treatment for critically ill patients is the main reason for medical expense overruns. In order to obtain more surplus funds from medical insurance, hospitals pass on the excess expenditures through performance penalties on physicians, which in turn leads to the phenomenon of physicians refusing to treat critically ill patients. This contradicts the interest demands of the healthcare security department, which aims to ensure the medical needs of patients, and is not conducive to the positive guiding effect of DRG payment on physicians' prescription behavior.

5.3. Incentive Compatibility between Public Hospitals and Physicians

5.3.1. Incentive Compatibility

In terms of physicians' prescription behavior, first, under the DRG payment system, based on the policy's incentive and constraint mechanisms, hospital administrators can incorporate DRG

indicators such as the Case Mix Index (CMI) and the Relative Weight (RW) of disease severity into hospital performance assessments, thereby transmitting the policy's incentive and constraint mechanisms to physicians. Moreover, the administrative characteristics of hospitals determine that administrators can use the hierarchical system, with the DRG indicator system at its core, to decompose objectives and tasks, and relay pressure layer by layer to clinical physicians. Under the influence of considerations for their own interests and hospital pressure, physicians will proactively constrain their individual behavior during the medication process, aligning it with the goal of maximizing collective interests.

5.3.2. Conflict of Interests

From the perspective of the hospital, in reality, top-tier tertiary hospitals often have a higher proportion of critically ill patients, frequently encountering situations of excess expenditures. In cases where the weight of critically ill patients is not high and the cost of drug treatment exceeds the budget, the hospital's approach to handling physicians' performance-related income can significantly affect the physicians' enthusiasm for implementing the policy.

From the perspective of the physicians, some may have an insufficient understanding of the DRG policy, which distorts their medication cost control behavior, unable to enhance the hospital's cost efficiency, thus creating a conflict with the hospital's interest demands.

6. Conclusions

This paper conducts an in-depth analysis of how China's DRG payment influences the prescription behavior of physicians in public hospitals, based on the theories of principal-agent and incentive compatibility. The paper posits that, under the interaction of various factors, DRG payment can have a diverse impact on the prescription behavior of physicians in hospitals of different levels, both in terms of the degree and the nature of the impact.

Regarding healthcare security institutions, the Chinese government can enhance the comprehensive service capabilities of the healthcare insurance sector through optimizing the top-level design of healthcare insurance and promoting synergy between policies, thereby exerting a positive guiding effect of DRG payment on physicians' prescription behavior. Public hospitals can optimize their internal performance management by improving the hospital's internal performance supervision system, guiding physicians to reasonably control the cost of medication. From the physicians' perspective, the implementation of extensive training on DRG policies and the enhancement of awareness regarding cost control can raise medical staff's understanding of the DRG policy, laying a solid foundation for the effective guidance of physicians' prescription behavior by the policy. Finally, promoting the collaboration between the health department and the healthcare security department can actively facilitate the positive guiding role of DRG payment on physicians' prescription behavior.

Acknowledgements

The authors are grateful to Dr. Zhou Cheng Chao for his helpful discussions on topics related to this work. We also thank the associate editor and the reviewers for their useful feedback that improved this paper.

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